

load linear algebra package

```
> restart;  
> with(CodeGeneration):  
> with(LinearAlgebra):
```

Transformation matrices for tower middle

```
> R[rho] := Matrix([[cos(rho),0,-sin(rho)],[0,1,0],[sin(rho),0,  
cos(rho)]]);
```

$$R_\rho := \begin{bmatrix} \cos(\rho) & 0 & -\sin(\rho) \\ 0 & 1 & 0 \\ \sin(\rho) & 0 & \cos(\rho) \end{bmatrix} \quad (2.1)$$

Transformation matrices for blade 1

```
> R[psi[1]] := Matrix([[-cos(psi),sin(psi),0],[-sin(psi),-cos  
(psi),0],[0,0,1]]);
```

$$R_{\psi_1} := \begin{bmatrix} -\cos(\psi) & \sin(\psi) & 0 \\ -\sin(\psi) & -\cos(\psi) & 0 \\ 0 & 0 & 1 \end{bmatrix} \quad (3.1)$$

```
> R[beta[1]] := Matrix([[cos(beta[1]),0,-sin(beta[1])],[0,1,0],  
[sin(beta[1]),0,cos(beta[1])]]);
```

$$R_{\beta_1} := \begin{bmatrix} \cos(\beta_1) & 0 & -\sin(\beta_1) \\ 0 & 1 & 0 \\ \sin(\beta_1) & 0 & \cos(\beta_1) \end{bmatrix} \quad (3.2)$$

Transformation matrices for blade 2

```
> R[psi[2]] := Matrix([[cos(psi),-sin(psi),0],[sin(psi),cos(psi),  
0],[0,0,1]]);
```

$$R_{\psi_2} := \begin{bmatrix} \cos(\psi) & -\sin(\psi) & 0 \\ \sin(\psi) & \cos(\psi) & 0 \\ 0 & 0 & 1 \end{bmatrix} \quad (4.1)$$

```
> R[beta[2]] := Matrix([[cos(beta[2]),0,-sin(beta[2])],[0,1,0],  
[sin(beta[2]),0,cos(beta[2])]]);
```

$$R_{\beta_2} := \begin{bmatrix} \cos(\beta_2) & 0 & -\sin(\beta_2) \\ 0 & 1 & 0 \\ \sin(\beta_2) & 0 & \cos(\beta_2) \end{bmatrix} \quad (4.2)$$

omega of blade 1, in function of {E_beta_1}

omega of the tower, in function of {E_1}

```
> omega[rho] := Vector[row]([0,rho[flux],0]);
 $\omega_\rho := \begin{bmatrix} 0 & \rho_{flux} & 0 \end{bmatrix}$ 
```

(5.1)

```
> omega[rho[1]] := Multiply(omega[rho],MultiplyTranspose(R[psi[1]]),Transpose(R[beta[1]]));
```

$$\omega_{\rho_1} := \begin{bmatrix} \rho_{flux} \sin(\psi) \cos(\beta_1) & -\rho_{flux} \cos(\psi) & \rho_{flux} \sin(\psi) \sin(\beta_1) \end{bmatrix} \quad (5.2)$$

```
> omega[Omega[1]] := Multiply(Vector[row]([0,0,-Omega]),Transpose(R[beta[1]]));
```

$$\omega_{\Omega_1} := \begin{bmatrix} \Omega \sin(\beta_1) & 0 & -\Omega \cos(\beta_1) \end{bmatrix} \quad (5.3)$$

```
> omega[beta[1]] := Vector[row]([0,beta[flux[1]],0]);
```

$$\omega_{\beta_1} := \begin{bmatrix} 0 & \beta_{flux_1} & 0 \end{bmatrix} \quad (5.4)$$

```
> omega[1] := VectorAdd(VectorAdd(omega[rho[1]],omega[Omega[1]]),omega[beta[1]]);
```

$$\omega_1 := \begin{bmatrix} \rho_{flux} \sin(\psi) \cos(\beta_1) + \Omega \sin(\beta_1), -\rho_{flux} \cos(\psi) + \beta_{flux_1}, \rho_{flux} \sin(\psi) \sin(\beta_1) \\ -\Omega \cos(\beta_1) \end{bmatrix} \quad (5.5)$$

```
> p_omega[1]:=omega[1][1];
```

$$p_{omega_1} := \rho_{flux} \sin(\psi) \cos(\beta_1) + \Omega \sin(\beta_1) \quad (5.6)$$

```
> q_omega[1]:=omega[1][2];
```

$$q_{omega_1} := -\rho_{flux} \cos(\psi) + \beta_{flux_1} \quad (5.7)$$

```
> r_omega[1]:=omega[1][3];
```

$$r_{omega_1} := \rho_{flux} \sin(\psi) \sin(\beta_1) - \Omega \cos(\beta_1) \quad (5.8)$$

omega of blade 2, in function of {E_beta_2}

```
> omega[rho[2]] := Multiply(omega[rho], Multiply(Transpose(R[psi[2]]), Transpose(R[beta[2]])));

```

$$\omega_{\rho_2} := \begin{bmatrix} -\rho_{flux} \sin(\psi) \cos(\beta_2) & \rho_{flux} \cos(\psi) & -\rho_{flux} \sin(\psi) \sin(\beta_2) \end{bmatrix} \quad (6.1)$$

```
> omega[Omega[2]] := Multiply(Vector[row]([0, 0, -Omega]), Transpose(R[beta[2]]));

```

$$\omega_{\Omega_2} := \begin{bmatrix} \Omega \sin(\beta_2) & 0 & -\Omega \cos(\beta_2) \end{bmatrix} \quad (6.2)$$

```
> omega[beta[2]] := Vector[row]([0, beta[flux[2]], 0]);

```

$$\omega_{\beta_2} := \begin{bmatrix} 0 & \beta_{flux_2} & 0 \end{bmatrix} \quad (6.3)$$

```
> omega[2] := VectorAdd(VectorAdd(omega[rho[2]], omega[Omega[2]]),
omega[beta[2]]);

```

$$\omega_2 := \begin{bmatrix} -\rho_{flux} \sin(\psi) \cos(\beta_2) + \Omega \sin(\beta_2), \rho_{flux} \cos(\psi) + \beta_{flux_2}, -\rho_{flux} \sin(\psi) \sin(\beta_2) \\ -\Omega \cos(\beta_2) \end{bmatrix} \quad (6.4)$$

```
> p_omega[2]:=omega[2][1];

```

$$p_{omega_2} := -\rho_{flux} \sin(\psi) \cos(\beta_2) + \Omega \sin(\beta_2) \quad (6.5)$$

```
> q_omega[2]:=omega[2][2];

```

$$q_{omega_2} := \rho_{flux} \cos(\psi) + \beta_{flux_2} \quad (6.6)$$

```
> r_omega[2]:=omega[2][3];

```

$$r_{omega_2} := -\rho_{flux} \sin(\psi) \sin(\beta_2) - \Omega \cos(\beta_2) \quad (6.7)$$

rotation operators

```
> Omega[Xomega[rho]]:=Matrix([[0, 0, -rho[flux]], [0, 0, 0], [rho[flux], 0, 0]]);

```

$$\Omega_{Xomega}^{\rho} := \begin{bmatrix} 0 & 0 & -\rho_{flux} \\ 0 & 0 & 0 \\ \rho_{flux} & 0 & 0 \end{bmatrix} \quad (7.1)$$

```
> Omega[Xomega[1]]:=Matrix([[0, r_omega[1], -q_omega[1]], [-r_omega[1], 0, p_omega[1]], [q_omega[1], -p_omega[1], 0]]);

```

$$\Omega_{Xomega}^1 := \begin{bmatrix} [0, \rho_{flux} \sin(\psi) \sin(\beta_1) - \Omega \cos(\beta_1), \rho_{flux} \cos(\psi) - \beta_{flux_1}], \\ [-\rho_{flux} \sin(\psi) \sin(\beta_1) + \Omega \cos(\beta_1), 0, \rho_{flux} \sin(\psi) \cos(\beta_1) + \Omega \sin(\beta_1)] \end{bmatrix}, \quad (7.2)$$

$$\begin{aligned}
& \left[-\rho_{flux} \cos(\psi) + \beta_{flux_1}, -\rho_{flux} \sin(\psi) \cos(\beta_1) - \Omega \sin(\beta_1), 0 \right] \\
> \Omega[Xomega[2]] &:= \text{Matrix}([[0, r_omega[2], -q_omega[2]], [-r_omega[2], 0, p_omega[2]], [q_omega[2], -p_omega[2], 0]]); \\
\Omega_{Xomega[2]} &:= \left[\left[0, -\rho_{flux} \sin(\psi) \sin(\beta_2) - \Omega \cos(\beta_2), -\rho_{flux} \cos(\psi) - \beta_{flux_2} \right], \right. \\
& \left[\rho_{flux} \sin(\psi) \sin(\beta_2) + \Omega \cos(\beta_2), 0, -\rho_{flux} \sin(\psi) \cos(\beta_2) + \Omega \sin(\beta_2) \right], \\
& \left. \left[\rho_{flux} \cos(\psi) + \beta_{flux_2}, \rho_{flux} \sin(\psi) \cos(\beta_2) - \Omega \sin(\beta_2), 0 \right] \right]
\end{aligned} \tag{7.3}$$

Position vectors for the cg of the blades and the cg of the 2nd tower section

All capital R position vectors here are expressed in {E_1}
all r position vectors are in local reference frame

$$> r_2 := \text{Vector[row]}([1/2, 0, 0]);
r_2 := \left[\frac{1}{2} l \ 0 \ 0 \right] \tag{8.1}$$

$$> r_0 := \text{Vector[row]}([1/2, 0, 0]);
r_0 := \left[\frac{1}{2} l \ 0 \ 0 \right] \tag{8.2}$$

$$> r_cg_beta := \text{Vector[row]}([R/2, 0, 0]);
r_cg_beta := \left[\frac{1}{2} R \ 0 \ 0 \right] \tag{8.3}$$

$$> r_cg_T := \text{Vector[row]}([1/4, 0, 0]);
r_cg_T := \left[\frac{1}{4} l \ 0 \ 0 \right] \tag{8.4}$$

$$> r_3_beta_1 := \text{Vector[row]}([(-e * \cos(psi)), (e * \sin(psi)), 0]);
r_3_beta_1 := \left[-e \cos(\psi) \ e \sin(\psi) \ 0 \right] \tag{8.5}$$

$$> r_3_beta_2 := \text{Vector[row]}([(e * \cos(psi)), (-e * \sin(psi)), 0]);
r_3_beta_2 := \left[e \cos(\psi) \ -e \sin(\psi) \ 0 \right] \tag{8.6}$$

$$> r_3_beta_1_flux := \text{Vector[row]}([(e * \sin(psi)) * psi[flux]], (e * \cos(psi)) * psi[flux], 0);
r_3_beta_1_flux := \left[e \sin(\psi) \ \psi_{flux} \ e \cos(\psi) \ \psi_{flux} \ 0 \right] \tag{8.7}$$

$$> r_3_beta_2_flux := \text{Vector[row]}([(-e * \sin(psi)) * psi[flux]], (-e * \cos(psi)) * psi[flux], 0);
\tag{8.8}$$

$$r_3_{beta}_2_{flux} := \begin{bmatrix} -e \sin(\psi) \Psi_{flux} & -e \cos(\psi) \Psi_{flux} & 0 \end{bmatrix} \quad (8.8)$$

```
> R_cg_beta_1 := Multiply(r_0,Transpose(R[rho])) + r_2 +
r_3_beta_1 + Multiply(r_cg_beta,Multiply(R[beta[1]],R[psi[1]]));
;
```

$$\begin{aligned} R_cg_beta_1 := & \left[\frac{1}{2} l \cos(\rho) + \frac{1}{2} l - e \cos(\psi) - \frac{1}{2} R \cos(\psi) \cos(\beta_1), e \sin(\psi) \right. \\ & \left. + \frac{1}{2} R \sin(\psi) \cos(\beta_1), \frac{1}{2} l \sin(\rho) - \frac{1}{2} R \sin(\beta_1) \right] \end{aligned} \quad (8.9)$$

```
> R_cg_beta_2 := Multiply(r_0,Transpose(R[rho])) + r_2 +
r_3_beta_2 + Multiply(r_cg_beta,Multiply(R[beta[2]],R[psi[2]]));
;
```

$$\begin{aligned} R_cg_beta_2 := & \left[\frac{1}{2} l \cos(\rho) + \frac{1}{2} l + e \cos(\psi) + \frac{1}{2} R \cos(\psi) \cos(\beta_2), -e \sin(\psi) \right. \\ & \left. - \frac{1}{2} R \sin(\psi) \cos(\beta_2), \frac{1}{2} l \sin(\rho) - \frac{1}{2} R \sin(\beta_2) \right] \end{aligned} \quad (8.10)$$

```
> R_cg_T := Multiply(r_0,Transpose(R[rho])) + r_cg_T;
```

$$R_cg_T := \begin{bmatrix} \frac{1}{2} l \cos(\rho) + \frac{1}{4} l & 0 & \frac{1}{2} l \sin(\rho) \end{bmatrix} \quad (8.11)$$

```
> R_cg_beta_1_flux := Multiply(r_2,Omega[Xomega[rho]]) + Multiply
(r_3_beta_1,Omega[Xomega[rho]]) + r_3_beta_1_flux + Multiply
(r_cg_beta,Multiply(Omega[Xomega[1]],Multiply(R[beta[1]],R[psi
[1]])));
;
```

$$\begin{aligned} R_cg_beta_1_flux := & \left[e \sin(\psi) \Psi_{flux} + \frac{1}{2} R \left(-(\rho_{flux} \sin(\psi) \sin(\beta_1) - \Omega \cos(\beta_1)) \sin(\psi) \right. \right. \\ & \left. \left. - (\rho_{flux} \cos(\psi) - \beta_{flux}) \cos(\psi) \sin(\beta_1) \right), e \cos(\psi) \Psi_{flux} + \frac{1}{2} R \left(\right. \right. \\ & \left. \left. - (\rho_{flux} \sin(\psi) \sin(\beta_1) - \Omega \cos(\beta_1)) \cos(\psi) + (\rho_{flux} \cos(\psi) \right. \right. \\ & \left. \left. - \beta_{flux}) \sin(\psi) \sin(\beta_1) \right), -\frac{1}{2} l \rho_{flux} + e \cos(\psi) \rho_{flux} + \frac{1}{2} R \left(\rho_{flux} \cos(\psi) \right. \right. \\ & \left. \left. - \beta_{flux} \right) \cos(\beta_1) \right] \end{aligned} \quad (8.12)$$

```
> R_cg_beta_2_flux := Multiply(r_2,Omega[Xomega[rho]]) + Multiply
(r_3_beta_2,Omega[Xomega[rho]]) + r_3_beta_2_flux + Multiply
(r_cg_beta,Multiply(Omega[Xomega[2]],Multiply(R[beta[2]],R[psi
[2]])));
;
```

$$R_cg_beta_2_flux := \left[-e \sin(\psi) \Psi_{flux} + \frac{1}{2} R \left((-\rho_{flux} \sin(\psi) \sin(\beta_2) \right. \right. \quad (8.13)$$

$$\begin{aligned}
& -\Omega \cos(\beta_2) \sin(\psi) + \left(-\rho_{flux} \cos(\psi) - \beta_{flux_2} \right) \cos(\psi) \sin(\beta_2), -e \cos(\psi) \psi_{flux} \\
& + \frac{1}{2} R \left(\left(-\rho_{flux} \sin(\psi) \sin(\beta_2) - \Omega \cos(\beta_2) \right) \cos(\psi) - \left(-\rho_{flux} \cos(\psi) \right. \right. \\
& \left. \left. - \beta_{flux_2} \right) \sin(\psi) \sin(\beta_2) \right), -\frac{1}{2} l \rho_{flux} - e \cos(\psi) \rho_{flux} + \frac{1}{2} R \left(-\rho_{flux} \cos(\psi) \right. \\
& \left. - \beta_{flux_2} \right) \cos(\beta_2)
\end{aligned}$$

> **R_cg_T_flux := Multiply(r_cg_T, Omega[Xomega[rho]]);**

$$R_{cg_T_flux} := \begin{bmatrix} 0 & 0 & -\frac{1}{4} l \rho_{flux} \end{bmatrix} \quad (8.14)$$

Inertia matrices of cg

> **JB = (1/12)*m_b*R*R;**

$$JB = \frac{1}{12} m_b R^2 \quad (9.1)$$

> **J[blade] := Matrix([[0,0,0],[0,JB,0],[0,0,JB]]);**

$$J_{blade} := \begin{bmatrix} 0 & 0 & 0 \\ 0 & JB & 0 \\ 0 & 0 & JB \end{bmatrix} \quad (9.2)$$

> **JT = (1/12)*m_t*(1/2)*(1/2);**

$$JT = \frac{1}{48} m_t l^2 \quad (9.3)$$

> **J[tower] := Matrix([[0,0,0],[0,JT,0],[0,0,JT]]);**

$$J_{tower} := \begin{bmatrix} 0 & 0 & 0 \\ 0 & JT & 0 \\ 0 & 0 & JT \end{bmatrix} \quad (9.4)$$

Kinetic energy: translational part

> **T blade_1 := 0.5*m_b*((R_cg_beta_1_flux[1]*R_cg_beta_1_flux[1])**
 $+ (R_cg_beta_1_flux[2]*R_cg_beta_1_flux[2]) + (R_cg_beta_1_flux[3]$
 $*R_cg_beta_1_flux[3]));$

$$T_{blade_1} := 0.5 m_b \left(\left(e \sin(\psi) \psi_{flux} + \frac{1}{2} R \left(-(\rho_{flux} \sin(\psi) \sin(\beta_1) \right. \right. \right.$$

$$\left. \left. \left. - \Omega \cos(\beta_1) \right) \sin(\psi) - (\rho_{flux} \cos(\psi) - \beta_{flux_1}) \cos(\psi) \sin(\beta_1) \right) \right)^2 \quad (10.1)$$

$$\begin{aligned}
& + \left(e \cos(\psi) \Psi_{flux} + \frac{1}{2} R \left(-(\rho_{flux} \sin(\psi) \sin(\beta_1) - \Omega \cos(\beta_1)) \cos(\psi) \right. \right. \\
& + \left(\rho_{flux} \cos(\psi) - \beta_{flux_1} \right) \sin(\psi) \sin(\beta_1) \Big) \Big)^2 + \left(-\frac{1}{2} l \rho_{flux} + e \cos(\psi) \rho_{flux} \right. \\
& \left. \left. + \frac{1}{2} R \left(\rho_{flux} \cos(\psi) - \beta_{flux_1} \right) \cos(\beta_1) \right)^2 \right) \\
> T_blade_2 := 0.5 * m_b * ((R_cg_beta_2_flux[1] * R_cg_beta_2_flux[1]) \\
& + (R_cg_beta_2_flux[2] * R_cg_beta_2_flux[2]) + (R_cg_beta_2_flux[3] \\
& * R_cg_beta_2_flux[3]));
\end{aligned}$$

(10.2)

$$\begin{aligned}
T_blade_2 := 0.5 m_b & \left(\left(-e \sin(\psi) \Psi_{flux} + \frac{1}{2} R \left((-\rho_{flux} \sin(\psi) \sin(\beta_2) \right. \right. \right. \right. \\
& - \Omega \cos(\beta_2)) \sin(\psi) + \left(-\rho_{flux} \cos(\psi) - \beta_{flux_2} \right) \cos(\psi) \sin(\beta_2) \Big) \Big)^2 + \left(\right. \\
& - e \cos(\psi) \Psi_{flux} + \frac{1}{2} R \left((-\rho_{flux} \sin(\psi) \sin(\beta_2) - \Omega \cos(\beta_2)) \cos(\psi) - \right. \\
& \left. \left. \left. \left. -\rho_{flux} \cos(\psi) - \beta_{flux_2} \right) \sin(\psi) \sin(\beta_2) \right) \right)^2 + \left(-\frac{1}{2} l \rho_{flux} - e \cos(\psi) \rho_{flux} \right. \\
& \left. \left. + \frac{1}{2} R \left(-\rho_{flux} \cos(\psi) - \beta_{flux_2} \right) \cos(\beta_2) \right)^2 \right)
\end{aligned}$$

$$\begin{aligned}
> T_tower := 0.5 * m_t * ((R_cg_T_flux[1] * R_cg_T_flux[1]) + \\
& (R_cg_T_flux[2] * R_cg_T_flux[2]) + (R_cg_T_flux[3] * R_cg_T_flux[3])) \\
& ;
\end{aligned}$$

(10.3)

▼ Kinetic energy: rotational part

$$\begin{aligned}
> D_blade_1 := Multiply(\omega[1], J[blade]);
D_blade_1 := \left[0 \quad \left(-\rho_{flux} \cos(\psi) + \beta_{flux_1} \right) JB \quad \left(\rho_{flux} \sin(\psi) \sin(\beta_1) - \Omega \cos(\beta_1) \right) JB \right] \quad (11.1)
\end{aligned}$$

$$\begin{aligned}
> D_blade_2 := Multiply(\omega[2], J[blade]);
D_blade_2 := \left[0 \quad \left(\rho_{flux} \cos(\psi) + \beta_{flux_2} \right) JB \quad \left(-\rho_{flux} \sin(\psi) \sin(\beta_2) - \Omega \cos(\beta_2) \right) JB \right] \quad (11.2)
\end{aligned}$$

$$\begin{aligned}
> D_tower := Multiply(\omega[rho], J[tower]);
D_tower := \left[0 \quad \rho_{flux} JT \quad 0 \right] \quad (11.3)
\end{aligned}$$

$$\begin{aligned}
> T_rot_blade_1 := 0.5 * ((D_blade_1[1] * \omega[1][1]) + (D_blade_1[2] * \\
& \omega[1][2]) + (D_blade_1[3] * \omega[1][3]));
\end{aligned}$$

$$T_{rot_blade_1} := 0.5 \left(-\rho_{flux} \cos(\psi) + \beta_{flux_1} \right)^2 JB + 0.5 \left(\rho_{flux} \sin(\psi) \sin(\beta_1) - \Omega \cos(\beta_1) \right)^2 JB \quad (11.4)$$

```
> T_rot_blade_2 := 0.5*((D_blade_2[1]*omega[2][1])+(D_blade_2[2]*omega[2][2])+(D_blade_2[3]*omega[2][3]));
```

$$T_{rot_blade_2} := 0.5 \left(\rho_{flux} \cos(\psi) + \beta_{flux_2} \right)^2 JB + 0.5 \left(-\rho_{flux} \sin(\psi) \sin(\beta_2) - \Omega \cos(\beta_2) \right)^2 JB \quad (11.5)$$

```
> T_rot_tower := 0.5*((D_tower[1]*omega[rho][1])+(D_tower[2]*omega[rho][2])+(D_tower[3]*omega[rho][3]));
```

$$T_{rot_tower} := 0.5 \rho_{flux}^2 J T \quad (11.6)$$

➤ Total kinetic energy

```
> T_total := T_blade_1 + T_blade_2 + T_tower + T_rot_blade_1 +  
T_rot_blade_2 + T_rot_tower;
```

$$\begin{aligned}
T_{total} := & 0.5 m_b \left(\left(e \sin(\psi) \Psi_{flux} + \frac{1}{2} R \left(-(\rho_{flux} \sin(\psi) \sin(\beta_1) \right. \right. \right. \\
& \left. \left. \left. - \Omega \cos(\beta_1) \right) \sin(\psi) - (\rho_{flux} \cos(\psi) - \beta_{flux_1}) \cos(\psi) \sin(\beta_1) \right) \right)^2 \\
& + \left(e \cos(\psi) \Psi_{flux} + \frac{1}{2} R \left(-(\rho_{flux} \sin(\psi) \sin(\beta_1) - \Omega \cos(\beta_1)) \cos(\psi) \right. \right. \\
& \left. \left. + (\rho_{flux} \cos(\psi) - \beta_{flux_1}) \sin(\psi) \sin(\beta_1) \right) \right)^2 + \left(-\frac{1}{2} l \rho_{flux} + e \cos(\psi) \rho_{flux} \right. \\
& \left. + \frac{1}{2} R \left(\rho_{flux} \cos(\psi) - \beta_{flux_1} \right) \cos(\beta_1) \right)^2 \Big) + 0.5 m_b \left(\left(-e \sin(\psi) \Psi_{flux} \right. \right. \\
& \left. \left. + \frac{1}{2} R \left((-\rho_{flux} \sin(\psi) \sin(\beta_2) - \Omega \cos(\beta_2)) \sin(\psi) + (-\rho_{flux} \cos(\psi) \right. \right. \right. \\
& \left. \left. \left. - \beta_{flux_2}) \cos(\psi) \sin(\beta_2) \right) \right)^2 + \left(-e \cos(\psi) \Psi_{flux} + \frac{1}{2} R \left(\left(\right. \right. \right. \\
& \left. \left. \left. -e \sin(\psi) \rho_{flux} - \frac{1}{2} R \left(\rho_{flux} \cos(\psi) - \beta_{flux_2} \right) \cos(\beta_2) \right) \right)^2 \right)
\end{aligned} \tag{12.1}$$

$$-\rho_{flux} \sin(\psi) \sin(\beta_2) - \Omega \cos(\beta_2) \right) \cos(\psi) - \left(-\rho_{flux} \cos(\psi) \right. \\ \left. - \beta_{flux} \right) \sin(\psi) \sin(\beta_2) \Bigg)^2 + \left(-\frac{1}{2} l \rho_{flux} - e \cos(\psi) \rho_{flux} + \frac{1}{2} R \left(\right. \right. \\ \left. \left. - \rho_{flux} \cos(\psi) - \beta_{flux} \right) \cos(\beta_2) \Bigg)^2 \Bigg) + 0.03125000000 m_t l^2 \rho_{flux}^2 + 0.5 \Bigg)$$

```


$$\begin{aligned}
& -\rho_{flux} \cos(\psi) + \beta_{flux_1} \Big)^2 JB + 0.5 \left( \rho_{flux} \sin(\psi) \sin(\beta_1) - \Omega \cos(\beta_1) \right)^2 JB \\
& + 0.5 \left( \rho_{flux} \cos(\psi) + \beta_{flux_2} \right)^2 JB + 0.5 \left( -\rho_{flux} \sin(\psi) \sin(\beta_2) - \Omega \cos(\beta_2) \right)^2 JB \\
& + 0.5 \rho_{flux}^2 JT
\end{aligned}$$


```

=> `starting length` = length(%), `converting to horner`=length
 (convert(%,<horner>)), factoring=length(factor(%)), `simplify
 length` = length(symplify(%));
 starting length = 1860, converting to horner = 4279, factoring = 5026, simplify length = 1873 (12.2)

Potential energy

```

> g := Vector[row]([g_,0,0]);

$$g := \begin{bmatrix} g_ & 0 & 0 \end{bmatrix} \quad (13.1)$$


```

Position vectors expressed in {E_0} for the potential energy

```

> R_cg blade_1_0 := r_0 + Multiply(r_2,R[rho]) + Multiply
  (r_3_beta_1,R[rho]) + Multiply(r_cg_beta,Multiply(R[beta[1]],
  Multiply(R[psi[1]],R[rho])));

$$R_{cg\_blade\_1\_0} := \begin{bmatrix} \frac{1}{2} l + \frac{1}{2} l \cos(\rho) - e \cos(\psi) \cos(\rho) + \frac{1}{2} R \left( -\cos(\beta_1) \cos(\psi) \cos(\rho) - \sin(\beta_1) \sin(\rho) \right), e \sin(\psi) + \frac{1}{2} R \sin(\psi) \cos(\beta_1), -\frac{1}{2} l \sin(\rho) + e \cos(\psi) \sin(\rho) + \frac{1}{2} R \left( \cos(\beta_1) \cos(\psi) \sin(\rho) - \sin(\beta_1) \cos(\rho) \right) \end{bmatrix} \quad (13.2)$$


```

```

> R_cg blade_2_0 := r_0 + Multiply(r_2,R[rho]) + Multiply
  (r_3_beta_2,R[rho]) + Multiply(r_cg_beta,Multiply(R[beta[2]],
  Multiply(R[psi[2]],R[rho])));

$$R_{cg\_blade\_2\_0} := \begin{bmatrix} \frac{1}{2} l + \frac{1}{2} l \cos(\rho) + e \cos(\psi) \cos(\rho) + \frac{1}{2} R \left( \cos(\beta_2) \cos(\psi) \cos(\rho) - \sin(\beta_2) \sin(\rho) \right), -e \sin(\psi) - \frac{1}{2} R \sin(\psi) \cos(\beta_2), -\frac{1}{2} l \sin(\rho) - e \cos(\psi) \sin(\rho) + \frac{1}{2} R \left( -\cos(\beta_2) \cos(\psi) \sin(\rho) - \sin(\beta_2) \cos(\rho) \right) \end{bmatrix} \quad (13.3)$$


```

```

> R_cg_T_0 := r_0 + Multiply(r_cg_T,R[rho]);

$$R_{cg\_T\_0} := \begin{bmatrix} \frac{1}{2} l + \frac{1}{4} l \cos(\rho) & 0 & -\frac{1}{4} l \sin(\rho) \end{bmatrix} \quad (13.4)$$


```

```

> V_g := (m_b*g[1]*(R_cg blade_1_0[1] + R_cg blade_2_0[1]))+(m_t*
  g[1]*R_cg_T_0[1]);

$$(13.5)$$


```

$$V_g := m_b g_- \left(l + l \cos(\rho) + \frac{1}{2} R (-\cos(\beta_1) \cos(\psi) \cos(\rho) - \sin(\beta_1) \sin(\rho)) \right. \\ \left. + \frac{1}{2} R (\cos(\beta_2) \cos(\psi) \cos(\rho) - \sin(\beta_2) \sin(\rho)) \right) + m_t g_- \left(\frac{1}{2} l \right. \\ \left. + \frac{1}{4} l \cos(\rho) \right)$$

```
> v_springs := 1/2*kb*beta[1]*beta[1]+1/2*kb*beta[2]*beta[2]+1/2*
ka*rho*rho;
```

$$V_{springs} := \frac{1}{2} kb \beta_1^2 + \frac{1}{2} kb \beta_2^2 + \frac{1}{2} ka \rho^2 \quad (13.6)$$

```
> v_total := v_g + v_springs;
```

$$V_{total} := m_b g_- \left(l + l \cos(\rho) + \frac{1}{2} R (-\cos(\beta_1) \cos(\psi) \cos(\rho) - \sin(\beta_1) \sin(\rho)) \right. \\ \left. + \frac{1}{2} R (\cos(\beta_2) \cos(\psi) \cos(\rho) - \sin(\beta_2) \sin(\rho)) \right) + m_t g_- \left(\frac{1}{2} l \right. \\ \left. + \frac{1}{4} l \cos(\rho) \right) + \frac{1}{2} kb \beta_1^2 + \frac{1}{2} kb \beta_2^2 + \frac{1}{2} ka \rho^2$$

```
> `starting length` = length(v_total), `converting to horner`=
length(convert(v_total,horner)), factoring=length(factor
(v_total)), `simplify length` = length(simplify(v_total));
starting length=386, converting to horner=359, factoring=444, simplify length=399
```

(13.7)

(13.8)

Full equations of motion using the Lagrangian

eq of motion for beta_1

$$> dT_dbeta1flux := diff(T_total, beta[flux[1]]); \\ dT_dbeta1flux := 0.5 m_b \left(\left(e \sin(\psi) \psi_{flux} + \frac{1}{2} R \left(-(\rho_{flux} \sin(\psi) \sin(\beta_1) \right. \right. \right. \\ \left. \left. \left. - \Omega \cos(\beta_1) \right) \sin(\psi) - (\rho_{flux} \cos(\psi) - \beta_{flux_1}) \cos(\psi) \sin(\beta_1) \right) \right) \\ \left. R \cos(\psi) \sin(\beta_1) - \left(e \cos(\psi) \psi_{flux} + \frac{1}{2} R \left(-(\rho_{flux} \sin(\psi) \sin(\beta_1) \right. \right. \right. \\ \left. \left. \left. - \Omega \cos(\beta_1) \right) \cos(\psi) + (\rho_{flux} \cos(\psi) - \beta_{flux_1}) \sin(\psi) \sin(\beta_1) \right) \right) \\ \left. R \sin(\beta_1) \sin(\psi) - \left(-\frac{1}{2} l \rho_{flux} + e \cos(\psi) \rho_{flux} + \frac{1}{2} R \left(\rho_{flux} \cos(\psi) \right. \right. \right. \\ \left. \left. \left. - \beta_{flux_1} \right) \cos(\beta_1) \right) R \cos(\beta_1) \right) + 1.0 \left(-\rho_{flux} \cos(\psi) + \beta_{flux_1} \right) JB$$

$$> dT_dbeta1 := diff(T_total, beta[1]); \quad (14.1.2)$$

$$\begin{aligned}
dT_dbeta1 := & 0.5 m_b \left(\left(e \sin(\psi) \psi_{flux} + \frac{1}{2} R \left(-(\rho_{flux} \sin(\psi) \sin(\beta_1) \right. \right. \right. \\
& \left. \left. \left. - \Omega \cos(\beta_1) \right) \sin(\psi) - (\rho_{flux} \cos(\psi) - \beta_{flux_1}) \cos(\psi) \sin(\beta_1) \right) R \left(\right. \right. \\
& \left. \left. - (\rho_{flux} \sin(\psi) \cos(\beta_1) + \Omega \sin(\beta_1)) \sin(\psi) - (\rho_{flux} \cos(\psi) \right. \right. \\
& \left. \left. - \beta_{flux_1}) \cos(\psi) \cos(\beta_1) \right) + \left(e \cos(\psi) \psi_{flux} + \frac{1}{2} R \left(-(\rho_{flux} \sin(\psi) \sin(\beta_1) \right. \right. \\
& \left. \left. - \Omega \cos(\beta_1) \right) \cos(\psi) + (\rho_{flux} \cos(\psi) - \beta_{flux_1}) \sin(\psi) \sin(\beta_1) \right) R \left(\right. \right. \\
& \left. \left. - (\rho_{flux} \sin(\psi) \cos(\beta_1) + \Omega \sin(\beta_1)) \cos(\psi) + (\rho_{flux} \cos(\psi) \right. \right. \\
& \left. \left. - \beta_{flux_1}) \sin(\psi) \cos(\beta_1) \right) - \left(-\frac{1}{2} l \rho_{flux} + e \cos(\psi) \rho_{flux} + \frac{1}{2} R \left(\rho_{flux} \cos(\psi) \right. \right. \\
& \left. \left. - \beta_{flux_1}) \cos(\beta_1) \right) R \left(\rho_{flux} \cos(\psi) - \beta_{flux_1} \right) \sin(\beta_1) \right) \\
& + 1.0 \left(\rho_{flux} \sin(\psi) \sin(\beta_1) - \Omega \cos(\beta_1) \right) JB \left(\rho_{flux} \sin(\psi) \cos(\beta_1) \right. \\
& \left. \left. + \Omega \sin(\beta_1) \right)
\end{aligned} \tag{14.1.2}$$

> **dv_dbeta1 := diff(v_total, beta[1]);**

$$dV_dbeta1 := \frac{1}{2} m_b g_- R \left(\sin(\beta_1) \cos(\psi) \cos(\rho) - \cos(\beta_1) \sin(\rho) \right) + kb \beta_1 \tag{14.1.3}$$

indicate time dependencies

indicate time dependencies

> **dT_dbeta1_t := subs({beta[flux[1]]=beta[flux[1]](t),beta[flux[2]]=beta[flux[2]](t),rho[flux]=rho[flux](t), psi[flux]=Omega, beta[1]=beta[1](t), beta[2]=beta[2](t), rho=rho(t), psi=Omega*t},dT_dbeta1);**

$$\begin{aligned}
dT_dbeta1_t := & 0.5 m_b \left(\left(e \sin(\Omega t) \Omega + \frac{1}{2} R \left(-(\rho_{flux}(t) \sin(\Omega t) \sin(\beta_1(t)) \right. \right. \right. \\
& \left. \left. \left. - \Omega \cos(\beta_1(t)) \right) \sin(\Omega t) - (\rho_{flux}(t) \cos(\Omega t) \right. \right. \\
& \left. \left. - \beta_{flux_1}(t) \right) \cos(\Omega t) \sin(\beta_1(t)) \right) R \left(-(\rho_{flux}(t) \sin(\Omega t) \cos(\beta_1(t)) \right. \right. \\
& \left. \left. + \Omega \sin(\beta_1(t)) \right) \sin(\Omega t) - (\rho_{flux}(t) \cos(\Omega t) \right. \right. \\
& \left. \left. - \beta_{flux_1}(t) \right) \cos(\Omega t) \cos(\beta_1(t)) \right) + \left(e \cos(\Omega t) \Omega + \frac{1}{2} R \left(\right. \right. \\
& \left. \left. - (\rho_{flux}(t) \sin(\Omega t) \sin(\beta_1(t)) - \Omega \cos(\beta_1(t))) \cos(\Omega t) \right)
\end{aligned} \tag{14.1.1.1}$$

$$\begin{aligned}
& + \left(\rho_{flux}(t) \cos(\Omega t) - \beta_{flux_1}(t) \right) \sin(\Omega t) \sin(\beta_1(t)) \Big) \Big) R \Big(\\
& - \left(\rho_{flux}(t) \sin(\Omega t) \cos(\beta_1(t)) + \Omega \sin(\beta_1(t)) \right) \cos(\Omega t) \\
& + \left(\rho_{flux}(t) \cos(\Omega t) - \beta_{flux_1}(t) \right) \sin(\Omega t) \cos(\beta_1(t)) \Big) - \left(-\frac{1}{2} l \rho_{flux}(t) \right. \\
& + e \cos(\Omega t) \rho_{flux}(t) + \frac{1}{2} R \left(\rho_{flux}(t) \cos(\Omega t) - \beta_{flux_1}(t) \right) \cos(\beta_1(t)) \Big) \\
& R \left(\rho_{flux}(t) \cos(\Omega t) - \beta_{flux_1}(t) \right) \sin(\beta_1(t)) \Big) \\
& + 1.0 \left(\rho_{flux}(t) \sin(\Omega t) \sin(\beta_1(t)) \right. \\
& \left. - \Omega \cos(\beta_1(t)) \right) JB \left(\rho_{flux}(t) \sin(\Omega t) \cos(\beta_1(t)) + \Omega \sin(\beta_1(t)) \right) \\
> \text{dv_dbeta1_t} := \text{subs}(\{\beta_{flux[1]}=\beta_{flux[1]}(t), \beta_{flux[2]}=\beta_{flux[2]}(t), \rho_{flux}=\rho_{flux}(t), \psi_{flux}=\Omega, \beta_1=\beta_1(t), \beta_2=\beta_2(t), \rho=\rho(t), \psi=\Omega*t\}, \text{dv_dbeta1}); \\
dV_dbeta1_t := \frac{1}{2} m_b g_- R \left(\sin(\beta_1(t)) \cos(\Omega t) \cos(\rho(t)) \right. \\
& \left. - \cos(\beta_1(t)) \sin(\rho(t)) \right) + kb \beta_1(t) \tag{14.1.1.2} \\
> \text{dT_dbeta1flux_t} := \text{subs}(\{\beta_{flux[1]}=\beta_{flux[1]}(t), \beta_{flux[2]}=\beta_{flux[2]}(t), \rho_{flux}=\rho_{flux}(t), \psi_{flux}=\Omega, \beta_1=\beta_1(t), \beta_2=\beta_2(t), \rho=\rho(t), \psi=\Omega*t\}, \text{dT_dbeta1flux}); \\
dT_dbeta1flux_t := 0.5 m_b \left(\left(e \sin(\Omega t) \Omega + \frac{1}{2} R \left(\right. \right. \right. \\
& \left. \left. \left. - \left(\rho_{flux}(t) \sin(\Omega t) \sin(\beta_1(t)) - \Omega \cos(\beta_1(t)) \right) \sin(\Omega t) \right. \right. \right. \\
& \left. \left. \left. - \left(\rho_{flux}(t) \cos(\Omega t) - \beta_{flux_1}(t) \right) \cos(\Omega t) \sin(\beta_1(t)) \right) \right) \\
& R \cos(\Omega t) \sin(\beta_1(t)) - \left(e \cos(\Omega t) \Omega + \frac{1}{2} R \left(\right. \right. \\
& \left. \left. - \left(\rho_{flux}(t) \sin(\Omega t) \sin(\beta_1(t)) - \Omega \cos(\beta_1(t)) \right) \cos(\Omega t) \right. \right. \\
& \left. \left. + \left(\rho_{flux}(t) \cos(\Omega t) - \beta_{flux_1}(t) \right) \sin(\Omega t) \sin(\beta_1(t)) \right) \right) \\
& R \sin(\beta_1(t)) \sin(\Omega t) - \left(-\frac{1}{2} l \rho_{flux}(t) + e \cos(\Omega t) \rho_{flux}(t) \right. \\
& \left. + \frac{1}{2} R \left(\rho_{flux}(t) \cos(\Omega t) - \beta_{flux_1}(t) \right) \cos(\beta_1(t)) \right) R \cos(\beta_1(t)) \right) + 1.0 \left(\right. \\
\end{aligned}$$

$$-\rho_{flux}(t) \cos(\Omega t) + \beta_{flux_1}(t) \Big) JB$$

change q_flux to d/dt(q)

```
> dT_dbeta1_tt := subs({beta[flux[1]](t)=diff(beta[1](t),t),
  beta[flux[2]](t)=diff(beta[2](t),t),rho[flux](t)=diff(rho
  (t),t)},dT_dbeta1_t);
```

$$dT_dbeta1_tt := 0.5 m_b \left(\left(e \sin(\Omega t) \right) \Omega + \frac{1}{2} R \left(\right. \right. \quad (14.1.1.4)$$

$$\begin{aligned}
& - \left(\left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \sin(\beta_1(t)) - \Omega \cos(\beta_1(t)) \right) \sin(\Omega t) \\
& - \left(\left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) - \left(\frac{d}{dt} \beta_1(t) \right) \right) \cos(\Omega t) \sin(\beta_1(t)) \Big) R \Big(\\
& - \left(\left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \cos(\beta_1(t)) + \Omega \sin(\beta_1(t)) \right) \sin(\Omega t) \\
& - \left(\left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) - \left(\frac{d}{dt} \beta_1(t) \right) \right) \cos(\Omega t) \cos(\beta_1(t)) \Big) \\
& + \left(e \cos(\Omega t) \Omega + \frac{1}{2} R \left(- \left(\left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \sin(\beta_1(t)) \right. \right. \right. \\
& \left. \left. \left. - \Omega \cos(\beta_1(t)) \right) \cos(\Omega t) + \left(\left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) \right. \right. \right. \\
& \left. \left. \left. - \left(\frac{d}{dt} \beta_1(t) \right) \right) \sin(\Omega t) \sin(\beta_1(t)) \right) \Big) R \Big(\\
& - \left(\left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \cos(\beta_1(t)) + \Omega \sin(\beta_1(t)) \right) \cos(\Omega t) \\
& + \left(\left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) - \left(\frac{d}{dt} \beta_1(t) \right) \right) \sin(\Omega t) \cos(\beta_1(t)) \Big) - \Big(\\
& - \frac{1}{2} l \left(\frac{d}{dt} \rho(t) \right) + e \cos(\Omega t) \left(\frac{d}{dt} \rho(t) \right) + \frac{1}{2} R \left(\left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) \right. \\
& \left. \left. - \left(\frac{d}{dt} \beta_1(t) \right) \right) \cos(\beta_1(t)) \right) R \left(\left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) \right. \\
& \left. \left. - \left(\frac{d}{dt} \beta_1(t) \right) \right) \sin(\beta_1(t)) \right) + 1.0 \left(\left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \sin(\beta_1(t)) \right. \\
& \left. \left. - \Omega \cos(\beta_1(t)) \right) JB \left(\left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \cos(\beta_1(t)) + \Omega \sin(\beta_1(t)) \right)
\end{aligned}$$

```
> dv_dbeta1_tt := subs({beta[flux[1]](t)=diff(beta[1](t),t),
  beta[flux[2]](t)=diff(beta[2](t),t),rho[flux](t)=diff(rho
  (t),t)},{dv_dbeta1_t});
```

$$dV_dbeta1_tt := \frac{1}{2} m_b g_- R \left(\sin(\beta_1(t)) \cos(\Omega t) \cos(\rho(t)) \right) \quad (14.1.1.5)$$

$$-\cos(\beta_1(t)) \sin(\rho(t)) \Big) + kb \beta_1(t)$$

```
> dT_dbeta1flux_tt := subs({beta[flux[1]](t)=diff(beta[1](t),t),beta[flux[2]](t)=diff(beta[2](t),t),rho[flux](t)=diff(rho(t),t)},dT_dbeta1flux_t);
```

$$\begin{aligned}
dT_dbeta1flux_tt := & 0.5 m_b \left(\left(e \sin(\Omega t) \Omega + \frac{1}{2} R \left(\right. \right. \right. \\
& - \left(\left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \sin(\beta_1(t)) - \Omega \cos(\beta_1(t)) \right) \sin(\Omega t) \\
& - \left(\left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) - \left(\frac{d}{dt} \beta_1(t) \right) \right) \cos(\Omega t) \sin(\beta_1(t)) \left. \right) \\
& R \cos(\Omega t) \sin(\beta_1(t)) - \left(e \cos(\Omega t) \Omega + \frac{1}{2} R \left(\right. \right. \\
& - \left(\left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \sin(\beta_1(t)) - \Omega \cos(\beta_1(t)) \right) \cos(\Omega t) \\
& + \left(\left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) - \left(\frac{d}{dt} \beta_1(t) \right) \right) \sin(\Omega t) \sin(\beta_1(t)) \left. \right) \\
& R \sin(\beta_1(t)) \sin(\Omega t) - \left(-\frac{1}{2} l \left(\frac{d}{dt} \rho(t) \right) + e \cos(\Omega t) \left(\frac{d}{dt} \rho(t) \right) \right. \\
& + \frac{1}{2} R \left(\left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) - \left(\frac{d}{dt} \beta_1(t) \right) \right) \cos(\beta_1(t)) \left. \right) R \cos(\beta_1(t)) \\
& \left. \left. \left. + 1.0 \left(-\left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) + \frac{d}{dt} \beta_1(t) \right) JB \right) \right)
\end{aligned} \tag{14.1.1.6}$$

```

> `starting length` = length(%), `converting to horner` =
length(convert(% ,horner)), factoring=length(factor(%)),
`simplify length` = length(simplify(%));
starting length=1187, converting to horner=769, factoring=943, simplify length (14.1.1.7)
=1200

```

$$\begin{aligned}
> dT_dbeta1flux_tt := & \text{convert}(dT_dbeta1flux_tt, \text{horner}); \\
dT_dbeta1flux_tt := & 1.0 \left(-1. \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) + \frac{d}{dt} \beta_1(t) \right) JB \tag{14.1.1.8} \\
& + \left(0.2500000000 m_b l \left(\frac{d}{dt} \rho(t) \right) \cos(\beta_1(t)) + 0.5 m_b \left(\right. \right. \\
& - 0.5000000000 \left(\left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) \right. \\
& \left. \left. - 1. \left(\frac{d}{dt} \beta_1(t) \right) \right) \cos(\Omega t)^2 \sin(\beta_1(t))^2 \right. \\
& - 0.5000000000 \left(\left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) - 1. \left(\frac{d}{dt} \beta_1(t) \right) \right) \cos(\beta_1(t))^2 + \left(\right. \\
& - 0.5000000000 \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) + 0.5000000000 \left(\frac{d}{dt} \beta_1(t) \right) \right) \\
& \left. \left. \sin(\beta_1(t))^2 \sin(\Omega t)^2 \right) R \right) R - 0.5 m_b \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) R \cos(\beta_1(t)) e
\end{aligned}$$

 **differentiate with respect to t and construct equations of motion for beta 1**

$$\begin{aligned}
> ddt_dT_dbeta1flux := & \text{diff}(dT_dbeta1flux_tt, t); \\
ddt_dT_dbeta1flux := & 1.0 \left(-1. \left(\frac{d^2}{dt^2} \rho(t) \right) \cos(\Omega t) + 1. \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \Omega \right) \tag{14.1.2.1}
\end{aligned}$$

$$\begin{aligned}
& + \frac{d^2}{dt^2} \beta_1(t) \Big) JB + \left(0.2500000000 m_b l \left(\frac{d^2}{dt^2} \rho(t) \right) \cos(\beta_1(t)) \right. \\
& - 0.2500000000 m_b l \left(\frac{d}{dt} \rho(t) \right) \sin(\beta_1(t)) \left(\frac{d}{dt} \beta_1(t) \right) + 0.5 m_b \left(\right. \\
& - 0.5000000000 \left(\left(\frac{d^2}{dt^2} \rho(t) \right) \cos(\Omega t) - \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \Omega \right. \\
& - 1. \left(\frac{d^2}{dt^2} \beta_1(t) \right) \left. \right) \cos(\Omega t)^2 \sin(\beta_1(t))^2 \\
& + 1.000000000 \left(\left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) \right. \\
& - 1. \left(\frac{d}{dt} \beta_1(t) \right) \left. \right) \cos(\Omega t) \sin(\beta_1(t))^2 \sin(\Omega t) \Omega \\
& - 1.000000000 \left(\left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) \right. \\
& - 1. \left(\frac{d}{dt} \beta_1(t) \right) \left. \right) \cos(\Omega t)^2 \sin(\beta_1(t)) \cos(\beta_1(t)) \left(\frac{d}{dt} \beta_1(t) \right) \\
& - 0.5000000000 \left(\left(\frac{d^2}{dt^2} \rho(t) \right) \cos(\Omega t) - \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \Omega \right. \\
& - 1. \left(\frac{d^2}{dt^2} \beta_1(t) \right) \left. \right) \cos(\beta_1(t))^2 + 1.000000000 \left(\left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) \right. \\
& - 1. \left(\frac{d}{dt} \beta_1(t) \right) \left. \right) \cos(\beta_1(t)) \sin(\beta_1(t)) \left(\frac{d}{dt} \beta_1(t) \right) + \left(\right. \\
& - 0.5000000000 \left(\frac{d^2}{dt^2} \rho(t) \right) \cos(\Omega t) \\
& + 0.5000000000 \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \Omega + 0.5000000000 \left(\frac{d^2}{dt^2} \beta_1(t) \right) \left. \right) \\
& \sin(\beta_1(t))^2 \sin(\Omega t)^2 + 2 \left(- 0.5000000000 \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) \right. \\
& + 0.5000000000 \left(\frac{d}{dt} \beta_1(t) \right) \left. \right) \sin(\beta_1(t)) \sin(\Omega t)^2 \cos(\beta_1(t)) \left(\frac{d}{dt} \beta_1(t) \right) \\
& + 2 \left(- 0.5000000000 \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) \right. \\
& + 0.5000000000 \left(\frac{d}{dt} \beta_1(t) \right) \left. \right) \sin(\beta_1(t))^2 \sin(\Omega t) \cos(\Omega t) \Omega \Big) R \Big) R \\
& - 0.5 m_b \left(\frac{d^2}{dt^2} \rho(t) \right) \cos(\Omega t) R \cos(\beta_1(t)) e \\
& + 0.5 m_b \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \Omega R \cos(\beta_1(t)) e
\end{aligned}$$

```

+ 0.5 m_b  $\left( \frac{d}{dt} \rho(t) \right) \cos(\Omega t) R \sin(\beta_1(t)) \left( \frac{d}{dt} \beta_1(t) \right) e$ 

> `starting length` = length(%), `converting to horner`=
length(convert(% , horner)), factoring=length(factor(%)),
`simplify length` = length(simplify(%));
starting length=2485, converting to horner=2167, factoring=2731, (14.1.2.2)
simplify length=2498

> ddt_dT_dbeta1flux := convert(ddt_dT_dbeta1flux, horner);
ddt_dT_dbeta1flux := 1.0  $\left( -1. \left( \frac{d^2}{dt^2} \rho(t) \right) \cos(\Omega t) + 1. \left( \frac{d}{dt} \rho(t) \right) \sin(\Omega t) \Omega \right)$  (14.1.2.3)
+  $\frac{d^2}{dt^2} \beta_1(t) \right) JB + \left( \left( 0.2500000000 \left( \frac{d^2}{dt^2} \rho(t) \right) \cos(\beta_1(t)) \right.$ 
- 0.2500000000  $\left( \frac{d}{dt} \rho(t) \right) \sin(\beta_1(t)) \left( \frac{d}{dt} \beta_1(t) \right) \right) m_b l + 0.5 m_b \left(
- 0.5000000000 \left( \left( \frac{d^2}{dt^2} \rho(t) \right) \cos(\Omega t) - 1. \left( \frac{d^2}{dt^2} \beta_1(t) \right) \right) \cos(\beta_1(t))^2 \right.$ 
+  $\left( \left( -1.000000000 \left( \frac{d}{dt} \beta_1(t) \right)^2 + \left( 1.000000000 \left( \frac{d}{dt} \rho(t) \right) \left( \frac{d}{dt} \beta_1(t) \right) \right. \right.$ 
+  $\left( 1.000000000 \left( \frac{d}{dt} \beta_1(t) \right)^2 \right.$ 
- 1.000000000  $\left( \frac{d}{dt} \rho(t) \right) \left( \frac{d}{dt} \beta_1(t) \right) \cos(\Omega t) \right) \cos(\Omega t) \right)$ 
 $\cos(\beta_1(t)) - 0.5000000000 \left( \left( \frac{d^2}{dt^2} \rho(t) \right) \cos(\Omega t) \right.$ 
- 1.  $\left( \frac{d^2}{dt^2} \beta_1(t) \right) \right) \cos(\Omega t)^2 \sin(\beta_1(t)) \sin(\beta_1(t)) + \left( 2. \left( \right.$ 
- 0.5000000000  $\left( \frac{d}{dt} \rho(t) \right) \cos(\Omega t) + 0.5000000000 \left( \frac{d}{dt} \beta_1(t) \right) \right)$ 
 $\cos(\beta_1(t)) \left( \frac{d}{dt} \beta_1(t) \right) + \left( -0.5000000000 \left( \frac{d^2}{dt^2} \rho(t) \right) \cos(\Omega t) \right.$ 
+ 0.5000000000  $\left( \frac{d^2}{dt^2} \beta_1(t) \right) \right) \sin(\beta_1(t)) \sin(\beta_1(t)) \sin(\Omega t)^2$ 
+  $\left( 0.5000000000 \left( \frac{d}{dt} \rho(t) \right) \cos(\beta_1(t))^2 \right.$ 
+ 0.5000000000  $\left( \frac{d}{dt} \rho(t) \right) \cos(\Omega t)^2 \sin(\beta_1(t))^2$ 
+ 0.5000000000  $\left( \frac{d}{dt} \rho(t) \right) \sin(\beta_1(t))^2 \sin(\Omega t)^2 \right) \sin(\Omega t) \Omega \right) R \right) R$ 
```

$$\begin{aligned}
& + \left(\left(-0.5 \left(\frac{d^2}{dt^2} \rho(t) \right) \cos(\Omega t) \cos(\beta_1(t)) \right. \right. \\
& + 0.5 \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) \sin(\beta_1(t)) \left(\frac{d}{dt} \beta_1(t) \right) \left. \right) m_b \\
& \left. + 0.5 m_b \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \Omega \cos(\beta_1(t)) \right) R e \\
> \text{eq_beta1[full]} := \text{ddt_dT_dbeta1flux} - \text{dT_dbeta1_tt} + \\
& \text{dv_dbeta1_tt} = 0; \\
\text{eq_beta1full} := & 1.0 \left(-1. \left(\frac{d^2}{dt^2} \rho(t) \right) \cos(\Omega t) + 1. \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \Omega \right. \quad (14.1.2.4) \\
& + \frac{d^2}{dt^2} \beta_1(t) \right) J B + \left(\left(0.2500000000 \left(\frac{d^2}{dt^2} \rho(t) \right) \cos(\beta_1(t)) \right. \right. \\
& - 0.2500000000 \left(\frac{d}{dt} \rho(t) \right) \sin(\beta_1(t)) \left(\frac{d}{dt} \beta_1(t) \right) \left. \right) m_b l + 0.5 m_b \left(\right. \\
& - 0.5000000000 \left(\left(\frac{d^2}{dt^2} \rho(t) \right) \cos(\Omega t) - 1. \left(\frac{d^2}{dt^2} \beta_1(t) \right) \right) \cos(\beta_1(t))^2 \\
& + \left(\left(-1.000000000 \left(\frac{d}{dt} \beta_1(t) \right)^2 + \left(1.000000000 \left(\frac{d}{dt} \rho(t) \right) \left(\frac{d}{dt} \beta_1(t) \right) \right. \right. \\
& + \left(1.000000000 \left(\frac{d}{dt} \beta_1(t) \right)^2 \right. \\
& - 1.000000000 \left(\frac{d}{dt} \rho(t) \right) \left(\frac{d}{dt} \beta_1(t) \right) \cos(\Omega t) \right) \cos(\Omega t) \right) \cos(\Omega t) \left. \right) \\
& \cos(\beta_1(t)) - 0.5000000000 \left(\left(\frac{d^2}{dt^2} \rho(t) \right) \cos(\Omega t) \right. \\
& \left. - 1. \left(\frac{d^2}{dt^2} \beta_1(t) \right) \right) \cos(\Omega t)^2 \sin(\beta_1(t)) \sin(\beta_1(t)) + \left(2. \left(\right. \right. \\
& - 0.5000000000 \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) + 0.5000000000 \left(\frac{d}{dt} \beta_1(t) \right) \left. \right) \\
& \cos(\beta_1(t)) \left(\frac{d}{dt} \beta_1(t) \right) + \left(-0.5000000000 \left(\frac{d^2}{dt^2} \rho(t) \right) \cos(\Omega t) \right. \\
& + 0.5000000000 \left(\frac{d^2}{dt^2} \beta_1(t) \right) \left. \right) \sin(\beta_1(t)) \sin(\beta_1(t)) \sin(\Omega t)^2 \\
& + \left(0.5000000000 \left(\frac{d}{dt} \rho(t) \right) \cos(\beta_1(t))^2 \right. \\
& + 0.5000000000 \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t)^2 \sin(\beta_1(t))^2 \\
& \left. + 0.5000000000 \left(\frac{d}{dt} \rho(t) \right) \sin(\beta_1(t))^2 \sin(\Omega t)^2 \right) \sin(\Omega t) \Omega \left. \right) R \left. \right) R
\end{aligned}$$

$$\begin{aligned}
& + \left(\left(-0.5 \left(\frac{d^2}{dt^2} \rho(t) \right) \cos(\Omega t) \cos(\beta_1(t)) \right. \right. \\
& + 0.5 \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) \sin(\beta_1(t)) \left(\frac{d}{dt} \beta_1(t) \right) \left. \right) m_b \\
& + 0.5 m_b \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \Omega \cos(\beta_1(t)) \Big) R e \\
& - 0.5 m_b \left(\left(e \sin(\Omega t) \Omega + \frac{1}{2} R \left(- \left(\left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \sin(\beta_1(t)) \right. \right. \right. \right. \\
& - \Omega \cos(\beta_1(t)) \Big) \sin(\Omega t) - \left(\left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) \right. \\
& - \left. \left. \left. \left. \left(\frac{d}{dt} \beta_1(t) \right) \right) \cos(\Omega t) \sin(\beta_1(t)) \right) \right) R \Big(\\
& - \left(\left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \cos(\beta_1(t)) + \Omega \sin(\beta_1(t)) \right) \sin(\Omega t) \\
& - \left(\left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) - \left(\frac{d}{dt} \beta_1(t) \right) \right) \cos(\Omega t) \cos(\beta_1(t)) \Big) \\
& + \left(\left(e \cos(\Omega t) \Omega + \frac{1}{2} R \left(- \left(\left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \sin(\beta_1(t)) \right. \right. \right. \right. \\
& - \Omega \cos(\beta_1(t)) \Big) \cos(\Omega t) + \left(\left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) \right. \\
& - \left. \left. \left. \left. \left(\frac{d}{dt} \beta_1(t) \right) \right) \sin(\Omega t) \sin(\beta_1(t)) \right) \right) R \Big(\\
& - \left(\left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \cos(\beta_1(t)) + \Omega \sin(\beta_1(t)) \right) \cos(\Omega t) \\
& + \left(\left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) - \left(\frac{d}{dt} \beta_1(t) \right) \right) \sin(\Omega t) \cos(\beta_1(t)) \Big) - \Big(\\
& - \frac{1}{2} l \left(\frac{d}{dt} \rho(t) \right) + e \cos(\Omega t) \left(\frac{d}{dt} \rho(t) \right) + \frac{1}{2} R \left(\left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) \right. \\
& - \left. \left. \left(\frac{d}{dt} \beta_1(t) \right) \right) \cos(\beta_1(t)) \Big) R \left(\left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) \right. \\
& - \left. \left. \left(\frac{d}{dt} \beta_1(t) \right) \right) \sin(\beta_1(t)) \Big) - 1.0 \left(\left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \sin(\beta_1(t)) \right. \\
& - \Omega \cos(\beta_1(t)) \Big) JB \left(\left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \cos(\beta_1(t)) + \Omega \sin(\beta_1(t)) \right) \\
& + \frac{1}{2} m_b g_R \left(\sin(\beta_1(t)) \cos(\Omega t) \cos(\rho(t)) - \cos(\beta_1(t)) \sin(\rho(t)) \right) \\
& + kb \beta_1(t) = 0
\end{aligned}$$

```

> `starting length` = length(%), `converting to horner`=
length(convert(% ,horner)), factoring=length(factor(%)),
`simplify length` = length(simplify(%));
starting length=4263, converting to horner=3171, factoring=4039,
simplify length=4276

```

(14.1.2.5)

```

> eq_beta1[full]:= convert(eq_beta1[full], horner);

$$eq_{beta1}_{full} := kb \beta_1(t) + \left( -1.0 \left( \frac{d^2}{dt^2} \rho(t) \right) \cos(\Omega t) + 1.0 \left( \frac{d^2}{dt^2} \beta_1(t) \right) \right.$$


$$- 1.0 \left( \frac{d}{dt} \rho(t) \right)^2 \sin(\Omega t)^2 \sin(\beta_1(t)) \cos(\beta_1(t)) \left. JB + \left( \left( -1.0 \left( \frac{d}{dt} \rho(t) \right) \sin(\beta_1(t))^2 + 1.0 \left( \frac{d}{dt} \rho(t) \right) \cos(\beta_1(t))^2 \right. \right. \right.$$


$$+ 1.0 \left( \frac{d}{dt} \rho(t) \right) \left. \right) \sin(\Omega t) JB + 1.0 \cos(\beta_1(t)) JB \sin(\beta_1(t)) \Omega \left. \right) \Omega$$


$$+ \left( 0.5000000000 m_b g_- \left( \sin(\beta_1(t)) \cos(\Omega t) \cos(\rho(t)) \right. \right.$$


$$- 1. \cos(\beta_1(t)) \sin(\rho(t)) \left. \right) + \left( 0.2500000000 \left( \frac{d^2}{dt^2} \rho(t) \right) \cos(\beta_1(t)) \right.$$


$$- 0.2500000000 \left( \frac{d}{dt} \rho(t) \right)^2 \cos(\Omega t) \sin(\beta_1(t)) \left. m_b l + \left( \left( -0.2500000000 \left( \frac{d^2}{dt^2} \rho(t) \right) \cos(\Omega t) - 1. \left( \frac{d^2}{dt^2} \beta_1(t) \right) \right) \cos(\beta_1(t))^2 \right. \right.$$


$$+ \left( \left( -0.2500000000 \left( \frac{d}{dt} \beta_1(t) \right)^2 + 0.2500000000 \left( \frac{d}{dt} \beta_1(t) \right)^2 \right. \right. \right.$$


$$+ 0.2500000000 \left( \frac{d}{dt} \rho(t) \right)^2 - 0.2500000000 \left( \frac{d}{dt} \rho(t) \right)^2 \cos(\Omega t)^2 \left. \right. \left. \right)$$


$$\cos(\Omega t)^2 \right) \cos(\beta_1(t)) - 0.2500000000 \left( \left( \frac{d^2}{dt^2} \rho(t) \right) \cos(\Omega t) \right. \left. \right. \left. \right)$$


$$- 1. \left( \frac{d^2}{dt^2} \beta_1(t) \right) \cos(\Omega t)^2 \sin(\beta_1(t)) \left. \right) \sin(\beta_1(t))$$


$$+ \left( \left( 0.2500000000 \left( \frac{d}{dt} \beta_1(t) \right)^2 \right. \right. \right.$$


$$- 0.5000000000 \left( \frac{d}{dt} \rho(t) \right)^2 \cos(\Omega t)^2 \left. \right) \cos(\beta_1(t)) + \left( \right.$$


$$- 0.2500000000 \left( \frac{d^2}{dt^2} \rho(t) \right) \cos(\Omega t) + 0.2500000000 \left( \frac{d^2}{dt^2} \beta_1(t) \right) \left. \right)$$


$$\sin(\beta_1(t)) \left. \right) \sin(\beta_1(t))$$


$$- 0.2500000000 \left( \frac{d}{dt} \rho(t) \right)^2 \sin(\Omega t)^2 \sin(\beta_1(t)) \cos(\beta_1(t)) \left. \right) \sin(\Omega t)^2 \\ m_b + \left( \left( 0.2500000000 \left( \frac{d}{dt} \rho(t) \right) \right. \right. \right.$$


```

$$\begin{aligned}
& + 0.2500000000 \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t)^2 \cos(\beta_1(t))^2 \\
& + 0.2500000000 \left(\frac{d}{dt} \rho(t) \right) \cos(\beta_1(t))^2 \sin(\Omega t)^2 \sin(\Omega t) m_b \\
& - 0.5 m_b (-0.5000000000 \cos(\beta_1(t)) \cos(\Omega t)^2 \sin(\beta_1(t))) \\
& - 0.5000000000 \cos(\beta_1(t)) \sin(\Omega t)^2 \sin(\beta_1(t)) \Omega \Omega R \Big) R + \Big(\Big(\\
& - 0.5 \left(\frac{d^2}{dt^2} \rho(t) \right) \cos(\Omega t) \cos(\beta_1(t)) \\
& + 0.5 \left(\frac{d}{dt} \rho(t) \right)^2 \cos(\Omega t)^2 \sin(\beta_1(t)) \Big) m_b + \Big(\Big(0.5 \left(\frac{d}{dt} \rho(t) \right) \\
& + 0.5 \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t)^2 \cos(\beta_1(t)) \\
& + 0.5 \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t)^2 \cos(\beta_1(t)) \Big) \sin(\Omega t) m_b - 0.5 m_b \Big(\\
& - 1. \sin(\Omega t)^2 \sin(\beta_1(t)) - 1. \cos(\Omega t)^2 \sin(\beta_1(t)) \Big) \Omega \Big) \Omega \Big) R e = 0 \\
\Rightarrow & \text{eq_beta1[full]} := \text{solve(eq_beta1[full], diff(beta[1](t), t, t));} \\
\text{eq_beta1full} := & - \left(1. \left(4. JB \cos(\beta_1(t))^2 \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \Omega \right. \right. \quad (14.1.2.7) \\
& + 4. JB \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \Omega - 4. JB \left(\frac{d^2}{dt^2} \rho(t) \right) \cos(\Omega t) \\
& + R m_b l \left(\frac{d^2}{dt^2} \rho(t) \right) \cos(\beta_1(t)) \\
& - 1. m_b R^2 \cos(\Omega t)^3 \sin(\beta_1(t))^2 \left(\frac{d^2}{dt^2} \rho(t) \right) \\
& - 1. m_b R^2 \cos(\beta_1(t))^2 \left(\frac{d^2}{dt^2} \rho(t) \right) \cos(\Omega t) \\
& - 2. m_b \left(\frac{d^2}{dt^2} \rho(t) \right) \cos(\Omega t) R \cos(\beta_1(t)) e \\
& - 1. m_b R^2 \sin(\beta_1(t))^2 \sin(\Omega t)^2 \left(\frac{d^2}{dt^2} \rho(t) \right) \cos(\Omega t) + 4. kb \beta_1(t) \\
& + 2. m_b \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \Omega R \cos(\beta_1(t)) e \\
& + m_b R^2 \cos(\Omega t)^2 \sin(\beta_1(t)) \cos(\beta_1(t)) \left(\frac{d}{dt} \beta_1(t) \right)^2
\end{aligned}$$

$$\begin{aligned}
& + m_b R^2 \cos(\beta_1(t))^2 \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \Omega \\
& - 1. m_b R^2 \cos(\beta_1(t)) \sin(\beta_1(t)) \left(\frac{d}{dt} \beta_1(t) \right)^2 \\
& + m_b R^2 \sin(\beta_1(t)) \sin(\Omega t)^2 \cos(\beta_1(t)) \left(\frac{d}{dt} \beta_1(t) \right)^2 \\
& + 4. JB \Omega^2 \cos(\beta_1(t)) \sin(\beta_1(t)) \\
& - 1. m_b R^2 \cos(\Omega t)^4 \sin(\beta_1(t)) \left(\frac{d}{dt} \rho(t) \right)^2 \cos(\beta_1(t)) \\
& - 4. \left(\frac{d}{dt} \rho(t) \right)^2 \sin(\Omega t)^2 \sin(\beta_1(t)) JB \cos(\beta_1(t)) \\
& - 1. m_b R^2 \left(\frac{d}{dt} \rho(t) \right)^2 \sin(\Omega t)^4 \sin(\beta_1(t)) \cos(\beta_1(t)) \\
& - 2. m_b R^2 \left(\frac{d}{dt} \rho(t) \right)^2 \sin(\Omega t)^2 \sin(\beta_1(t)) \cos(\beta_1(t)) \cos(\Omega t)^2 \\
& + m_b R^2 \sin(\Omega t)^3 \Omega \cos(\beta_1(t))^2 \left(\frac{d}{dt} \rho(t) \right) \\
& + m_b R^2 \sin(\Omega t)^2 \Omega^2 \cos(\beta_1(t)) \sin(\beta_1(t)) \\
& + m_b R^2 \sin(\Omega t) \Omega \cos(\beta_1(t))^2 \cos(\Omega t)^2 \left(\frac{d}{dt} \rho(t) \right) \\
& + 2. m_b R e \sin(\Omega t)^3 \Omega \left(\frac{d}{dt} \rho(t) \right) \cos(\beta_1(t)) \\
& + 2. m_b R e \sin(\Omega t)^2 \Omega^2 \sin(\beta_1(t)) \\
& + 2. m_b R e \sin(\Omega t) \Omega \cos(\beta_1(t)) \cos(\Omega t)^2 \left(\frac{d}{dt} \rho(t) \right) \\
& + m_b R^2 \cos(\Omega t)^2 \Omega^2 \cos(\beta_1(t)) \sin(\beta_1(t)) \\
& + 2. m_b R e \cos(\Omega t)^2 \Omega^2 \sin(\beta_1(t)) \\
& - 1. m_b R \sin(\beta_1(t)) l \left(\frac{d}{dt} \rho(t) \right)^2 \cos(\Omega t) \\
& + 2. m_b R \sin(\beta_1(t)) e \cos(\Omega t)^2 \left(\frac{d}{dt} \rho(t) \right)^2
\end{aligned}$$

$$\begin{aligned}
& + m_b R^2 \sin(\beta_1(t)) \left(\frac{d}{dt} \rho(t) \right)^2 \cos(\Omega t)^2 \cos(\beta_1(t)) \\
& - 4 \cdot JB \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \sin(\beta_1(t))^2 \Omega \\
& + 2 \cdot m_b g_- R \sin(\beta_1(t)) \cos(\Omega t) \cos(\rho(t)) \\
& - 2 \cdot m_b g_- R \cos(\beta_1(t)) \sin(\rho(t)) \Big) \Big) \Bigg) \Bigg/ \left(4 \cdot JB \right. \\
& \left. + R^2 m_b \sin(\Omega t)^2 \sin(\beta_1(t))^2 + R^2 m_b \cos(\beta_1(t))^2 \right. \\
& \left. + R^2 m_b \cos(\Omega t)^2 \sin(\beta_1(t))^2 \right)
\end{aligned}$$

simplify expression and lose time dependencie notation and d/dt

```
> T1_eq_beta1[full]:= subs({diff(beta[1](t),t,t)=bb_FF_1,
    diff(beta[2](t),t,t)=bb_FF_2,diff(rho(t),t,t)=aa_FF},
    eq_beta1[full]);
```

$$T1_eq_beta1_{full} := - \left(1. \left(-4 \cdot JB aa_FF \cos(\Omega t) \right. \right. \tag{14.1.3.1}$$

$$\left. \left. + 4 \cdot JB \cos(\beta_1(t))^2 \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \Omega + 4 \cdot JB \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \Omega \right) \right)$$

$$- 1 \cdot m_b R^2 \cos(\beta_1(t))^2 aa_FF \cos(\Omega t) + R m_b l aa_FF \cos(\beta_1(t))$$

$$- 1 \cdot m_b R^2 \cos(\Omega t)^3 \sin(\beta_1(t))^2 aa_FF$$

$$- 2 \cdot m_b aa_FF \cos(\Omega t) R \cos(\beta_1(t)) e$$

$$- 1 \cdot m_b R^2 \sin(\beta_1(t))^2 \sin(\Omega t)^2 aa_FF \cos(\Omega t) + 4 \cdot kb \beta_1(t)$$

$$+ 2 \cdot m_b \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \Omega R \cos(\beta_1(t)) e$$

$$+ m_b R^2 \cos(\Omega t)^2 \sin(\beta_1(t)) \cos(\beta_1(t)) \left(\frac{d}{dt} \beta_1(t) \right)^2$$

$$+ m_b R^2 \cos(\beta_1(t))^2 \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \Omega$$

$$- 1 \cdot m_b R^2 \cos(\beta_1(t)) \sin(\beta_1(t)) \left(\frac{d}{dt} \beta_1(t) \right)^2$$

$$+ m_b R^2 \sin(\beta_1(t)) \sin(\Omega t)^2 \cos(\beta_1(t)) \left(\frac{d}{dt} \beta_1(t) \right)^2$$

$$+ 4 \cdot JB \Omega^2 \cos(\beta_1(t)) \sin(\beta_1(t))$$

$$\begin{aligned}
& -1 \cdot m_b R^2 \cos(\Omega t)^4 \sin(\beta_1(t)) \left(\frac{d}{dt} \rho(t) \right)^2 \cos(\beta_1(t)) \\
& - 4 \cdot \left(\frac{d}{dt} \rho(t) \right)^2 \sin(\Omega t)^2 \sin(\beta_1(t)) JB \cos(\beta_1(t)) \\
& - 1 \cdot m_b R^2 \left(\frac{d}{dt} \rho(t) \right)^2 \sin(\Omega t)^4 \sin(\beta_1(t)) \cos(\beta_1(t)) \\
& - 2 \cdot m_b R^2 \left(\frac{d}{dt} \rho(t) \right)^2 \sin(\Omega t)^2 \sin(\beta_1(t)) \cos(\beta_1(t)) \cos(\Omega t)^2 \\
& + m_b R^2 \sin(\Omega t)^3 \Omega \cos(\beta_1(t))^2 \left(\frac{d}{dt} \rho(t) \right) \\
& + m_b R^2 \sin(\Omega t)^2 \Omega^2 \cos(\beta_1(t)) \sin(\beta_1(t)) \\
& + m_b R^2 \sin(\Omega t) \Omega \cos(\beta_1(t))^2 \cos(\Omega t)^2 \left(\frac{d}{dt} \rho(t) \right) \\
& + 2 \cdot m_b R e \sin(\Omega t)^3 \Omega \left(\frac{d}{dt} \rho(t) \right) \cos(\beta_1(t)) \\
& + 2 \cdot m_b R e \sin(\Omega t)^2 \Omega^2 \sin(\beta_1(t)) \\
& + 2 \cdot m_b R e \sin(\Omega t) \Omega \cos(\beta_1(t)) \cos(\Omega t)^2 \left(\frac{d}{dt} \rho(t) \right) \\
& + m_b R^2 \cos(\Omega t)^2 \Omega^2 \cos(\beta_1(t)) \sin(\beta_1(t)) \\
& + 2 \cdot m_b R e \cos(\Omega t)^2 \Omega^2 \sin(\beta_1(t)) \\
& - 1 \cdot m_b R \sin(\beta_1(t)) l \left(\frac{d}{dt} \rho(t) \right)^2 \cos(\Omega t) \\
& + 2 \cdot m_b R \sin(\beta_1(t)) e \cos(\Omega t)^2 \left(\frac{d}{dt} \rho(t) \right)^2 \\
& + m_b R^2 \sin(\beta_1(t)) \left(\frac{d}{dt} \rho(t) \right)^2 \cos(\Omega t)^2 \cos(\beta_1(t)) \\
& - 4 \cdot JB \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \sin(\beta_1(t))^2 \Omega \\
& + 2 \cdot m_b g_- R \sin(\beta_1(t)) \cos(\Omega t) \cos(\rho(t)) \\
& - 2 \cdot m_b g_- R \cos(\beta_1(t)) \sin(\rho(t)) \Big) \Big) \Bigg) \Bigg/ \Big(4 \cdot JB \\
& + R^2 m_b \sin(\Omega t)^2 \sin(\beta_1(t))^2 + R^2 m_b \cos(\beta_1(t))^2 \\
& + R^2 m_b \cos(\Omega t)^2 \sin(\beta_1(t))^2 \Big)
\end{aligned}$$

```
(beta[2](t),t)=bb_F_2, diff(rho(t),t)=aa_F},T1_eq_beta1
[full]);
```

$$\begin{aligned}
T2_eq_beta1_{full} := & - \left(1. \left(-4. JB aa_FF \cos(\Omega t) \right. \right. \\
& + m_b R^2 \cos(\beta_1(t))^2 aa_F \sin(\Omega t) \Omega \\
& - 1. m_b R^2 \cos(\beta_1(t)) \sin(\beta_1(t)) bb_F_I^2 \\
& - 4. aa_F^2 \sin(\Omega t)^2 \sin(\beta_1(t)) JB \cos(\beta_1(t)) \\
& - 1. m_b R^2 aa_F^2 \sin(\Omega t)^4 \sin(\beta_1(t)) \cos(\beta_1(t)) \\
& + m_b R^2 \sin(\beta_1(t)) \sin(\Omega t)^2 \cos(\beta_1(t)) bb_F_I^2 \\
& - 1. m_b R^2 \cos(\Omega t)^4 \sin(\beta_1(t)) aa_F^2 \cos(\beta_1(t)) \\
& + m_b R^2 \sin(\Omega t) \Omega \cos(\beta_1(t))^2 \cos(\Omega t)^2 aa_F \\
& - 2. m_b R^2 aa_F^2 \sin(\Omega t)^2 \sin(\beta_1(t)) \cos(\beta_1(t)) \cos(\Omega t)^2 \\
& + m_b R^2 \sin(\Omega t)^3 \Omega \cos(\beta_1(t))^2 aa_F \\
& + 2. m_b R e \sin(\Omega t)^3 \Omega aa_F \cos(\beta_1(t)) \\
& - 1. m_b R^2 \cos(\beta_1(t))^2 aa_FF \cos(\Omega t) + 4. JB aa_F \sin(\Omega t) \Omega \\
& + R m_b l aa_FF \cos(\beta_1(t)) - 1. m_b R^2 \cos(\Omega t)^3 \sin(\beta_1(t))^2 aa_FF \\
& - 2. m_b aa_FF \cos(\Omega t) R \cos(\beta_1(t)) e \\
& + 2. m_b R e \sin(\Omega t) \Omega \cos(\beta_1(t)) \cos(\Omega t)^2 aa_F \\
& - 1. m_b R \sin(\beta_1(t)) l aa_F^2 \cos(\Omega t) \\
& + 2. m_b R \sin(\beta_1(t)) e \cos(\Omega t)^2 aa_F^2 \\
& + m_b R^2 \sin(\beta_1(t)) aa_F^2 \cos(\Omega t)^2 \cos(\beta_1(t)) \\
& - 4. JB aa_F \sin(\Omega t) \sin(\beta_1(t))^2 \Omega \\
& - 1. m_b R^2 \sin(\beta_1(t))^2 \sin(\Omega t)^2 aa_FF \cos(\Omega t) + 4. kb \beta_1(t) \\
& + 4. JB \cos(\beta_1(t))^2 aa_F \sin(\Omega t) \Omega + 4. JB \Omega^2 \cos(\beta_1(t)) \sin(\beta_1(t)) \\
& + m_b R^2 \sin(\Omega t)^2 \Omega^2 \cos(\beta_1(t)) \sin(\beta_1(t)) \\
& + 2. m_b R e \sin(\Omega t)^2 \Omega^2 \sin(\beta_1(t)) \\
& + m_b R^2 \cos(\Omega t)^2 \Omega^2 \cos(\beta_1(t)) \sin(\beta_1(t)) \\
& + 2. m_b R e \cos(\Omega t)^2 \Omega^2 \sin(\beta_1(t))
\end{aligned} \tag{14.1.3.2}$$

$$\begin{aligned}
& + 2 \cdot m_b g_- R \sin(\beta_1(t)) \cos(\Omega t) \cos(\rho(t)) \\
& - 2 \cdot m_b g_- R \cos(\beta_1(t)) \sin(\rho(t)) \\
& + 2 \cdot m_b a a_- F \sin(\Omega t) \Omega R \cos(\beta_1(t)) e \\
& + m_b R^2 \cos(\Omega t)^2 \sin(\beta_1(t)) \cos(\beta_1(t)) b b_- F_- I^2 \Big) \Big) / \left(4 \cdot J B \right. \\
& \left. + R^2 m_b \sin(\Omega t)^2 \sin(\beta_1(t))^2 + R^2 m_b \cos(\beta_1(t))^2 \right. \\
& \left. + R^2 m_b \cos(\Omega t)^2 \sin(\beta_1(t))^2 \right) \\
= & \text{> T3_eq_beta1[full] := subs(\{beta[1](t)=bb_1, beta[2](t)=} \\
& \text{bb_2, rho(t)=aa, Omega=om}, \text{T2_eq_beta1[full]});} \\
& T3_eq_beta1_{full} := - \left(1. \left(-4 \cdot J B a a_- F F \cos(o m t) \right. \right. \\
& \left. \left. + m_b R^2 \sin(o m t) o m \cos(b b_- 1)^2 \cos(o m t)^2 a a_- F \right. \right. \\
& \left. \left. - 2 \cdot m_b R^2 a a_- F^2 \sin(o m t)^2 \sin(b b_- 1) \cos(b b_- 1) \cos(o m t)^2 \right. \right. \\
& \left. \left. + m_b R^2 \sin(o m t)^3 o m \cos(b b_- 1)^2 a a_- F \right. \right. \\
& \left. \left. + 2 \cdot m_b R e \sin(o m t)^3 o m a a_- F \cos(b b_- 1) \right. \right. \\
& \left. \left. - 1 \cdot m_b R^2 \cos(b b_- 1)^2 a a_- F F \cos(o m t) + R m_b l a a_- F F \cos(b b_- 1) \right. \right. \\
& \left. \left. - 1 \cdot m_b R^2 \cos(o m t)^3 \sin(b b_- 1)^2 a a_- F F \right. \right. \\
& \left. \left. - 2 \cdot m_b a a_- F F \cos(o m t) R \cos(b b_- 1) e \right. \right. \\
& \left. \left. + 2 \cdot m_b R e \sin(o m t) o m \cos(b b_- 1) \cos(o m t)^2 a a_- F \right. \right. \\
& \left. \left. + m_b R^2 \sin(b b_- 1) a a_- F^2 \cos(o m t)^2 \cos(b b_- 1) \right. \right. \\
& \left. \left. - 4 \cdot J B a a_- F \sin(o m t) \sin(b b_- 1)^2 o m \right. \right. \\
& \left. \left. - 1 \cdot m_b R \sin(b b_- 1) l a a_- F^2 \cos(o m t) \right. \right. \\
& \left. \left. + 2 \cdot m_b R \sin(b b_- 1) e \cos(o m t)^2 a a_- F^2 \right. \right. \\
& \left. \left. + m_b R^2 \sin(o m t)^2 o m^2 \cos(b b_- 1) \sin(b b_- 1) \right. \right. \\
& \left. \left. + 2 \cdot m_b R e \sin(o m t)^2 o m^2 \sin(b b_- 1) \right. \right. \\
& \left. \left. - 1 \cdot m_b R^2 \sin(b b_- 1)^2 \sin(o m t)^2 a a_- F F \cos(o m t) \right. \right. \\
& \left. \left. + 4 \cdot J B \cos(b b_- 1)^2 a a_- F \sin(o m t) o m \right. \right. \\
& \left. \left. + m_b R^2 \cos(o m t)^2 o m^2 \cos(b b_- 1) \sin(b b_- 1) \right. \right. \\
& \left. \left. + 2 \cdot m_b R e \cos(o m t)^2 o m^2 \sin(b b_- 1) \right. \right. \\
& \left. \left. + 2 \cdot m_b g_- R \sin(b b_- 1) \cos(o m t) \cos(a a) \right. \right. \\
& \left. \left. - 2 \cdot m_b g_- R \cos(b b_- 1) \sin(a a) + 4 \cdot k b b b_- 1 \right. \right. \\
& \left. \left. + 2 \cdot m_b a a_- F \sin(o m t) o m R \cos(b b_- 1) e \right. \right. \\
& \left. \left. + m_b R^2 \cos(o m t)^2 \sin(b b_- 1) \cos(b b_- 1) b b_- F_- I^2 \right. \right. \\
& \left. \left. + 4 \cdot J B o m^2 \cos(b b_- 1) \sin(b b_- 1) + 4 \cdot J B a a_- F \sin(o m t) o m \right. \right. \\
& \left. \left. - 4 \cdot a a_- F^2 \sin(o m t)^2 \sin(b b_- 1) J B \cos(b b_- 1) \right. \right)
\end{aligned} \tag{14.1.3.3}$$

```


$$\begin{aligned}
& -1. m_b R^2 aa_F^2 \sin(om t)^4 \sin(bb_1) \cos(bb_1) \\
& + m_b R^2 \cos(bb_1)^2 aa_F \sin(om t) om \\
& -1. m_b R^2 \cos(bb_1) \sin(bb_1) bb_F I^2 \\
& + m_b R^2 \sin(bb_1) \sin(om t)^2 \cos(bb_1) bb_F I^2 \\
& -1. m_b R^2 \cos(om t)^4 \sin(bb_1) aa_F^2 \cos(bb_1)) \Big) / (4. JB \\
& + R^2 m_b \sin(om t)^2 \sin(bb_1)^2 + R^2 m_b \cos(bb_1)^2 \\
& + R^2 m_b \cos(om t)^2 \sin(bb_1)^2)
\end{aligned}$$



$$> \text{bb\_FF\_1} := \text{T3\_eq\_beta1[full]}; \quad (14.1.3.4)$$


$$\begin{aligned}
bb\_FF\_1 := & - (1. (-4. JB aa\_FF \cos(om t) \\
& + m_b R^2 \sin(om t) om \cos(bb_1)^2 \cos(om t)^2 aa_F \\
& - 2. m_b R^2 aa_F^2 \sin(om t)^2 \sin(bb_1) \cos(bb_1) \cos(om t)^2 \\
& + m_b R^2 \sin(om t)^3 om \cos(bb_1)^2 aa_F \\
& + 2. m_b R e \sin(om t)^3 om aa_F \cos(bb_1) \\
& - 1. m_b R^2 \cos(bb_1)^2 aa\_FF \cos(om t) + R m_b l aa\_FF \cos(bb_1) \\
& - 1. m_b R^2 \cos(om t)^3 \sin(bb_1)^2 aa\_FF \\
& - 2. m_b aa\_FF \cos(om t) R \cos(bb_1) e \\
& + 2. m_b R e \sin(om t) om \cos(bb_1) \cos(om t)^2 aa_F \\
& + m_b R^2 \sin(bb_1) aa_F^2 \cos(om t)^2 \cos(bb_1) \\
& - 4. JB aa_F \sin(om t) \sin(bb_1)^2 om \\
& - 1. m_b R \sin(bb_1) l aa_F^2 \cos(om t) \\
& + 2. m_b R \sin(bb_1) e \cos(om t)^2 aa_F^2 \\
& + m_b R^2 \sin(om t)^2 om^2 \cos(bb_1) \sin(bb_1) \\
& + 2. m_b R e \sin(om t)^2 om^2 \sin(bb_1) \\
& - 1. m_b R^2 \sin(bb_1)^2 \sin(om t)^2 aa\_FF \cos(om t) \\
& + 4. JB \cos(bb_1)^2 aa_F \sin(om t) om \\
& + m_b R^2 \cos(om t)^2 om^2 \cos(bb_1) \sin(bb_1) \\
& + 2. m_b R e \cos(om t)^2 om^2 \sin(bb_1) \\
& + 2. m_b g\_R \sin(bb_1) \cos(om t) \cos(aa) \\
& - 2. m_b g\_R \cos(bb_1) \sin(aa) + 4. kb bb_1 \\
& + 2. m_b aa_F \sin(om t) om R \cos(bb_1) e \\
& + m_b R^2 \cos(om t)^2 \sin(bb_1) \cos(bb_1) bb_F I^2 \\
& + 4. JB om^2 \cos(bb_1) \sin(bb_1) + 4. JB aa_F \sin(om t) om \\
& - 4. aa_F^2 \sin(om t)^2 \sin(bb_1) JB \cos(bb_1) \\
& - 1. m_b R^2 aa_F^2 \sin(om t)^4 \sin(bb_1) \cos(bb_1) \\
& + m_b R^2 \cos(bb_1)^2 aa_F \sin(om t) om \\
& - 1. m_b R^2 \cos(bb_1) \sin(bb_1) bb_F I^2
\end{aligned}$$


```

$$\begin{aligned}
& + m_b R^2 \sin(bb_1) \sin(om t)^2 \cos(bb_1) bb_F I^2 \\
& - 1. m_b R^2 \cos(om t)^4 \sin(bb_1) aa_F^2 \cos(bb_1))) / (4. JB \\
& + R^2 m_b \sin(om t)^2 \sin(bb_1)^2 + R^2 m_b \cos(bb_1)^2 \\
& + R^2 m_b \cos(om t)^2 \sin(bb_1)^2)
\end{aligned}$$

eq of motion for beta_2

$$\begin{aligned}
> \text{dT_dbeta2flux} := \text{diff}(\text{T_total}, \text{beta}[\text{flux}[2]]); \\
dT_dbeta2flux := 0.5 m_b \left(- \left(-e \sin(\psi) \Psi_{flux} + \frac{1}{2} R \left((-\rho_{flux} \sin(\psi) \sin(\beta_2) \right. \right. \right. \\
\left. \left. \left. - \Omega \cos(\beta_2) \right) \sin(\psi) + \left(-\rho_{flux} \cos(\psi) - \beta_{flux} \right) \cos(\psi) \sin(\beta_2) \right) \right) \\
R \cos(\psi) \sin(\beta_2) + \left(-e \cos(\psi) \Psi_{flux} + \frac{1}{2} R \left((-\rho_{flux} \sin(\psi) \sin(\beta_2) \right. \right. \\
\left. \left. - \Omega \cos(\beta_2) \right) \cos(\psi) - \left(-\rho_{flux} \cos(\psi) - \beta_{flux} \right) \sin(\psi) \sin(\beta_2) \right) \right) \\
R \sin(\psi) \sin(\beta_2) - \left(-\frac{1}{2} l \rho_{flux} - e \cos(\psi) \rho_{flux} + \frac{1}{2} R \left(-\rho_{flux} \cos(\psi) \right. \right. \\
\left. \left. - \beta_{flux} \right) \cos(\beta_2) \right) R \cos(\beta_2) \right) + 1.0 \left(\rho_{flux} \cos(\psi) + \beta_{flux} \right) JB
\end{aligned} \tag{14.2.1}$$

$$\begin{aligned}
> \text{dT_dbeta2} := \text{diff}(\text{T_total}, \text{beta}[2]); \\
dT_dbeta2 := 0.5 m_b \left(\left(-e \sin(\psi) \Psi_{flux} + \frac{1}{2} R \left((-\rho_{flux} \sin(\psi) \sin(\beta_2) \right. \right. \right. \\
\left. \left. \left. - \Omega \cos(\beta_2) \right) \sin(\psi) + \left(-\rho_{flux} \cos(\psi) - \beta_{flux} \right) \cos(\psi) \sin(\beta_2) \right) \right) R \left(\left(\right. \right. \\
\left. \left. -\rho_{flux} \sin(\psi) \cos(\beta_2) + \Omega \sin(\beta_2) \right) \sin(\psi) + \left(-\rho_{flux} \cos(\psi) \right. \right. \\
\left. \left. - \beta_{flux} \right) \cos(\psi) \cos(\beta_2) \right) + \left(-e \cos(\psi) \Psi_{flux} + \frac{1}{2} R \left((-\rho_{flux} \sin(\psi) \sin(\beta_2) \right. \right. \\
\left. \left. - \Omega \cos(\beta_2) \right) \cos(\psi) - \left(-\rho_{flux} \cos(\psi) - \beta_{flux} \right) \sin(\psi) \sin(\beta_2) \right) \right) R \left(\left(\right. \right. \\
\left. \left. -\rho_{flux} \sin(\psi) \cos(\beta_2) + \Omega \sin(\beta_2) \right) \cos(\psi) - \left(-\rho_{flux} \cos(\psi) \right. \right. \\
\left. \left. - \beta_{flux} \right) \sin(\psi) \cos(\beta_2) \right) - \left(-\frac{1}{2} l \rho_{flux} - e \cos(\psi) \rho_{flux} + \frac{1}{2} R \left(-\rho_{flux} \cos(\psi) \right. \right. \\
\left. \left. - \beta_{flux} \right) \cos(\beta_2) \right) R \left(-\rho_{flux} \cos(\psi) - \beta_{flux} \right) \sin(\beta_2) \right) + 1.0 \left(\right.
\end{aligned} \tag{14.2.2}$$

$$\begin{aligned}
 & -\rho_{flux} \sin(\psi) \sin(\beta_2) - \Omega \cos(\beta_2) \Big) JB \Big(-\rho_{flux} \sin(\psi) \cos(\beta_2) + \Omega \sin(\beta_2) \Big) \\
 > \text{dv_dbeta2} := \text{diff}(\text{v_total}, \text{beta}[2]); \\
 dV_dbeta2 := \frac{1}{2} m_b g_R \Big(-\sin(\beta_2) \cos(\psi) \cos(\rho) - \cos(\beta_2) \sin(\rho) \Big) + kb \beta_2 \quad (14.2.3)
 \end{aligned}$$

indicate time dependencies

indicate time dependencies

$$\begin{aligned}
 > \text{dT_dbeta2_t} := \text{subs}(\{\text{beta}[\text{flux}[1]] = \text{beta}[\text{flux}[1]](\text{t}), \text{beta}[\text{flux}[2]] = \text{beta}[\text{flux}[2]](\text{t}), \text{rho}[\text{flux}] = \text{rho}[\text{flux}](\text{t}), \text{psi}[\text{flux}] = \text{Omega}, \text{beta}[1] = \text{beta}[1](\text{t}), \text{beta}[2] = \text{beta}[2](\text{t}), \text{rho} = \text{rho}(\text{t}), \text{psi} = \text{Omega} * \text{t}\}, \text{dT_dbeta2}); \\
 \text{dT_dbeta2_t} := 0.5 m_b \left(\left(-e \sin(\Omega \text{t}) \Omega + \frac{1}{2} R \left(\left(\right. \right. \right. \right. \right. \\
 & -\rho_{flux}(t) \sin(\Omega \text{t}) \sin(\beta_2(t)) - \Omega \cos(\beta_2(t)) \right) \sin(\Omega \text{t}) + \left(\right. \\
 & -\rho_{flux}(t) \cos(\Omega \text{t}) - \beta_{flux_2}(t) \right) \cos(\Omega \text{t}) \sin(\beta_2(t)) \Big) R \left(\left(\right. \right. \\
 & -\rho_{flux}(t) \sin(\Omega \text{t}) \cos(\beta_2(t)) + \Omega \sin(\beta_2(t)) \right) \sin(\Omega \text{t}) + \left(\right. \\
 & -\rho_{flux}(t) \cos(\Omega \text{t}) - \beta_{flux_2}(t) \right) \cos(\Omega \text{t}) \cos(\beta_2(t)) \Big) + \left(-e \cos(\Omega \text{t}) \Omega \right. \\
 & + \frac{1}{2} R \left(\left(-\rho_{flux}(t) \sin(\Omega \text{t}) \sin(\beta_2(t)) - \Omega \cos(\beta_2(t)) \right) \cos(\Omega \text{t}) - \left(\right. \right. \\
 & -\rho_{flux}(t) \cos(\Omega \text{t}) - \beta_{flux_2}(t) \right) \sin(\Omega \text{t}) \sin(\beta_2(t)) \Big) \Big) R \left(\left(\right. \right. \\
 & -\rho_{flux}(t) \sin(\Omega \text{t}) \cos(\beta_2(t)) + \Omega \sin(\beta_2(t)) \right) \cos(\Omega \text{t}) - \left(\right. \\
 & -\rho_{flux}(t) \cos(\Omega \text{t}) - \beta_{flux_2}(t) \right) \sin(\Omega \text{t}) \cos(\beta_2(t)) \Big) - \left(-\frac{1}{2} l \rho_{flux}(t) \right. \\
 & - e \cos(\Omega \text{t}) \rho_{flux}(t) + \frac{1}{2} R \left(-\rho_{flux}(t) \cos(\Omega \text{t}) - \beta_{flux_2}(t) \right) \cos(\beta_2(t)) \Big) \\
 & R \left(-\rho_{flux}(t) \cos(\Omega \text{t}) - \beta_{flux_2}(t) \right) \sin(\beta_2(t)) \Big) + 1.0 \Big(\\
 & -\rho_{flux}(t) \sin(\Omega \text{t}) \sin(\beta_2(t)) - \Omega \cos(\beta_2(t)) \Big) JB \Big(\\
 & -\rho_{flux}(t) \sin(\Omega \text{t}) \cos(\beta_2(t)) + \Omega \sin(\beta_2(t)) \Big) \\
 > \text{dv_dbeta2_t} := \text{subs}(\{\text{beta}[\text{flux}[1]] = \text{beta}[\text{flux}[1]](\text{t}), \text{beta}[\text{flux}[2]] = \text{beta}[\text{flux}[2]](\text{t}), \text{rho}[\text{flux}] = \text{rho}[\text{flux}](\text{t}), \text{psi}[\text{flux}] = \text{Omega}, \text{beta}[1] = \text{beta}[1](\text{t}), \text{beta}[2] = \text{beta}[2](\text{t}), \text{rho} = \text{rho}(\text{t}), \text{psi} = \text{Omega} * \text{t}\}, \text{dv_dbeta2});
 \end{aligned}$$

$$dV_dbeta2_t := \frac{1}{2} m_b g_R (-\sin(\beta_2(t)) \cos(\Omega t) \cos(\rho(t)) - \cos(\beta_2(t)) \sin(\rho(t))) + kb \beta_2(t) \quad (14.2.1.2)$$

```
> dT_dbeta2flux_t := subs({beta[flux[1]]=beta[flux[1]](t),
beta[flux[2]]=beta[flux[2]](t), rho[flux]=rho[flux](t), psi
[flux]=Omega, beta[1]=beta[1](t), beta[2]=beta[2](t), rho=
rho(t), psi=Omega*t},dT_dbeta2flux);
```

$$dT_dbeta2flux_t := 0.5 m_b \left(- \left(-e \sin(\Omega t) \Omega + \frac{1}{2} R \left(\right. \right. \right. \quad (14.2.1.3)$$

$$\begin{aligned} & \left. \left. \left. - \rho_{flux}(t) \sin(\Omega t) \sin(\beta_2(t)) - \Omega \cos(\beta_2(t)) \right) \sin(\Omega t) + \left(\right. \right. \\ & \left. \left. - \rho_{flux}(t) \cos(\Omega t) - \beta_{flux_2}(t) \right) \cos(\Omega t) \sin(\beta_2(t)) \right) R \cos(\Omega t) \sin(\beta_2(t)) \\ & + \left(-e \cos(\Omega t) \Omega + \frac{1}{2} R \left(\left(- \rho_{flux}(t) \sin(\Omega t) \sin(\beta_2(t)) \right. \right. \right. \\ & \left. \left. \left. - \Omega \cos(\beta_2(t)) \right) \cos(\Omega t) - \left(- \rho_{flux}(t) \cos(\Omega t) \right. \right. \\ & \left. \left. - \beta_{flux_2}(t) \right) \sin(\Omega t) \sin(\beta_2(t)) \right) R \sin(\Omega t) \sin(\beta_2(t)) - \left(- \frac{1}{2} l \rho_{flux}(t) \right. \\ & \left. \left. - e \cos(\Omega t) \rho_{flux}(t) + \frac{1}{2} R \left(- \rho_{flux}(t) \cos(\Omega t) - \beta_{flux_2}(t) \right) \cos(\beta_2(t)) \right) \\ & \left. \left. \left. R \cos(\beta_2(t)) \right) + 1.0 \left(\rho_{flux}(t) \cos(\Omega t) + \beta_{flux_2}(t) \right) JB \right) \end{aligned}$$

change q_flux to d/dt(q)

```
> dT_dbeta2_tt := subs({beta[flux[1]](t)=diff(beta[1](t),t),
beta[flux[2]](t)=diff(beta[2](t),t), rho[flux](t)=diff(rho
(t),t)},dT_dbeta2_t);
```

$$dT_dbeta2_tt := 0.5 m_b \left(\left(-e \sin(\Omega t) \Omega + \frac{1}{2} R \left(\left(\right. \right. \quad (14.2.1.4)$$

$$\begin{aligned} & \left. \left. - \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \sin(\beta_2(t)) - \Omega \cos(\beta_2(t)) \right) \sin(\Omega t) + \left(\right. \right. \\ & \left. \left. - \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) - \left(\frac{d}{dt} \beta_2(t) \right) \right) \cos(\Omega t) \sin(\beta_2(t)) \right) R \left(\left(\right. \right. \\ & \left. \left. - \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \cos(\beta_2(t)) + \Omega \sin(\beta_2(t)) \right) \sin(\Omega t) + \left(\right. \right. \\ & \left. \left. - \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) - \left(\frac{d}{dt} \beta_2(t) \right) \right) \cos(\Omega t) \cos(\beta_2(t)) \right) + \left(\right. \right. \\ & \left. \left. - e \cos(\Omega t) \Omega + \frac{1}{2} R \left(\left(- \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \sin(\beta_2(t)) \right. \right. \right. \\ & \left. \left. \left. - \Omega \cos(\beta_2(t)) \right) \cos(\Omega t) - \left(- \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) \right. \right. \right. \end{aligned}$$

$$\begin{aligned}
& - \left(\frac{d}{dt} \beta_2(t) \right) \sin(\Omega t) \sin(\beta_2(t)) \right) R \left(\left(\right. \right. \\
& - \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \cos(\beta_2(t)) + \Omega \sin(\beta_2(t)) \right) \cos(\Omega t) - \left(\right. \\
& - \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) - \left(\frac{d}{dt} \beta_2(t) \right) \sin(\Omega t) \cos(\beta_2(t)) \right) - \left(\right. \\
& - \frac{1}{2} l \left(\frac{d}{dt} \rho(t) \right) - e \cos(\Omega t) \left(\frac{d}{dt} \rho(t) \right) + \frac{1}{2} R \left(- \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) \right. \\
& - \left. \left. \left(\frac{d}{dt} \beta_2(t) \right) \right) \cos(\beta_2(t)) \right) R \left(- \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) \right. \\
& - \left. \left. \left(\frac{d}{dt} \beta_2(t) \right) \right) \sin(\beta_2(t)) \right) + 1.0 \left(- \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \sin(\beta_2(t)) \right. \\
& - \left. \left. \left. - \Omega \cos(\beta_2(t)) \right) \right) JB \left(- \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \cos(\beta_2(t)) + \Omega \sin(\beta_2(t)) \right)
\end{aligned}$$

```
> dv_dbeta2_tt := subs({beta[flux[1]](t)=diff(beta[1](t),t),
  beta[flux[2]](t)=diff(beta[2](t),t),rho[flux](t)=diff(rho
  (t),t)},dv_dbeta2_t);
```

$$dV_dbeta2_tt := \frac{1}{2} m_b g_- R \left(-\sin(\beta_2(t)) \cos(\Omega t) \cos(\rho(t)) \right. \\ \left. - \cos(\beta_2(t)) \sin(\rho(t)) \right) + kb \beta_2(t) \quad (14.2.1.5)$$

```
> dT_dbeta2flux_tt := subs({beta[flux[1]](t)=diff(beta[1]
  (t),t),beta[flux[2]](t)=diff(beta[2](t),t),rho[flux](t)=
  diff(rho(t),t)},dT_dbeta2flux_t);
```

$$dT_dbeta2flux_tt := 0.5 m_b \left(- \left(-e \sin(\Omega t) \Omega + \frac{1}{2} R \left(\left(\right. \right. \right. \right. \\ \left. \left. \left. \left. - \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \sin(\beta_2(t)) - \Omega \cos(\beta_2(t)) \right) \sin(\Omega t) + \left(\right. \right. \right. \right. \\ \left. \left. \left. \left. - \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) - \left(\frac{d}{dt} \beta_2(t) \right) \right) \cos(\Omega t) \sin(\beta_2(t)) \right) \right) \\ R \cos(\Omega t) \sin(\beta_2(t)) + \left(-e \cos(\Omega t) \Omega + \frac{1}{2} R \left(\left(\right. \right. \right. \right. \\ \left. \left. \left. \left. - \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \sin(\beta_2(t)) - \Omega \cos(\beta_2(t)) \right) \cos(\Omega t) - \left(\right. \right. \right. \right. \\ \left. \left. \left. \left. - \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) - \left(\frac{d}{dt} \beta_2(t) \right) \right) \sin(\Omega t) \sin(\beta_2(t)) \right) \right) \\ R \sin(\Omega t) \sin(\beta_2(t)) - \left(-\frac{1}{2} l \left(\frac{d}{dt} \rho(t) \right) - e \cos(\Omega t) \left(\frac{d}{dt} \rho(t) \right) \right. \\ \left. + \frac{1}{2} R \left(- \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) - \left(\frac{d}{dt} \beta_2(t) \right) \right) \cos(\beta_2(t)) \right) \\ R \cos(\beta_2(t)) \right) + 1.0 \left(\left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) + \frac{d}{dt} \beta_2(t) \right) JB$$

```
> `starting length` = length(%), `converting to horner`=
length(convert(% ,horner)), factoring=length(factor(%)),
```

```

`simplify_length` = length(symplify(%));
starting length = 1187, converting to horner = 837, factoring = 943, simplify length (14.2.1.7)
= 1200

```

```

> dT_dbeta2flux_tt := convert(dT_dbeta2flux_tt, horner);
dT_dbeta2flux_tt := 1.0  $\left( \left( \frac{d}{dt} \rho(t) \right) \cos(\Omega t) + \frac{d}{dt} \beta_2(t) \right) JB$  (14.2.1.8)
+  $\left( 0.2500000000 m_b l \left( \frac{d}{dt} \rho(t) \right) \cos(\beta_2(t)) \right)$ 
+  $0.5 m_b \left( \left( 0.5000000000 \left( \frac{d}{dt} \rho(t) \right) \cos(\beta_2(t)) \right)^2 \right.$ 
+  $0.5000000000 \left( \frac{d}{dt} \rho(t) \right) \sin(\beta_2(t))^2 \cos(\Omega t)^2 \cos(\Omega t)$ 
+  $0.5000000000 \left( \frac{d}{dt} \rho(t) \right) \sin(\beta_2(t))^2 \cos(\Omega t) \sin(\Omega t)^2$ 
+  $\left( 0.5000000000 \cos(\Omega t)^2 \sin(\beta_2(t))^2 \right.$ 
+  $0.5000000000 \sin(\Omega t)^2 \sin(\beta_2(t))^2 + 0.5000000000 \cos(\beta_2(t))^2 \left. \right)$ 
 $\left( \frac{d}{dt} \beta_2(t) \right) R \right) R + 0.5 m_b \left( \frac{d}{dt} \rho(t) \right) \cos(\Omega t) R \cos(\beta_2(t)) e$ 

```

▼ differentiate with respect to t and construct equations of motion for beta 2

```

> ddt_dT_dbeta2flux := diff(dT_dbeta2flux_tt, t);
ddt_dT_dbeta2flux := 1.0  $\left( \left( \frac{d^2}{dt^2} \rho(t) \right) \cos(\Omega t) - \left( \frac{d}{dt} \rho(t) \right) \sin(\Omega t) \Omega \right.$  (14.2.2.1)
+  $\frac{d^2}{dt^2} \beta_2(t) \right) JB + \left( 0.2500000000 m_b l \left( \frac{d^2}{dt^2} \rho(t) \right) \cos(\beta_2(t)) \right.$ 
-  $0.2500000000 m_b l \left( \frac{d}{dt} \rho(t) \right) \sin(\beta_2(t)) \left( \frac{d}{dt} \beta_2(t) \right)$ 
+  $0.5 m_b \left( \left( 0.5000000000 \left( \frac{d^2}{dt^2} \rho(t) \right) \cos(\beta_2(t)) \right)^2 \right.$ 
-  $1.000000000 \left( \frac{d}{dt} \rho(t) \right) \cos(\beta_2(t)) \sin(\beta_2(t)) \left( \frac{d}{dt} \beta_2(t) \right)$ 
+  $0.5000000000 \left( \frac{d^2}{dt^2} \rho(t) \right) \sin(\beta_2(t))^2 \cos(\Omega t)^2$ 
+  $1.000000000 \left( \frac{d}{dt} \rho(t) \right) \sin(\beta_2(t)) \cos(\Omega t)^2 \cos(\beta_2(t)) \left( \frac{d}{dt} \beta_2(t) \right)$ 
-  $1.000000000 \left( \frac{d}{dt} \rho(t) \right) \sin(\beta_2(t))^2 \cos(\Omega t) \sin(\Omega t) \Omega \right) \cos(\Omega t)$ 
-  $\left( 0.5000000000 \left( \frac{d}{dt} \rho(t) \right) \cos(\beta_2(t))^2 \right)$ 

```

$$\begin{aligned}
& + 0.5000000000 \left(\frac{d}{dt} \rho(t) \right) \sin(\beta_2(t))^2 \cos(\Omega t)^2 \right) \sin(\Omega t) \Omega \\
& + 0.5000000000 \left(\frac{d^2}{dt^2} \rho(t) \right) \sin(\beta_2(t))^2 \cos(\Omega t) \sin(\Omega t)^2 \\
& + 1.0000000000 \left(\frac{d}{dt} \rho(t) \right) \sin(\beta_2(t)) \cos(\Omega t) \sin(\Omega t)^2 \cos(\beta_2(t)) \left(\frac{d}{dt} \right. \\
& \left. \beta_2(t) \right) - 0.5000000000 \left(\frac{d}{dt} \rho(t) \right) \sin(\beta_2(t))^2 \sin(\Omega t)^3 \Omega \\
& + 1.0000000000 \left(\frac{d}{dt} \rho(t) \right) \sin(\beta_2(t))^2 \cos(\Omega t)^2 \sin(\Omega t) \Omega \\
& + \left(1.0000000000 \cos(\Omega t)^2 \sin(\beta_2(t)) \cos(\beta_2(t)) \left(\frac{d}{dt} \beta_2(t) \right) \right. \\
& \left. + 1.0000000000 \sin(\Omega t)^2 \sin(\beta_2(t)) \cos(\beta_2(t)) \left(\frac{d}{dt} \beta_2(t) \right) \right. \\
& \left. - 1.0000000000 \cos(\beta_2(t)) \sin(\beta_2(t)) \left(\frac{d}{dt} \beta_2(t) \right) \right) \left(\frac{d}{dt} \beta_2(t) \right) \\
& + \left(0.5000000000 \cos(\Omega t)^2 \sin(\beta_2(t))^2 \right. \\
& \left. + 0.5000000000 \sin(\Omega t)^2 \sin(\beta_2(t))^2 + 0.5000000000 \cos(\beta_2(t))^2 \right) \\
& \left(\frac{d^2}{dt^2} \beta_2(t) \right) R \right) R + 0.5 m_b \left(\frac{d^2}{dt^2} \rho(t) \right) \cos(\Omega t) R \cos(\beta_2(t)) e \\
& - 0.5 m_b \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \Omega R \cos(\beta_2(t)) e \\
& - 0.5 m_b \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) R \sin(\beta_2(t)) \left(\frac{d}{dt} \beta_2(t) \right) e
\end{aligned}$$

```

> `starting length` = length(%), `converting to horner`=
length(convert(%,>horner)), factoring=length(factor(%)),
`simplify length` = length(simplify(%));
starting length=2701, converting to horner=2398, factoring=2731,
simplify length=2714

```

(14.2.2.2)

```

> ddt_dT_dbeta2flux := convert(ddt_dT_dbeta2flux,horner);
ddt_dT_dbeta2flux:=1.0 \left( \left( \frac{d^2}{dt^2} \rho(t) \right) \cos(\Omega t) - 1. \left( \frac{d}{dt} \rho(t) \right) \sin(\Omega t) \Omega \right. 
+ \frac{d^2}{dt^2} \beta_2(t) \right) JB + \left( \left( 0.2500000000 \left( \frac{d^2}{dt^2} \rho(t) \right) \cos(\beta_2(t)) \right. \right. \\
\left. \left. - 0.2500000000 \left( \frac{d}{dt} \rho(t) \right) \sin(\beta_2(t)) \left( \frac{d}{dt} \beta_2(t) \right) \right) m_b l

```

(14.2.2.3)

$$\begin{aligned}
& + 0.5 m_b \left(0.50000000000 \cos(\beta_2(t))^2 \left(\frac{d^2}{dt^2} \beta_2(t) \right) \right. \\
& + \left(0.50000000000 \left(\frac{d^2}{dt^2} \rho(t) \right) \cos(\beta_2(t))^2 \right. \\
& + \left(0.50000000000 \sin(\beta_2(t))^2 \left(\frac{d^2}{dt^2} \beta_2(t) \right) \right. \\
& + 0.50000000000 \left(\frac{d^2}{dt^2} \rho(t) \right) \sin(\beta_2(t))^2 \cos(\Omega t) \Big) \cos(\Omega t) \Big) \cos(\Omega t) \\
& + \left(0.50000000000 \sin(\beta_2(t))^2 \left(\frac{d^2}{dt^2} \beta_2(t) \right) \right. \\
& + 0.50000000000 \left(\frac{d^2}{dt^2} \rho(t) \right) \sin(\beta_2(t))^2 \cos(\Omega t) \Big) \sin(\Omega t)^2 \\
& + \left(1.0000000000 \left(\frac{d}{dt} \rho(t) \right) \sin(\beta_2(t)) \cos(\Omega t) \sin(\Omega t)^2 \cos(\beta_2(t)) + \right. \\
& - 1.0000000000 \left(\frac{d}{dt} \rho(t) \right) \cos(\beta_2(t)) \sin(\beta_2(t)) \\
& + 1.0000000000 \left(\frac{d}{dt} \rho(t) \right) \sin(\beta_2(t)) \cos(\Omega t)^2 \cos(\beta_2(t)) \Big) \cos(\Omega t) \\
& + \left(1.0000000000 \cos(\Omega t)^2 \sin(\beta_2(t)) \cos(\beta_2(t)) \right. \\
& + 1.0000000000 \sin(\Omega t)^2 \sin(\beta_2(t)) \cos(\beta_2(t)) \\
& - 1.0000000000 \cos(\beta_2(t)) \sin(\beta_2(t)) \Big) \left(\frac{d}{dt} \beta_2(t) \right) \left(\frac{d}{dt} \beta_2(t) \right) + \Big(\\
& - 0.50000000000 \left(\frac{d}{dt} \rho(t) \right) \cos(\beta_2(t))^2 \\
& - 0.50000000000 \left(\frac{d}{dt} \rho(t) \right) \sin(\beta_2(t))^2 \cos(\Omega t)^2 \\
& - 0.50000000000 \left(\frac{d}{dt} \rho(t) \right) \sin(\beta_2(t))^2 \sin(\Omega t)^2 \Big) \sin(\Omega t) \Omega \Big) R \Big) R \\
& + \left(\left(0.5 \left(\frac{d^2}{dt^2} \rho(t) \right) \cos(\Omega t) \cos(\beta_2(t)) \right. \right. \\
& - 0.5 \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) \sin(\beta_2(t)) \left(\frac{d}{dt} \beta_2(t) \right) \Big) m_b \\
& \left. \left. - 0.5 m_b \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \Omega \cos(\beta_2(t)) \right) R e
\end{aligned}$$

> **eq_beta2[full] := ddt_dT_dbeta2flux - dT_dbeta2_tt +**
dv_dbeta2_tt = 0;

$$eq_beta2_{full} := 1.0 \left(\left(\frac{d^2}{dt^2} \rho(t) \right) \cos(\Omega t) - 1. \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \Omega \right) \quad (14.2.2.4)$$

$$\begin{aligned}
& + \frac{d^2}{dt^2} \beta_2(t) \Big) JB + \left(\left(0.2500000000 \left(\frac{d^2}{dt^2} \rho(t) \right) \cos(\beta_2(t)) \right. \right. \\
& - 0.2500000000 \left(\frac{d}{dt} \rho(t) \right) \sin(\beta_2(t)) \left(\frac{d}{dt} \beta_2(t) \right) \Big) m_b l \\
& + 0.5 m_b \left(0.5000000000 \cos(\beta_2(t))^2 \left(\frac{d^2}{dt^2} \beta_2(t) \right) \right. \\
& + \left(0.5000000000 \left(\frac{d^2}{dt^2} \rho(t) \right) \cos(\beta_2(t))^2 \right. \\
& + \left(0.5000000000 \sin(\beta_2(t))^2 \left(\frac{d^2}{dt^2} \beta_2(t) \right) \right. \\
& + 0.5000000000 \left(\frac{d^2}{dt^2} \rho(t) \right) \sin(\beta_2(t))^2 \cos(\Omega t) \Big) \cos(\Omega t) \\
& + \left(0.5000000000 \sin(\beta_2(t))^2 \left(\frac{d^2}{dt^2} \beta_2(t) \right) \right. \\
& + 0.5000000000 \left(\frac{d^2}{dt^2} \rho(t) \right) \sin(\beta_2(t))^2 \cos(\Omega t) \Big) \sin(\Omega t)^2 \\
& + \left(1.0000000000 \left(\frac{d}{dt} \rho(t) \right) \sin(\beta_2(t)) \cos(\Omega t) \sin(\Omega t)^2 \cos(\beta_2(t)) + \right. \\
& - 1.0000000000 \left(\frac{d}{dt} \rho(t) \right) \cos(\beta_2(t)) \sin(\beta_2(t)) \\
& + 1.0000000000 \left(\frac{d}{dt} \rho(t) \right) \sin(\beta_2(t)) \cos(\Omega t)^2 \cos(\beta_2(t)) \Big) \cos(\Omega t) \\
& + \left(1.0000000000 \cos(\Omega t)^2 \sin(\beta_2(t)) \cos(\beta_2(t)) \right. \\
& + 1.0000000000 \sin(\Omega t)^2 \sin(\beta_2(t)) \cos(\beta_2(t)) \\
& - 1.0000000000 \cos(\beta_2(t)) \sin(\beta_2(t)) \Big) \left(\frac{d}{dt} \beta_2(t) \right) \Big) \left(\frac{d}{dt} \beta_2(t) \right) + \Big(\\
& - 0.5000000000 \left(\frac{d}{dt} \rho(t) \right) \cos(\beta_2(t))^2 \\
& - 0.5000000000 \left(\frac{d}{dt} \rho(t) \right) \sin(\beta_2(t))^2 \cos(\Omega t)^2 \\
& - 0.5000000000 \left(\frac{d}{dt} \rho(t) \right) \sin(\beta_2(t))^2 \sin(\Omega t)^2 \Big) \sin(\Omega t) \Omega \Big) R \Big) R \\
& + \left(\left(0.5 \left(\frac{d^2}{dt^2} \rho(t) \right) \cos(\Omega t) \cos(\beta_2(t)) \right. \right. \\
& - 0.5 \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) \sin(\beta_2(t)) \left(\frac{d}{dt} \beta_2(t) \right) \Big) m_b \\
& - 0.5 m_b \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \Omega \cos(\beta_2(t)) \Big) R e - 0.5 m_b \left(\left(\right. \right.
\end{aligned}$$

$$\begin{aligned}
& -e \sin(\Omega t) \Omega + \frac{1}{2} R \left(\left(- \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \sin(\beta_2(t)) \right. \right. \\
& \left. \left. - \Omega \cos(\beta_2(t)) \right) \sin(\Omega t) + \left(- \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) \right. \right. \\
& \left. \left. - \left(\frac{d}{dt} \beta_2(t) \right) \right) \cos(\Omega t) \sin(\beta_2(t)) \right) R \left(\left(\right. \right. \\
& \left. \left. - \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \cos(\beta_2(t)) + \Omega \sin(\beta_2(t)) \right) \sin(\Omega t) + \left(\right. \right. \\
& \left. \left. - \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) - \left(\frac{d}{dt} \beta_2(t) \right) \right) \cos(\Omega t) \cos(\beta_2(t)) \right) + \left(\right. \right. \\
& \left. \left. - e \cos(\Omega t) \Omega + \frac{1}{2} R \left(\left(- \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \sin(\beta_2(t)) \right. \right. \right. \right. \\
& \left. \left. \left. - \Omega \cos(\beta_2(t)) \right) \cos(\Omega t) - \left(- \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) \right. \right. \right. \\
& \left. \left. \left. - \left(\frac{d}{dt} \beta_2(t) \right) \right) \sin(\Omega t) \sin(\beta_2(t)) \right) R \left(\left(\right. \right. \\
& \left. \left. - \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \cos(\beta_2(t)) + \Omega \sin(\beta_2(t)) \right) \cos(\Omega t) - \left(\right. \right. \\
& \left. \left. - \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) - \left(\frac{d}{dt} \beta_2(t) \right) \right) \sin(\Omega t) \cos(\beta_2(t)) \right) - \left(\right. \right. \\
& \left. \left. - \frac{1}{2} l \left(\frac{d}{dt} \rho(t) \right) - e \cos(\Omega t) \left(\frac{d}{dt} \rho(t) \right) + \frac{1}{2} R \left(- \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) \right. \right. \\
& \left. \left. - \left(\frac{d}{dt} \beta_2(t) \right) \right) \cos(\beta_2(t)) \right) R \left(- \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) \right. \right. \\
& \left. \left. - \left(\frac{d}{dt} \beta_2(t) \right) \right) \sin(\beta_2(t)) \right) - 1.0 \left(- \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \sin(\beta_2(t)) \right. \right. \\
& \left. \left. - \Omega \cos(\beta_2(t)) \right) JB \left(- \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \cos(\beta_2(t)) + \Omega \sin(\beta_2(t)) \right) \right. \right. \\
& \left. \left. + \frac{1}{2} m_b g_R \left(- \sin(\beta_2(t)) \cos(\Omega t) \cos(\rho(t)) - \cos(\beta_2(t)) \sin(\rho(t)) \right) \right. \right. \\
& \left. \left. + kb \beta_2(t) = 0 \right)
\end{aligned}$$

```

> `starting length` = length(%), `converting to horner` =
length(convert(%,>horner)), factoring=length(factor(%)),
`simplify length` = length(simplify(%));
starting length=4494, converting to horner=3449, factoring=4039,
simplify length=4507

```

(14.2.2.5)

```

> eq_beta2[full] := convert(eq_beta2[full],>horner);
eq_beta2full:=kb beta2(t) + (1.0 (d^2/dt^2 rho(t)) cos(Omega t) + 1.0 (d^2/dt^2 beta2(t))
- 1.0 (d/dt rho(t))^2 sin(Omega t)^2 sin(beta2(t)) cos(beta2(t))) JB

```

(14.2.2.6)

$$\begin{aligned}
& + \left(\left(1.0 \sin(\beta_2(t))^2 - 1.0 \cos(\beta_2(t))^2 - 1.0 \right) \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) JB \right. \\
& + 1.0 \cos(\beta_2(t)) JB \sin(\beta_2(t)) \Omega \Big) \Omega + \left(0.5000000000 m_b g_- \left(\right. \right. \\
& - 1. \sin(\beta_2(t)) \cos(\Omega t) \cos(\rho(t)) - 1. \cos(\beta_2(t)) \sin(\rho(t)) \Big) \\
& + \left(0.2500000000 \left(\frac{d^2}{dt^2} \rho(t) \right) \cos(\beta_2(t)) \right. \\
& + 0.2500000000 \left(\frac{d}{dt} \rho(t) \right)^2 \cos(\Omega t) \sin(\beta_2(t)) \Big) m_b l \\
& + \left(\left(0.2500000000 \cos(\beta_2(t))^2 \left(\frac{d^2}{dt^2} \beta_2(t) \right) \right. \right. \\
& + \left(0.2500000000 \left(\frac{d^2}{dt^2} \rho(t) \right) \cos(\beta_2(t))^2 \right. \\
& + \left(0.2500000000 \sin(\beta_2(t))^2 \left(\frac{d^2}{dt^2} \beta_2(t) \right) \right. \\
& + 0.2500000000 \left(\frac{d}{dt} \rho(t) \right)^2 \sin(\beta_2(t)) \cos(\beta_2(t)) \\
& + \left(0.2500000000 \left(\frac{d^2}{dt^2} \rho(t) \right) \sin(\beta_2(t))^2 \right. \\
& \left. \left. - 0.2500000000 \left(\frac{d}{dt} \rho(t) \right)^2 \sin(\beta_2(t)) \cos(\beta_2(t)) \cos(\Omega t) \right) \cos(\Omega t) \right) \\
& \cos(\Omega t) \Big) \cos(\Omega t) + \left(0.2500000000 \sin(\beta_2(t))^2 \left(\frac{d^2}{dt^2} \beta_2(t) \right) \right. \\
& + \left(0.2500000000 \left(\frac{d^2}{dt^2} \rho(t) \right) \sin(\beta_2(t))^2 \right. \\
& - 0.5000000000 \left(\frac{d}{dt} \rho(t) \right)^2 \sin(\beta_2(t)) \cos(\beta_2(t)) \cos(\Omega t) \Big) \cos(\Omega t) \\
& - 0.2500000000 \left(\frac{d}{dt} \rho(t) \right)^2 \sin(\Omega t)^2 \sin(\beta_2(t)) \cos(\beta_2(t)) \Big) \sin(\Omega t)^2 \\
& + \left(0.2500000000 \cos(\Omega t)^2 \sin(\beta_2(t)) \cos(\beta_2(t)) \right. \\
& - 0.2500000000 \cos(\beta_2(t)) \sin(\beta_2(t)) \\
& + 0.2500000000 \sin(\Omega t)^2 \sin(\beta_2(t)) \cos(\beta_2(t)) \Big) \left(\frac{d}{dt} \beta_2(t) \right)^2 \Big) m_b \\
& + \left(\left(-0.2500000000 \cos(\beta_2(t))^2 \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t)^2 \right. \right.
\end{aligned}$$

$$\begin{aligned}
& -0.2500000000 \left(\frac{d}{dt} \rho(t) \right) \cos(\beta_2(t))^2 \\
& -0.2500000000 \left(\frac{d}{dt} \rho(t) \right) \cos(\beta_2(t))^2 \sin(\Omega t) m_b \\
& -0.5 m_b \left(-0.5000000000 \cos(\Omega t)^2 \sin(\beta_2(t)) \cos(\beta_2(t)) \right. \\
& \left. -0.5000000000 \sin(\Omega t)^2 \sin(\beta_2(t)) \cos(\beta_2(t)) \right) \Omega R \\
& + \left(\left(0.5 \left(\frac{d^2}{dt^2} \rho(t) \right) \cos(\beta_2(t)) \right. \right. \\
& \left. \left. + 0.5 \left(\frac{d}{dt} \rho(t) \right)^2 \cos(\Omega t) \sin(\beta_2(t)) \right) \cos(\Omega t) m_b + \left(\left(\right. \right. \right. \\
& \left. \left. \left. -0.5 \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t)^2 \cos(\beta_2(t)) - 0.5 \left(\frac{d}{dt} \rho(t) \right) \cos(\beta_2(t)) \right. \right. \\
& \left. \left. -0.5 \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t)^2 \cos(\beta_2(t)) \right) \sin(\Omega t) m_b - 0.5 m_b \left(\right. \right. \\
& \left. \left. -1. \sin(\Omega t)^2 \sin(\beta_2(t)) - 1. \cos(\Omega t)^2 \sin(\beta_2(t)) \right) \Omega \right) R e = 0
\end{aligned}$$

> **eq_beta2[full] := solve(eq_beta2[full], diff(beta[2](t), t, t));**

$$\begin{aligned}
eq_beta2_{full} := & - \left(1. \left(-4. JB \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \Omega + 4. kb \beta_2(t) \right. \right. \\
& \left. \left. + m_b R^2 \cos(\Omega t) \left(\frac{d^2}{dt^2} \rho(t) \right) \cos(\beta_2(t))^2 + 4. JB \left(\frac{d^2}{dt^2} \rho(t) \right) \cos(\Omega t) \right. \right. \\
& \left. \left. + 2. m_b \left(\frac{d^2}{dt^2} \rho(t) \right) \cos(\Omega t) R \cos(\beta_2(t)) e \right. \right. \\
& \left. \left. + R m_b l \left(\frac{d^2}{dt^2} \rho(t) \right) \cos(\beta_2(t)) \right. \right. \\
& \left. \left. - 2. m_b \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \Omega R \cos(\beta_2(t)) e \right. \right. \\
& \left. \left. - 1. m_b R^2 \left(\frac{d}{dt} \rho(t) \right)^2 \cos(\Omega t)^4 \sin(\beta_2(t)) \cos(\beta_2(t)) \right. \right. \\
& \left. \left. - 1. m_b R^2 \sin(\Omega t) \Omega \left(\frac{d}{dt} \rho(t) \right) \cos(\beta_2(t))^2 \right. \right. \\
& \left. \left. + m_b R^2 \cos(\Omega t)^2 \sin(\beta_2(t)) \cos(\beta_2(t)) \left(\frac{d}{dt} \beta_2(t) \right)^2 \right. \right. \\
& \left. \left. + m_b R^2 \sin(\Omega t)^2 \sin(\beta_2(t)) \cos(\beta_2(t)) \left(\frac{d}{dt} \beta_2(t) \right)^2 \right. \right. \\
& \left. \left. - 1. m_b R^2 \cos(\beta_2(t)) \sin(\beta_2(t)) \left(\frac{d}{dt} \beta_2(t) \right)^2 \right)
\right) \Omega^{14.2.2.7}
\end{aligned}$$

$$\begin{aligned}
& + m_b R^2 \cos(\Omega t)^2 \Omega^2 \cos(\beta_2(t)) \sin(\beta_2(t)) \\
& + 2. m_b R e \cos(\Omega t)^2 \Omega^2 \sin(\beta_2(t)) \\
& + m_b R \sin(\beta_2(t)) l \left(\frac{d}{dt} \rho(t) \right)^2 \cos(\Omega t) \\
& + 2. m_b R \sin(\beta_2(t)) e \cos(\Omega t)^2 \left(\frac{d}{dt} \rho(t) \right)^2 \\
& + m_b R^2 \sin(\beta_2(t)) \left(\frac{d}{dt} \rho(t) \right)^2 \cos(\Omega t)^2 \cos(\beta_2(t)) \\
& - 1. m_b R^2 \left(\frac{d}{dt} \rho(t) \right)^2 \sin(\Omega t)^4 \sin(\beta_2(t)) \cos(\beta_2(t)) \\
& + 4. JB \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \sin(\beta_2(t))^2 \Omega \\
& - 2. m_b R^2 \left(\frac{d}{dt} \rho(t) \right)^2 \sin(\Omega t)^2 \sin(\beta_2(t)) \cos(\Omega t)^2 \cos(\beta_2(t)) \\
& - 1. m_b R^2 \sin(\Omega t)^3 \Omega \cos(\beta_2(t))^2 \left(\frac{d}{dt} \rho(t) \right) \\
& + m_b R^2 \sin(\Omega t)^2 \Omega^2 \cos(\beta_2(t)) \sin(\beta_2(t)) \\
& - 1. m_b R^2 \sin(\Omega t) \Omega \cos(\beta_2(t))^2 \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t)^2 \\
& - 2. m_b R e \sin(\Omega t)^3 \Omega \left(\frac{d}{dt} \rho(t) \right) \cos(\beta_2(t)) \\
& + 2. m_b R e \sin(\Omega t)^2 \Omega^2 \sin(\beta_2(t)) \\
& - 2. m_b R e \sin(\Omega t) \Omega \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t)^2 \cos(\beta_2(t)) \\
& - 4. JB \sin(\Omega t) \Omega \left(\frac{d}{dt} \rho(t) \right) \cos(\beta_2(t))^2 \\
& - 2. m_b g_R \sin(\beta_2(t)) \cos(\Omega t) \cos(\rho(t)) \\
& - 2. m_b g_R \cos(\beta_2(t)) \sin(\rho(t)) \\
& + m_b R^2 \left(\frac{d^2}{dt^2} \rho(t) \right) \sin(\beta_2(t))^2 \cos(\Omega t)^3
\end{aligned}$$

simplify expression and lose time dependencie notation and d/dt

```

> T1_eq_beta2[full]:= subs({diff(diff(beta[1](t),t),t)=
bb_FF_1,diff(diff(beta[2](t),t),t)=bb_FF_2,diff(diff(rho
(t),t),t)=aa_FF},eq_beta2[full]);
T1_eq_beta2full := - \left( 1. \left( 4. JB aa\_FF \cos(\Omega t) - 4. JB \left( \frac{d}{dt} \rho(t) \right) \sin(\Omega t) \Omega \right. \right. \quad (14.2.3.1)
+ 4. kb \beta_2(t) + m_b R^2 \cos(\Omega t) aa\_FF \cos(\beta_2(t))^2
- 2. m_b \left( \frac{d}{dt} \rho(t) \right) \sin(\Omega t) \Omega R \cos(\beta_2(t)) e
- 1. m_b R^2 \left( \frac{d}{dt} \rho(t) \right)^2 \cos(\Omega t)^4 \sin(\beta_2(t)) \cos(\beta_2(t))
- 1. m_b R^2 \sin(\Omega t) \Omega \left( \frac{d}{dt} \rho(t) \right) \cos(\beta_2(t))^2
+ m_b R^2 \cos(\Omega t)^2 \sin(\beta_2(t)) \cos(\beta_2(t)) \left( \frac{d}{dt} \beta_2(t) \right)^2
+ m_b R^2 \sin(\Omega t)^2 \sin(\beta_2(t)) \cos(\beta_2(t)) \left( \frac{d}{dt} \beta_2(t) \right)^2
- 1. m_b R^2 \cos(\beta_2(t)) \sin(\beta_2(t)) \left( \frac{d}{dt} \beta_2(t) \right)^2
+ m_b R^2 \cos(\Omega t)^2 \Omega^2 \cos(\beta_2(t)) \sin(\beta_2(t))
+ 2. m_b R e \cos(\Omega t)^2 \Omega^2 \sin(\beta_2(t))
+ m_b R \sin(\beta_2(t)) l \left( \frac{d}{dt} \rho(t) \right)^2 \cos(\Omega t)
+ 2. m_b R \sin(\beta_2(t)) e \cos(\Omega t)^2 \left( \frac{d}{dt} \rho(t) \right)^2
+ m_b R^2 \sin(\beta_2(t)) \left( \frac{d}{dt} \rho(t) \right)^2 \cos(\Omega t)^2 \cos(\beta_2(t))

```


$$\begin{aligned}
T2_eq_beta2_{full} := & - \left(1. \left(4. JB aa_FF \cos(\Omega t) + 4. kb \beta_2(t) \right. \right. \\
& + m_b R^2 \cos(\Omega t) aa_FF \cos(\beta_2(t))^2 - 4. JB aa_F \sin(\Omega t) \Omega \\
& + m_b R^2 \cos(\Omega t)^2 \Omega^2 \cos(\beta_2(t)) \sin(\beta_2(t)) \\
& - 2. m_b aa_F \sin(\Omega t) \Omega R \cos(\beta_2(t)) e \\
& - 1. m_b R^2 aa_F^2 \cos(\Omega t)^4 \sin(\beta_2(t)) \cos(\beta_2(t)) \\
& - 1. m_b R^2 \sin(\Omega t) \Omega aa_F \cos(\beta_2(t))^2 \\
& + m_b R^2 \cos(\Omega t)^2 \sin(\beta_2(t)) \cos(\beta_2(t)) bb_F_2^2 \\
& + m_b R^2 \sin(\Omega t)^2 \sin(\beta_2(t)) \cos(\beta_2(t)) bb_F_2^2 \\
& - 1. m_b R^2 \cos(\beta_2(t)) \sin(\beta_2(t)) bb_F_2^2 \\
& + m_b R \sin(\beta_2(t)) l aa_F^2 \cos(\Omega t) \\
& + 2. m_b R \sin(\beta_2(t)) e \cos(\Omega t)^2 aa_F^2 \\
& + m_b R^2 \sin(\beta_2(t)) aa_F^2 \cos(\Omega t)^2 \cos(\beta_2(t)) \\
& - 1. m_b R^2 aa_F^2 \sin(\Omega t)^4 \sin(\beta_2(t)) \cos(\beta_2(t)) \\
& + 4. JB aa_F \sin(\Omega t) \sin(\beta_2(t))^2 \Omega \\
& - 2. m_b R^2 aa_F^2 \sin(\Omega t)^2 \sin(\beta_2(t)) \cos(\Omega t)^2 \cos(\beta_2(t)) \\
& - 1. m_b R^2 \sin(\Omega t)^3 \Omega \cos(\beta_2(t))^2 aa_F \\
& - 1. m_b R^2 \sin(\Omega t) \Omega \cos(\beta_2(t))^2 aa_F \cos(\Omega t)^2 \\
& - 2. m_b R e \sin(\Omega t)^3 \Omega aa_F \cos(\beta_2(t)) \\
& - 2. m_b R e \sin(\Omega t) \Omega aa_F \cos(\Omega t)^2 \cos(\beta_2(t)) \\
& - 4. JB \sin(\Omega t) \Omega aa_F \cos(\beta_2(t))^2 \\
& - 4. aa_F^2 \sin(\Omega t)^2 \sin(\beta_2(t)) JB \cos(\beta_2(t)) \\
& + 2. m_b R e \cos(\Omega t)^2 \Omega^2 \sin(\beta_2(t)) \\
& + m_b R^2 \sin(\Omega t)^2 \Omega^2 \cos(\beta_2(t)) \sin(\beta_2(t)) \\
& + 2. m_b R e \sin(\Omega t)^2 \Omega^2 \sin(\beta_2(t)) \\
& - 2. m_b g_R \sin(\beta_2(t)) \cos(\Omega t) \cos(\rho(t)) \\
& - 2. m_b g_R \cos(\beta_2(t)) \sin(\rho(t)) + m_b R^2 aa_FF \sin(\beta_2(t))^2 \cos(\Omega t)^3
\end{aligned} \tag{14.2.3.2}$$

$$\begin{aligned}
& + m_b R^2 aa_{FF} \sin(\beta_2(t))^2 \cos(\Omega t) \sin(\Omega t)^2 \\
& + 2. m_b aa_{FF} \cos(\Omega t) R \cos(\beta_2(t)) e + R m_b l aa_{FF} \cos(\beta_2(t)) \\
& + 4. JB \Omega^2 \cos(\beta_2(t)) \sin(\beta_2(t))) \Big) / (4. JB \\
& + R^2 m_b \cos(\Omega t)^2 \sin(\beta_2(t))^2 + R^2 m_b \sin(\Omega t)^2 \sin(\beta_2(t))^2 \\
& + R^2 m_b \cos(\beta_2(t))^2)
\end{aligned}$$

> T3_eq_beta2[full] := subs({beta[1](t)=bb_1, beta[2](t)=bb_2, rho(t)=aa, Omega=om}, T2_eq_beta2[full]);

$$T3_eq_beta2_{full} := - \left(1. (4. JB aa_{FF} \cos(om t) - 4. JB aa_F \sin(om t) om \right. \quad (14.2.3.3) \\
- 2. m_b aa_F \sin(om t) om R \cos(bb_2) e \\
- 1. m_b R^2 \cos(bb_2) \sin(bb_2) bb_F^2 \\
+ m_b R^2 \sin(bb_2) aa_F^2 \cos(om t)^2 \cos(bb_2) \\
- 1. m_b R^2 aa_F^2 \sin(om t)^4 \sin(bb_2) \cos(bb_2) \\
- 2. m_b R^2 aa_F^2 \sin(om t)^2 \sin(bb_2) \cos(om t)^2 \cos(bb_2) \\
- 1. m_b R^2 \sin(om t)^3 om \cos(bb_2)^2 aa_F \\
- 1. m_b R^2 \sin(om t) om \cos(bb_2)^2 aa_F \cos(om t)^2 \\
- 2. m_b R e \sin(om t)^3 om aa_F \cos(bb_2) \\
- 2. m_b R e \sin(om t) om aa_F \cos(om t)^2 \cos(bb_2) \\
- 4. JB \sin(om t) om aa_F \cos(bb_2)^2 \\
- 4. aa_F^2 \sin(om t)^2 \sin(bb_2) JB \cos(bb_2) \\
+ 2. m_b R e \cos(om t)^2 om^2 \sin(bb_2) \\
+ m_b R^2 \sin(om t)^2 om^2 \cos(bb_2) \sin(bb_2) \\
+ 2. m_b R e \sin(om t)^2 om^2 \sin(bb_2) \\
- 2. m_b g_R \sin(bb_2) \cos(om t) \cos(aa) \\
- 2. m_b g_R \cos(bb_2) \sin(aa) + m_b R^2 aa_{FF} \sin(bb_2)^2 \cos(om t)^3 \\
+ m_b R^2 aa_{FF} \sin(bb_2)^2 \cos(om t) \sin(om t)^2 \\
+ 2. m_b aa_{FF} \cos(om t) R \cos(bb_2) e + R m_b l aa_{FF} \cos(bb_2) \\
+ m_b R \sin(bb_2) l aa_F^2 \cos(om t) \\
+ 2. m_b R \sin(bb_2) e \cos(om t)^2 aa_F^2 \\
+ m_b R^2 \sin(om t)^2 \sin(bb_2) \cos(bb_2) bb_F^2 \\
+ m_b R^2 \cos(om t) aa_{FF} \cos(bb_2)^2 \\
+ m_b R^2 \cos(om t)^2 \sin(bb_2) \cos(bb_2) bb_F^2 \\
+ m_b R^2 \cos(om t)^2 om^2 \cos(bb_2) \sin(bb_2) \\
- 1. m_b R^2 \sin(om t) om aa_F \cos(bb_2)^2 \\
+ 4. JB aa_F \sin(om t) \sin(bb_2)^2 om + 4. kb bb_2$$

```


$$\begin{aligned}
& -1. m_b R^2 aa_F^2 \cos(om t)^4 \sin(bb_2) \cos(bb_2) \\
& + 4. JB om^2 \cos(bb_2) \sin(bb_2)) \Big/ (4. JB + R^2 m_b \cos(om t)^2 \sin(bb_2)^2 \\
& + R^2 m_b \sin(om t)^2 \sin(bb_2)^2 + R^2 m_b \cos(bb_2)^2) \\
& > \text{bb\_FF\_2 := T3\_eq\_beta2[full];} \\
\text{bb\_FF\_2} := & - (1. (4. JB aa\_FF \cos(om t) - 4. JB aa\_F \sin(om t) om \\
& - 2. m_b aa\_F \sin(om t) om R \cos(bb_2) e \\
& - 1. m_b R^2 \cos(bb_2) \sin(bb_2) bb\_F\_2^2 \\
& + m_b R^2 \sin(bb_2) aa\_F^2 \cos(om t)^2 \cos(bb_2) \\
& - 1. m_b R^2 aa\_F^2 \sin(om t)^4 \sin(bb_2) \cos(bb_2) \\
& - 2. m_b R^2 aa\_F^2 \sin(om t)^2 \sin(bb_2) \cos(om t)^2 \cos(bb_2) \\
& - 1. m_b R^2 \sin(om t)^3 om \cos(bb_2)^2 aa\_F \\
& - 1. m_b R^2 \sin(om t) om \cos(bb_2)^2 aa\_F \cos(om t)^2 \\
& - 2. m_b R e \sin(om t)^3 om aa\_F \cos(bb_2) \\
& - 2. m_b R e \sin(om t) om aa\_F \cos(om t)^2 \cos(bb_2) \\
& - 4. JB \sin(om t) om aa\_F \cos(bb_2)^2 \\
& - 4. aa\_F^2 \sin(om t)^2 \sin(bb_2) JB \cos(bb_2) \\
& + 2. m_b R e \cos(om t)^2 om^2 \sin(bb_2) \\
& + m_b R^2 \sin(om t)^2 om^2 \cos(bb_2) \sin(bb_2) \\
& + 2. m_b R e \sin(om t)^2 om^2 \sin(bb_2) \\
& - 2. m_b g\_R \sin(bb_2) \cos(om t) \cos(aa) \\
& - 2. m_b g\_R \cos(bb_2) \sin(aa) + m_b R^2 aa\_FF \sin(bb_2)^2 \cos(om t)^3 \\
& + m_b R^2 aa\_FF \sin(bb_2)^2 \cos(om t) \sin(om t)^2 \\
& + 2. m_b aa\_FF \cos(om t) R \cos(bb_2) e + R m_b l aa\_FF \cos(bb_2) \\
& + m_b R \sin(bb_2) l aa\_F^2 \cos(om t) \\
& + 2. m_b R \sin(bb_2) e \cos(om t)^2 aa\_F^2 \\
& + m_b R^2 \sin(om t)^2 \sin(bb_2) \cos(bb_2) bb\_F\_2^2 \\
& + m_b R^2 \cos(om t) aa\_FF \cos(bb_2)^2 \\
& + m_b R^2 \cos(om t)^2 \sin(bb_2) \cos(bb_2) bb\_F\_2^2 \\
& + m_b R^2 \cos(om t)^2 om^2 \cos(bb_2) \sin(bb_2) \\
& - 1. m_b R^2 \sin(om t) om aa\_F \cos(bb_2)^2 \\
& + 4. JB aa\_F \sin(om t) \sin(bb_2)^2 om + 4. kb bb\_2 \\
& - 1. m_b R^2 aa\_F^2 \cos(om t)^4 \sin(bb_2) \cos(bb_2) \\
& + 4. JB om^2 \cos(bb_2) \sin(bb_2)) \Big/ (4. JB + R^2 m_b \cos(om t)^2 \sin(bb_2)^2 \\
& + R^2 m_b \sin(om t)^2 \sin(bb_2)^2 + R^2 m_b \cos(bb_2)^2)
\end{aligned}$$


```

(14.2.3.4)

eq of motion for rho

```

> dT_drhoflux := diff(T_total, rho[flux]);
dT_drhoflux := 0.5 m_b 
$$\left( \left( e \sin(\psi) \Psi_{flux} + \frac{1}{2} R \left( -(\rho_{flux} \sin(\psi) \sin(\beta_1) \right. \right. \right.$$
 (14.3.1)

$$- \Omega \cos(\beta_1) \right) \sin(\psi) - (\rho_{flux} \cos(\psi) - \beta_{flux_1}) \cos(\psi) \sin(\beta_1) \right) R \left( \right.$$


$$- \sin(\psi)^2 \sin(\beta_1) - \cos(\psi)^2 \sin(\beta_1) \right) + 2 \left( -\frac{1}{2} l \rho_{flux} + e \cos(\psi) \rho_{flux} \right.$$


$$+ \frac{1}{2} R \left( \rho_{flux} \cos(\psi) - \beta_{flux_1} \right) \cos(\beta_1) \right) \left( -\frac{1}{2} l + e \cos(\psi) \right.$$


$$+ \frac{1}{2} R \cos(\psi) \cos(\beta_1) \right) + 0.5 m_b \left( \left( -e \sin(\psi) \Psi_{flux} + \frac{1}{2} R \left( \right. \right. \right.$$


$$- \rho_{flux} \sin(\psi) \sin(\beta_2) - \Omega \cos(\beta_2) \right) \sin(\psi) + \left( -\rho_{flux} \cos(\psi) \right. \right. \right.$$


$$- \beta_{flux_2} \right) \cos(\psi) \sin(\beta_2) \right) R \left( -\sin(\psi)^2 \sin(\beta_2) - \cos(\psi)^2 \sin(\beta_2) \right) + 2 \left( \right.$$


$$-\frac{1}{2} l \rho_{flux} - e \cos(\psi) \rho_{flux} + \frac{1}{2} R \left( -\rho_{flux} \cos(\psi) - \beta_{flux_2} \right) \cos(\beta_2) \right) \left( -\frac{1}{2} l \right.$$


$$- e \cos(\psi) - \frac{1}{2} R \cos(\psi) \cos(\beta_2) \right) + 0.06250000000 m_t l^2 \rho_{flux} - 1.0 \left( \right.$$


$$- \rho_{flux} \cos(\psi) + \beta_{flux_1} \right) J B \cos(\psi) + 1.0 \left( \rho_{flux} \sin(\psi) \sin(\beta_1) \right.$$


$$- \Omega \cos(\beta_1) \right) J B \sin(\psi) \sin(\beta_1) + 1.0 \left( \rho_{flux} \cos(\psi) + \beta_{flux_2} \right) J B \cos(\psi)$$


$$- 1.0 \left( -\rho_{flux} \sin(\psi) \sin(\beta_2) - \Omega \cos(\beta_2) \right) J B \sin(\psi) \sin(\beta_2) + 1.0 \rho_{flux} J T$$

> `starting length` = length(%), `converting to horner`=length
(convert(% ,horner)), factoring=length(factor(%)), `simplify
length` = length(simplify(%));
starting length=1761, converting to horner=2799, factoring=3259, simplify length
=1774

```

(14.3.2)

replace first rho[flux] with rho_f, otherwise maple will display the partial derivative of d/drho (rho[flux]) which is ofcourse zero, but maple doesn't know

```

> dT_drho := diff(subs(rho[flux]=rho_f,T_total), rho);
dT_drho := 0

```

(14.3.3)

```

> dv_drho := diff(v_total, rho);
dV_drho := m_b g_- 
$$\left( -l \sin(\rho) + \frac{1}{2} R \left( \cos(\beta_1) \cos(\psi) \sin(\rho) - \sin(\beta_1) \cos(\rho) \right) \right. \right.$$
 (14.3.4)

$$+ \frac{1}{2} R \left( -\cos(\beta_2) \cos(\psi) \sin(\rho) - \sin(\beta_2) \cos(\rho) \right) \left. \right) - \frac{1}{4} m_t g_- l \sin(\rho)$$


$$+ ka \rho$$


```

indicate time dependencies

indicate time dependencies

```
> dT_drho_t := subs({beta[flux[1]]=beta[flux[1]](t),beta
  [flux[2]]=beta[flux[2]](t),rho[flux]=rho[flux](t), psi
  [flux]=Omega, beta[1]=beta[1](t), beta[2]=beta[2](t), rho=
  rho(t), psi=Omega*t},dT_drho);
dT_drho_t:=0
```

(14.3.1.1)

```
> dv_drho_t := subs({beta[flux[1]]=beta[flux[1]](t),beta
  [flux[2]]=beta[flux[2]](t),rho[flux]=rho[flux](t), psi
  [flux]=Omega, beta[1]=beta[1](t), beta[2]=beta[2](t), rho=
  rho(t), psi=Omega*t},dv_drho);
dV_drho_t:=m_bg_-(-l sin(p(t)) + 1/2 R (cos(beta_1(t)) cos(Omega t) sin(p(t))
  - sin(beta_1(t)) cos(p(t))) + 1/2 R (-cos(beta_2(t)) cos(Omega t) sin(p(t))
  - sin(beta_2(t)) cos(p(t)))) - 1/4 m_t g_ l sin(p(t)) + ka p(t)
```

(14.3.1.2)

```
> dt_drhoflux_t := subs({beta[flux[1]]=beta[flux[1]](t),beta
  [flux[2]]=beta[flux[2]](t),rho[flux]=rho[flux](t), psi
  [flux]=Omega, beta[1]=beta[1](t), beta[2]=beta[2](t), rho=
  rho(t), psi=Omega*t},dT_drhoflux);
dT_drhoflux_t:=0.5 m_b ((e sin(Omega t) Omega + 1/2 R (
  - (rho_flux(t) sin(Omega t) sin(beta_1(t)) - Omega cos(beta_1(t))) sin(Omega t)
  - (rho_flux(t) cos(Omega t) - beta_flux_1(t)) cos(Omega t) sin(beta_1(t)))) R (
  - sin(Omega t)^2 sin(beta_1(t)) - cos(Omega t)^2 sin(beta_1(t))) + 2 (- 1/2 l rho_flux(t)
  + e cos(Omega t) rho_flux(t) + 1/2 R (rho_flux(t) cos(Omega t) - beta_flux_1(t)) cos(beta_1(t))) (
  - 1/2 l + e cos(Omega t) + 1/2 R cos(Omega t) cos(beta_1(t))) ) + 0.5 m_b ((-
```

(14.3.1.3)

$$\begin{aligned} & - e \sin(\Omega t) \Omega + \frac{1}{2} R \left((-\rho_{flux}(t) \sin(\Omega t) \sin(\beta_2(t)) \right. \\ & \left. - \Omega \cos(\beta_2(t)) \right) \sin(\Omega t) + \left(-\rho_{flux}(t) \cos(\Omega t) \right. \\ & \left. - \beta_{flux_2}(t) \right) \cos(\Omega t) \sin(\beta_2(t)) \right) R \left(-\sin(\Omega t)^2 \sin(\beta_2(t)) \right) \end{aligned}$$

$$\begin{aligned}
& - \cos(\Omega t)^2 \sin(\beta_2(t)) \Big) + 2 \left(-\frac{1}{2} l \rho_{flux}(t) - e \cos(\Omega t) \rho_{flux}(t) + \frac{1}{2} R \left(\right. \right. \\
& \left. \left. - \rho_{flux}(t) \cos(\Omega t) - \beta_{flux_2}(t) \right) \cos(\beta_2(t)) \right) \left(-\frac{1}{2} l - e \cos(\Omega t) \right. \\
& \left. \left. - \frac{1}{2} R \cos(\Omega t) \cos(\beta_2(t)) \right) \right) + 0.06250000000 m_t l^2 \rho_{flux}(t) - 1.0 \left(\right. \\
& \left. - \rho_{flux}(t) \cos(\Omega t) + \beta_{flux_1}(t) \right) J B \cos(\Omega t) \\
& + 1.0 \left(\rho_{flux}(t) \sin(\Omega t) \sin(\beta_1(t)) - \Omega \cos(\beta_1(t)) \right) J B \sin(\Omega t) \sin(\beta_1(t)) \\
& + 1.0 \left(\rho_{flux}(t) \cos(\Omega t) + \beta_{flux_2}(t) \right) J B \cos(\Omega t) - 1.0 \left(\right. \\
& \left. - \rho_{flux}(t) \sin(\Omega t) \sin(\beta_2(t)) - \Omega \cos(\beta_2(t)) \right) J B \sin(\Omega t) \sin(\beta_2(t)) \\
& + 1.0 \rho_{flux}(t) J T
\end{aligned}$$

change q_flux to d/dt(q)

$$\begin{aligned}
& > \text{dT_drho_tt} := \text{subs}(\{\beta_{flux[1]}(t)=\text{diff}(\beta_{flux[1]}(t),t), \\
& \quad \beta_{flux[2]}(t)=\text{diff}(\beta_{flux[2]}(t),t), \rho_{flux}(t)=\text{diff}(\rho_{flux}(t),t)\}, \text{dT_drho_t}); \\
& \quad dT_drho_tt := 0 \tag{14.3.1.4}
\end{aligned}$$

$$\begin{aligned}
& > \text{dV_drho_tt} := \text{subs}(\{\beta_{flux[1]}(t)=\text{diff}(\beta_{flux[1]}(t),t), \\
& \quad \beta_{flux[2]}(t)=\text{diff}(\beta_{flux[2]}(t),t), \rho_{flux}(t)=\text{diff}(\rho_{flux}(t),t)\}, \text{dV_drho_t}); \\
& \quad dV_drho_tt := m_b g_- \left(-l \sin(\rho(t)) + \frac{1}{2} R \left(\cos(\beta_1(t)) \cos(\Omega t) \sin(\rho(t)) \right. \right. \\
& \quad \left. \left. - \sin(\beta_1(t)) \cos(\rho(t)) \right) + \frac{1}{2} R \left(-\cos(\beta_2(t)) \cos(\Omega t) \sin(\rho(t)) \right. \right. \\
& \quad \left. \left. - \sin(\beta_2(t)) \cos(\rho(t)) \right) \right) - \frac{1}{4} m_t g_- l \sin(\rho(t)) + k a \rho(t) \tag{14.3.1.5}
\end{aligned}$$

$$\begin{aligned}
& > \text{dT_drhoflux_tt} := \text{subs}(\{\beta_{flux[1]}(t)=\text{diff}(\beta_{flux[1]}(t),t), \\
& \quad \beta_{flux[2]}(t)=\text{diff}(\beta_{flux[2]}(t),t), \rho_{flux}(t)=\text{diff}(\rho_{flux}(t),t)\}, \text{dT_drhoflux_t}); \\
& \quad dT_drhoflux_tt := 0.5 m_b \left(\left(e \sin(\Omega t) \Omega + \frac{1}{2} R \left(\right. \right. \right. \\
& \quad \left. \left. \left. - \left(\left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \sin(\beta_1(t)) - \Omega \cos(\beta_1(t)) \right) \sin(\Omega t) \right. \right. \right. \\
& \quad \left. \left. \left. - \left(\left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) - \left(\frac{d}{dt} \beta_1(t) \right) \right) \cos(\Omega t) \sin(\beta_1(t)) \right) \right) R \left(\right. \right. \\
& \quad \left. \left. \left. - \sin(\Omega t)^2 \sin(\beta_1(t)) - \cos(\Omega t)^2 \sin(\beta_1(t)) \right) + 2 \left(-\frac{1}{2} l \left(\frac{d}{dt} \rho(t) \right) \right. \right. \\
& \quad \left. \left. + e \cos(\Omega t) \left(\frac{d}{dt} \rho(t) \right) + \frac{1}{2} R \left(\left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) \right. \right. \right. \\
& \quad \left. \left. \left. - \left(\frac{d}{dt} \beta_1(t) \right) \sin(\Omega t) \right) \right) \right) \tag{14.3.1.6}
\end{aligned}$$

$$\begin{aligned}
& - \left(\frac{d}{dt} \beta_1(t) \right) \cos(\beta_1(t)) \left(-\frac{1}{2} l + e \cos(\Omega t) \right. \\
& \left. + \frac{1}{2} R \cos(\Omega t) \cos(\beta_1(t)) \right) + 0.5 m_b \left(\left(-e \sin(\Omega t) \Omega + \frac{1}{2} R \left(\left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \sin(\beta_2(t)) - \Omega \cos(\beta_2(t)) \right) \sin(\Omega t) + \left(\left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) - \left(\frac{d}{dt} \beta_2(t) \right) \right) \cos(\Omega t) \sin(\beta_2(t)) \right) R \left(-\sin(\Omega t)^2 \sin(\beta_2(t)) - \cos(\Omega t)^2 \sin(\beta_2(t)) \right) + 2 \left(-\frac{1}{2} l \left(\frac{d}{dt} \rho(t) \right) \right. \right. \\
& \left. \left. - e \cos(\Omega t) \left(\frac{d}{dt} \rho(t) \right) + \frac{1}{2} R \left(- \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) \right. \right. \\
& \left. \left. - \left(\frac{d}{dt} \beta_2(t) \right) \right) \cos(\beta_2(t)) \right) \left(-\frac{1}{2} l - e \cos(\Omega t) \right. \\
& \left. \left. - \frac{1}{2} R \cos(\Omega t) \cos(\beta_2(t)) \right) \right) + 0.06250000000 m_t l^2 \left(\frac{d}{dt} \rho(t) \right) - 1.0 \left(\left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) + \frac{d}{dt} \beta_1(t) \right) JB \cos(\Omega t) \\
& + 1.0 \left(\left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \sin(\beta_1(t)) \right. \\
& \left. - \Omega \cos(\beta_1(t)) \right) JB \sin(\Omega t) \sin(\beta_1(t)) + 1.0 \left(\left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) \right. \\
& \left. + \frac{d}{dt} \beta_2(t) \right) JB \cos(\Omega t) - 1.0 \left(- \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \sin(\beta_2(t)) \right. \\
& \left. - \Omega \cos(\beta_2(t)) \right) JB \sin(\Omega t) \sin(\beta_2(t)) + 1.0 \left(\frac{d}{dt} \rho(t) \right) JT
\end{aligned}$$

> `starting length` = length(%), `converting to horner` =
length(convert(% ,horner)), factoring=length(factor(%)),
`simplify length` = length(simplify(%));
starting length=2343, converting to horner=3407, factoring=4159,
simplify length=2356 (14.3.1.7)

differentiate with respect to t and construct equations of motion for rho

> ddt_dT_drhoflux := diff(dT_drhoflux_tt, t);
ddt_dT_drhoflux:=0.5 m_b \left(\left(e \cos(\Omega t) \Omega^2 + \frac{1}{2} R \left(\left(\frac{d^2}{dt^2} \rho(t) \right) \sin(\Omega t) \sin(\beta_1(t)) + \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) \Omega \sin(\beta_1(t)) \right. \right. \right. \\ \left. \left. \left. + \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \cos(\beta_1(t)) \left(\frac{d}{dt} \beta_1(t) \right) \right. \right. \right. \\ \left. \left. \left. + \Omega \sin(\beta_1(t)) \left(\frac{d}{dt} \beta_1(t) \right) \right) \right) \sin(\Omega t) - \left(\left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \sin(\beta_1(t)) \right) \right) (14.3.2.1)

$$\begin{aligned}
& - \Omega \cos(\beta_1(t)) \right) \cos(\Omega t) \Omega - \left(\left(\frac{d^2}{dt^2} \rho(t) \right) \cos(\Omega t) \right. \\
& - \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \Omega - \left(\frac{d^2}{dt^2} \beta_1(t) \right) \right) \cos(\Omega t) \sin(\beta_1(t)) \\
& + \left(\left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) - \left(\frac{d}{dt} \beta_1(t) \right) \right) \sin(\Omega t) \Omega \sin(\beta_1(t)) \\
& - \left(\left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) \right. \\
& - \left. \left(\frac{d}{dt} \beta_1(t) \right) \right) \cos(\Omega t) \cos(\beta_1(t)) \left(\frac{d}{dt} \beta_1(t) \right) \Big) R \Big(\\
& - \sin(\Omega t)^2 \sin(\beta_1(t)) - \cos(\Omega t)^2 \sin(\beta_1(t)) \Big) + \left(e \sin(\Omega t) \Omega + \frac{1}{2} R \left(\right. \right. \\
& - \left(\left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \sin(\beta_1(t)) - \Omega \cos(\beta_1(t)) \right) \sin(\Omega t) \\
& - \left(\left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) - \left(\frac{d}{dt} \beta_1(t) \right) \right) \cos(\Omega t) \sin(\beta_1(t)) \Big) \Big) R \Big(\\
& - \sin(\Omega t)^2 \cos(\beta_1(t)) \left(\frac{d}{dt} \beta_1(t) \right) - \cos(\Omega t)^2 \cos(\beta_1(t)) \left(\frac{d}{dt} \beta_1(t) \right) \Big) \\
& + 2 \left(-\frac{1}{2} l \left(\frac{d^2}{dt^2} \rho(t) \right) - e \sin(\Omega t) \Omega \left(\frac{d}{dt} \rho(t) \right) \right. \\
& + e \cos(\Omega t) \left(\frac{d^2}{dt^2} \rho(t) \right) + \frac{1}{2} R \left(\left(\frac{d^2}{dt^2} \rho(t) \right) \cos(\Omega t) \right. \\
& - \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \Omega - \left(\frac{d^2}{dt^2} \beta_1(t) \right) \Big) \cos(\beta_1(t)) \\
& - \frac{1}{2} R \left(\left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) - \left(\frac{d}{dt} \beta_1(t) \right) \right) \sin(\beta_1(t)) \left(\frac{d}{dt} \beta_1(t) \right) \Big) \Big(\\
& - \frac{1}{2} l + e \cos(\Omega t) + \frac{1}{2} R \cos(\Omega t) \cos(\beta_1(t)) \Big) + 2 \left(-\frac{1}{2} l \left(\frac{d}{dt} \rho(t) \right) \right. \\
& + e \cos(\Omega t) \left(\frac{d}{dt} \rho(t) \right) + \frac{1}{2} R \left(\left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) \right. \\
& - \left. \left(\frac{d}{dt} \beta_1(t) \right) \right) \cos(\beta_1(t)) \Big) \Big(-e \sin(\Omega t) \Omega \\
& - \frac{1}{2} R \sin(\Omega t) \Omega \cos(\beta_1(t)) - \frac{1}{2} R \cos(\Omega t) \sin(\beta_1(t)) \left(\frac{d}{dt} \beta_1(t) \right) \Big) \Big) \\
& + 0.5 m_b \left(\left(-e \cos(\Omega t) \Omega^2 + \frac{1}{2} R \left(\left(-\left(\frac{d^2}{dt^2} \rho(t) \right) \sin(\Omega t) \sin(\beta_2(t)) \right. \right. \right. \right. \right. \\
& - \left. \left. \left. \left. \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) \Omega \sin(\beta_2(t)) \right) \right) \right)
\end{aligned}$$

$$\begin{aligned}
& - \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \cos(\beta_2(t)) \left(\frac{d}{dt} \beta_2(t) \right) \\
& + \Omega \sin(\beta_2(t)) \left(\frac{d}{dt} \beta_2(t) \right) \right) \sin(\Omega t) + \left(\right. \\
& - \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \sin(\beta_2(t)) - \Omega \cos(\beta_2(t)) \right) \cos(\Omega t) \Omega + \left(\right. \\
& - \left(\frac{d^2}{dt^2} \rho(t) \right) \cos(\Omega t) + \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \Omega - \left(\frac{d^2}{dt^2} \beta_2(t) \right) \left. \right) \\
& \cos(\Omega t) \sin(\beta_2(t)) - \left(- \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) \right. \\
& - \left. \left(\frac{d}{dt} \beta_2(t) \right) \right) \sin(\Omega t) \Omega \sin(\beta_2(t)) + \left(- \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) \right. \\
& - \left. \left(\frac{d}{dt} \beta_2(t) \right) \right) \cos(\Omega t) \cos(\beta_2(t)) \left(\frac{d}{dt} \beta_2(t) \right) \right) R \left(\right. \\
& - \sin(\Omega t)^2 \sin(\beta_2(t)) - \cos(\Omega t)^2 \sin(\beta_2(t)) \left. \right) + \left(-e \sin(\Omega t) \Omega \right. \\
& + \frac{1}{2} R \left(\left(- \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \sin(\beta_2(t)) - \Omega \cos(\beta_2(t)) \right) \sin(\Omega t) \right. \\
& + \left. \left(- \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) - \left(\frac{d}{dt} \beta_2(t) \right) \right) \cos(\Omega t) \sin(\beta_2(t)) \right) R \left(\right. \\
& - \sin(\Omega t)^2 \cos(\beta_2(t)) \left(\frac{d}{dt} \beta_2(t) \right) - \cos(\Omega t)^2 \cos(\beta_2(t)) \left(\frac{d}{dt} \beta_2(t) \right) \left. \right) \\
& + 2 \left(-\frac{1}{2} l \left(\frac{d^2}{dt^2} \rho(t) \right) + e \sin(\Omega t) \Omega \left(\frac{d}{dt} \rho(t) \right) \right. \\
& - e \cos(\Omega t) \left(\frac{d^2}{dt^2} \rho(t) \right) + \frac{1}{2} R \left(- \left(\frac{d^2}{dt^2} \rho(t) \right) \cos(\Omega t) \right. \\
& + \left. \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \Omega - \left(\frac{d^2}{dt^2} \beta_2(t) \right) \right) \cos(\beta_2(t)) - \frac{1}{2} R \left(\right. \\
& - \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) - \left(\frac{d}{dt} \beta_2(t) \right) \sin(\beta_2(t)) \left(\frac{d}{dt} \beta_2(t) \right) \left. \right) \left(-\frac{1}{2} l \right. \\
& - e \cos(\Omega t) - \frac{1}{2} R \cos(\Omega t) \cos(\beta_2(t)) \left. \right) + 2 \left(-\frac{1}{2} l \left(\frac{d}{dt} \rho(t) \right) \right. \\
& - e \cos(\Omega t) \left(\frac{d}{dt} \rho(t) \right) + \frac{1}{2} R \left(- \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) \right. \\
& - \left. \left(\frac{d}{dt} \beta_2(t) \right) \right) \cos(\beta_2(t)) \left. \right) \left(e \sin(\Omega t) \Omega + \frac{1}{2} R \sin(\Omega t) \Omega \cos(\beta_2(t)) \right) \\
& + \frac{1}{2} R \cos(\Omega t) \sin(\beta_2(t)) \left(\frac{d}{dt} \beta_2(t) \right) \left. \right)
\end{aligned}$$

$$\begin{aligned}
& + 0.06250000000 m_t l^2 \left(\frac{d^2}{dt^2} \rho(t) \right) - 1.0 \left(- \left(\frac{d^2}{dt^2} \rho(t) \right) \cos(\Omega t) \right. \\
& + \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \Omega + \frac{d^2}{dt^2} \beta_1(t) \Big) JB \cos(\Omega t) + 1.0 \Big(\\
& - \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) + \frac{d}{dt} \beta_1(t) \Big) JB \sin(\Omega t) \Omega \\
& + 1.0 \left(\left(\frac{d^2}{dt^2} \rho(t) \right) \sin(\Omega t) \sin(\beta_1(t)) \right. \\
& + \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) \Omega \sin(\beta_1(t)) \\
& + \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \cos(\beta_1(t)) \left(\frac{d}{dt} \beta_1(t) \right) \\
& + \Omega \sin(\beta_1(t)) \left(\frac{d}{dt} \beta_1(t) \right) \Big) JB \sin(\Omega t) \sin(\beta_1(t)) \\
& + 1.0 \left(\left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \sin(\beta_1(t)) \right. \\
& - \Omega \cos(\beta_1(t)) \Big) JB \cos(\Omega t) \Omega \sin(\beta_1(t)) \\
& + 1.0 \left(\left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \sin(\beta_1(t)) \right. \\
& - \Omega \cos(\beta_1(t)) \Big) JB \sin(\Omega t) \cos(\beta_1(t)) \left(\frac{d}{dt} \beta_1(t) \right) \\
& + 1.0 \left(\left(\frac{d^2}{dt^2} \rho(t) \right) \cos(\Omega t) - \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \Omega \right. \\
& + \frac{d^2}{dt^2} \beta_2(t) \Big) JB \cos(\Omega t) - 1.0 \left(\left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) \right. \\
& + \frac{d}{dt} \beta_2(t) \Big) JB \sin(\Omega t) \Omega - 1.0 \left(- \left(\frac{d^2}{dt^2} \rho(t) \right) \sin(\Omega t) \sin(\beta_2(t)) \right. \\
& - \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) \Omega \sin(\beta_2(t)) \\
& - \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \cos(\beta_2(t)) \left(\frac{d}{dt} \beta_2(t) \right) \\
& + \Omega \sin(\beta_2(t)) \left(\frac{d}{dt} \beta_2(t) \right) \Big) JB \sin(\Omega t) \sin(\beta_2(t)) - 1.0 \Big(\\
& - \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \sin(\beta_2(t)) - \Omega \cos(\beta_2(t)) \Big) \\
& JB \cos(\Omega t) \Omega \sin(\beta_2(t)) - 1.0 \left(- \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \sin(\beta_2(t)) \right)
\end{aligned}$$

```


$$-\Omega \cos(\beta_2(t)) \Big) JB \sin(\Omega t) \cos(\beta_2(t)) \left( \frac{d}{dt} \beta_2(t) \right) + 1.0 \left( \frac{d^2}{dt^2} \rho(t) \right) JT$$

> `starting length` = length(%), `converting to horner`=
length(convert(% ,horner)), factoring=length(factor(%));
starting length=8223, converting to horner=9125,factoring=11819 (14.3.2.2)

> eq_rho[full] := ddt_dT_drhoflux - dT_drho_tt + dv_drho_tt
= 0;
eq_rhofull := 0.5 m_b 
$$\left( \left( e \cos(\Omega t) \Omega^2 + \frac{1}{2} R \left( \right. \right.$$


$$- \left( \left( \frac{d^2}{dt^2} \rho(t) \right) \sin(\Omega t) \sin(\beta_1(t)) + \left( \frac{d}{dt} \rho(t) \right) \cos(\Omega t) \Omega \sin(\beta_1(t)) \right.$$


$$+ \left( \frac{d}{dt} \rho(t) \right) \sin(\Omega t) \cos(\beta_1(t)) \left( \frac{d}{dt} \beta_1(t) \right)$$


$$+ \Omega \sin(\beta_1(t)) \left( \frac{d}{dt} \beta_1(t) \right) \sin(\Omega t) - \left( \left( \frac{d}{dt} \rho(t) \right) \sin(\Omega t) \sin(\beta_1(t)) \right.$$


$$- \Omega \cos(\beta_1(t)) \cos(\Omega t) \Omega - \left( \left( \frac{d^2}{dt^2} \rho(t) \right) \cos(\Omega t) \right.$$


$$- \left( \frac{d}{dt} \rho(t) \right) \sin(\Omega t) \Omega - \left( \frac{d^2}{dt^2} \beta_1(t) \right) \cos(\Omega t) \sin(\beta_1(t))$$


$$+ \left( \left( \frac{d}{dt} \rho(t) \right) \cos(\Omega t) - \left( \frac{d}{dt} \beta_1(t) \right) \right) \sin(\Omega t) \Omega \sin(\beta_1(t))$$


$$- \left( \left( \frac{d}{dt} \rho(t) \right) \cos(\Omega t) \right.$$


$$- \left( \frac{d}{dt} \beta_1(t) \right) \cos(\Omega t) \cos(\beta_1(t)) \left( \frac{d}{dt} \beta_1(t) \right) \Big) R \left( \right.$$


$$- \sin(\Omega t)^2 \sin(\beta_1(t)) - \cos(\Omega t)^2 \sin(\beta_1(t)) \Big) + \left( e \sin(\Omega t) \Omega + \frac{1}{2} R \left( \right.$$


$$- \left( \left( \frac{d}{dt} \rho(t) \right) \sin(\Omega t) \sin(\beta_1(t)) - \Omega \cos(\beta_1(t)) \right) \sin(\Omega t) \right.$$


$$- \left( \left( \frac{d}{dt} \rho(t) \right) \cos(\Omega t) - \left( \frac{d}{dt} \beta_1(t) \right) \right) \cos(\Omega t) \sin(\beta_1(t)) \Big) \Big) R \left( \right.$$


$$- \sin(\Omega t)^2 \cos(\beta_1(t)) \left( \frac{d}{dt} \beta_1(t) \right) - \cos(\Omega t)^2 \cos(\beta_1(t)) \left( \frac{d}{dt} \beta_1(t) \right) \Big)$$


$$+ 2 \left( -\frac{1}{2} I \left( \frac{d^2}{dt^2} \rho(t) \right) - e \sin(\Omega t) \Omega \left( \frac{d}{dt} \rho(t) \right) \right.$$


$$+ e \cos(\Omega t) \left( \frac{d^2}{dt^2} \rho(t) \right) + \frac{1}{2} R \left( \left( \frac{d^2}{dt^2} \rho(t) \right) \cos(\Omega t) \right)$$


```

$$\begin{aligned}
& - \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \Omega - \left(\frac{d^2}{dt^2} \beta_1(t) \right) \cos(\beta_1(t)) \\
& - \frac{1}{2} R \left(\left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) - \left(\frac{d}{dt} \beta_1(t) \right) \right) \sin(\beta_1(t)) \left(\frac{d}{dt} \beta_1(t) \right) \left(\right. \\
& - \frac{1}{2} l + e \cos(\Omega t) + \frac{1}{2} R \cos(\Omega t) \cos(\beta_1(t)) \left. \right) + 2 \left(-\frac{1}{2} l \left(\frac{d}{dt} \rho(t) \right) \right. \\
& + e \cos(\Omega t) \left(\frac{d}{dt} \rho(t) \right) + \frac{1}{2} R \left(\left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) \right. \\
& - \left. \left. \left(\frac{d}{dt} \beta_1(t) \right) \right) \cos(\beta_1(t)) \right) \left(-e \sin(\Omega t) \Omega \right. \\
& - \frac{1}{2} R \sin(\Omega t) \Omega \cos(\beta_1(t)) - \frac{1}{2} R \cos(\Omega t) \sin(\beta_1(t)) \left(\frac{d}{dt} \beta_1(t) \right) \left. \right) \\
& + 0.5 m_b \left(\left(-e \cos(\Omega t) \Omega^2 + \frac{1}{2} R \left(\left(- \left(\frac{d^2}{dt^2} \rho(t) \right) \sin(\Omega t) \sin(\beta_2(t)) \right. \right. \right. \right. \\
& - \left. \left. \left. \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) \Omega \sin(\beta_2(t)) \right) \right. \right. \\
& - \left. \left. \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \cos(\beta_2(t)) \left(\frac{d}{dt} \beta_2(t) \right) \right. \right. \\
& + \Omega \sin(\beta_2(t)) \left(\frac{d}{dt} \beta_2(t) \right) \left. \right) \sin(\Omega t) + \left(\right. \\
& - \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \sin(\beta_2(t)) - \Omega \cos(\beta_2(t)) \left. \right) \cos(\Omega t) \Omega + \left(\right. \\
& - \left(\frac{d^2}{dt^2} \rho(t) \right) \cos(\Omega t) + \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \Omega - \left(\frac{d^2}{dt^2} \beta_2(t) \right) \left. \right) \\
& \cos(\Omega t) \sin(\beta_2(t)) - \left(- \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) \right. \\
& - \left. \left(\frac{d}{dt} \beta_2(t) \right) \right) \sin(\Omega t) \Omega \sin(\beta_2(t)) + \left(- \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) \right. \\
& - \left. \left(\frac{d}{dt} \beta_2(t) \right) \right) \cos(\Omega t) \cos(\beta_2(t)) \left(\frac{d}{dt} \beta_2(t) \right) \left. \right) R \left(\right. \\
& - \sin(\Omega t)^2 \sin(\beta_2(t)) - \cos(\Omega t)^2 \sin(\beta_2(t)) \left. \right) + \left(-e \sin(\Omega t) \Omega \right. \\
& + \frac{1}{2} R \left(\left(- \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \sin(\beta_2(t)) - \Omega \cos(\beta_2(t)) \right) \sin(\Omega t) \right. \\
& + \left(- \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) - \left(\frac{d}{dt} \beta_2(t) \right) \right) \cos(\Omega t) \sin(\beta_2(t)) \left. \right) R \left(\right. \\
& - \sin(\Omega t)^2 \cos(\beta_2(t)) \left(\frac{d}{dt} \beta_2(t) \right) - \cos(\Omega t)^2 \cos(\beta_2(t)) \left(\frac{d}{dt} \beta_2(t) \right) \left. \right)
\end{aligned}$$

$$\begin{aligned}
& + 2 \left(-\frac{1}{2} l \left(\frac{d^2}{dt^2} \rho(t) \right) + e \sin(\Omega t) \Omega \left(\frac{d}{dt} \rho(t) \right) \right. \\
& - e \cos(\Omega t) \left(\frac{d^2}{dt^2} \rho(t) \right) + \frac{1}{2} R \left(- \left(\frac{d^2}{dt^2} \rho(t) \right) \cos(\Omega t) \right. \\
& + \left. \left. \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \Omega - \left(\frac{d^2}{dt^2} \beta_2(t) \right) \right) \cos(\beta_2(t)) - \frac{1}{2} R \left(\right. \right. \\
& - \left. \left. \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) - \left(\frac{d}{dt} \beta_2(t) \right) \right) \sin(\beta_2(t)) \left(\frac{d}{dt} \beta_2(t) \right) \right) \left(-\frac{1}{2} l \right. \\
& - e \cos(\Omega t) - \frac{1}{2} R \cos(\Omega t) \cos(\beta_2(t)) \left. \right) + 2 \left(-\frac{1}{2} l \left(\frac{d}{dt} \rho(t) \right) \right. \\
& - e \cos(\Omega t) \left(\frac{d}{dt} \rho(t) \right) + \frac{1}{2} R \left(- \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) \right. \\
& - \left. \left. \left(\frac{d}{dt} \beta_2(t) \right) \right) \cos(\beta_2(t)) \right) \left(e \sin(\Omega t) \Omega + \frac{1}{2} R \sin(\Omega t) \Omega \cos(\beta_2(t)) \right. \\
& + \frac{1}{2} R \cos(\Omega t) \sin(\beta_2(t)) \left(\frac{d}{dt} \beta_2(t) \right) \left. \right) \\
& + 0.06250000000 m_- t l^2 \left(\frac{d^2}{dt^2} \rho(t) \right) - 1.0 \left(- \left(\frac{d^2}{dt^2} \rho(t) \right) \cos(\Omega t) \right. \\
& + \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \Omega + \frac{d^2}{dt^2} \beta_1(t) \left. \right) JB \cos(\Omega t) + 1.0 \left(\right. \\
& - \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) + \frac{d}{dt} \beta_1(t) \left. \right) JB \sin(\Omega t) \Omega \\
& + 1.0 \left(\left(\frac{d^2}{dt^2} \rho(t) \right) \sin(\Omega t) \sin(\beta_1(t)) \right. \\
& + \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) \Omega \sin(\beta_1(t)) \\
& + \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \cos(\beta_1(t)) \left(\frac{d}{dt} \beta_1(t) \right) \\
& + \Omega \sin(\beta_1(t)) \left(\frac{d}{dt} \beta_1(t) \right) \left. \right) JB \sin(\Omega t) \sin(\beta_1(t)) \\
& + 1.0 \left(\left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \sin(\beta_1(t)) \right. \\
& - \Omega \cos(\beta_1(t)) \left. \right) JB \cos(\Omega t) \Omega \sin(\beta_1(t)) \\
& + 1.0 \left(\left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \sin(\beta_1(t)) \right. \\
& - \Omega \cos(\beta_1(t)) \left. \right) JB \sin(\Omega t) \cos(\beta_1(t)) \left(\frac{d}{dt} \beta_1(t) \right)
\end{aligned}$$

$$\begin{aligned}
& + 1.0 \left(\left(\frac{d^2}{dt^2} \rho(t) \right) \cos(\Omega t) - \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \Omega \right. \\
& + \frac{d^2}{dt^2} \beta_2(t) \Big) JB \cos(\Omega t) - 1.0 \left(\left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) \right. \\
& + \frac{d}{dt} \beta_2(t) \Big) JB \sin(\Omega t) \Omega - 1.0 \left(- \left(\frac{d^2}{dt^2} \rho(t) \right) \sin(\Omega t) \sin(\beta_2(t)) \right. \\
& - \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) \Omega \sin(\beta_2(t)) \\
& - \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \cos(\beta_2(t)) \left(\frac{d}{dt} \beta_2(t) \right) \\
& \left. + \Omega \sin(\beta_2(t)) \left(\frac{d}{dt} \beta_2(t) \right) \right) JB \sin(\Omega t) \sin(\beta_2(t)) - 1.0 \left(\right. \\
& - \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \sin(\beta_2(t)) - \Omega \cos(\beta_2(t)) \Big) \\
& JB \cos(\Omega t) \Omega \sin(\beta_2(t)) - 1.0 \left(- \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \sin(\beta_2(t)) \right. \\
& - \Omega \cos(\beta_2(t)) \Big) JB \sin(\Omega t) \cos(\beta_2(t)) \left(\frac{d}{dt} \beta_2(t) \right) + 1.0 \left(\frac{d^2}{dt^2} \rho(t) \right) JT \\
& + m_b g_- \left(-l \sin(\rho(t)) + \frac{1}{2} R (\cos(\beta_1(t)) \cos(\Omega t) \sin(\rho(t)) \right. \\
& - \sin(\beta_1(t)) \cos(\rho(t))) + \frac{1}{2} R (-\cos(\beta_2(t)) \cos(\Omega t) \sin(\rho(t)) \\
& \left. - \sin(\beta_2(t)) \cos(\rho(t))) \right) - \frac{1}{4} m_t g_- l \sin(\rho(t)) + ka \rho(t) = 0
\end{aligned}$$

```

> `starting length` = length(%), `converting to horner` =
length(convert(% ,horner)), factoring=length(factor(%));
starting length=8621, converting to horner=9575,factoring=12329      (14.3.2.4)

```

```

> eq_rho[full] := solve(eq_rho[full],diff(rho(t),t,t));
eq_rhofull:=

$$\begin{aligned}
& 4. \left( -1. m_b R^2 \cos(\Omega t)^3 \Omega^2 \cos(\beta_2(t)) \sin(\beta_2(t)) \right. \\
& - 2. m_b R^2 \cos(\Omega t)^3 \cos(\beta_2(t)) \left( \frac{d}{dt} \beta_2(t) \right)^2 \sin(\beta_2(t)) \\
& - 4. JB \sin(\Omega t) \sin(\beta_1(t))^2 \Omega \left( \frac{d}{dt} \beta_1(t) \right) - 4. JB \cos(\Omega t) \left( \frac{d^2}{dt^2} \beta_2(t) \right) \\
& + 4. JB \cos(\Omega t) \left( \frac{d^2}{dt^2} \beta_1(t) \right) \\
& \left. - 2. m_b R^2 \cos(\Omega t) \cos(\beta_2(t)) \left( \frac{d}{dt} \beta_2(t) \right)^2 \sin(\Omega t)^2 \sin(\beta_2(t)) \right)
\end{aligned} \tag{14.3.2.5}$$


```

$$\begin{aligned}
& -1. m_b R^2 \sin(\Omega t) \Omega \cos(\beta_2(t))^2 \cos(\Omega t)^2 \left(\frac{d}{dt} \beta_2(t) \right) \\
& + 4. JB \cos(\Omega t) \Omega^2 \sin(\beta_1(t)) \cos(\beta_1(t)) \\
& - 8. JB \sin(\Omega t) \sin(\beta_1(t))^2 \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) \Omega \\
& + 2. m_b R \cos(\beta_2(t)) \left(\frac{d}{dt} \beta_2(t) \right) e \sin(\Omega t) \Omega \\
& + 4. JB \sin(\Omega t) \sin(\beta_2(t))^2 \Omega \left(\frac{d}{dt} \beta_2(t) \right) \\
& + 4. JB \sin(\Omega t) \cos(\beta_1(t))^2 \left(\frac{d}{dt} \beta_1(t) \right) \Omega \\
& - 2. m_b R e \sin(\Omega t)^3 \Omega \cos(\beta_2(t)) \left(\frac{d}{dt} \beta_2(t) \right) \\
& - 2. m_b R e \cos(\Omega t)^3 \Omega^2 \sin(\beta_2(t)) + 4. JB \sin(\Omega t) \Omega \left(\frac{d}{dt} \beta_2(t) \right) \\
& - 2. m_b R e \sin(\Omega t) \Omega \cos(\Omega t)^2 \cos(\beta_2(t)) \left(\frac{d}{dt} \beta_2(t) \right) \\
& + m_b R^2 \cos(\beta_2(t))^2 \left(\frac{d}{dt} \beta_2(t) \right) \sin(\Omega t) \Omega \\
& - 8. JB \sin(\Omega t)^2 \sin(\beta_1(t)) \left(\frac{d}{dt} \rho(t) \right) \cos(\beta_1(t)) \left(\frac{d}{dt} \beta_1(t) \right) \\
& + 2. m_b R \sin(\beta_2(t)) \left(\frac{d}{dt} \beta_2(t) \right) \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) l \\
& - 4. JB \cos(\Omega t) \Omega^2 \sin(\beta_2(t)) \cos(\beta_2(t)) \\
& - 4. JB \sin(\Omega t) \cos(\beta_2(t))^2 \left(\frac{d}{dt} \beta_2(t) \right) \Omega \\
& - 2. m_b R \cos(\beta_1(t)) \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \Omega l \\
& - 2. m_b R \sin(\beta_1(t)) \left(\frac{d}{dt} \beta_1(t) \right) \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) l \\
& + m_b R \sin(\beta_1(t)) \left(\frac{d}{dt} \beta_1(t) \right)^2 l \\
& - 8. JB \sin(\Omega t) \sin(\beta_2(t))^2 \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) \Omega
\end{aligned}$$

$$\begin{aligned}
& -8. JB \sin(\Omega t)^2 \sin(\beta_2(t)) \left(\frac{d}{dt} \rho(t) \right) \cos(\beta_2(t)) \left(\frac{d}{dt} \beta_2(t) \right) \\
& + 2. m_b R^2 \cos(\beta_1(t))^2 \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \Omega \cos(\Omega t) \\
& + 4. m_b R \sin(\beta_1(t)) \left(\frac{d}{dt} \beta_1(t) \right) \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t)^2 e \\
& - 2. m_b R \sin(\beta_1(t)) \left(\frac{d}{dt} \beta_1(t) \right)^2 e \cos(\Omega t) \\
& - 2. m_b R^2 \sin(\beta_1(t)) \left(\frac{d}{dt} \beta_1(t) \right)^2 \cos(\Omega t) \cos(\beta_1(t)) \\
& + 2. m_b R^2 \sin(\beta_1(t)) \left(\frac{d}{dt} \beta_1(t) \right) \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t)^2 \cos(\beta_1(t)) \\
& + m_b R^2 \sin(\Omega t) \Omega \cos(\beta_1(t))^2 \cos(\Omega t)^2 \left(\frac{d}{dt} \beta_1(t) \right) \\
& + 16. m_b e^2 \sin(\Omega t) \Omega \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) \\
& + 2. m_b R e \sin(\Omega t)^3 \Omega \cos(\beta_1(t)) \left(\frac{d}{dt} \beta_1(t) \right) \\
& + 8. m_b e \sin(\Omega t) \Omega \left(\frac{d}{dt} \rho(t) \right) R \cos(\Omega t) \cos(\beta_1(t)) \\
& + 2. m_b R e \sin(\Omega t) \Omega \cos(\Omega t)^2 \cos(\beta_1(t)) \left(\frac{d}{dt} \beta_1(t) \right) \\
& - 2. m_b R \cos(\beta_1(t)) \left(\frac{d}{dt} \beta_1(t) \right) e \sin(\Omega t) \Omega \\
& - 2. m_b R e \cos(\Omega t) \Omega^2 \sin(\Omega t)^2 \sin(\beta_2(t)) \\
& - 2. m_b R^2 \cos(\Omega t)^4 \cos(\beta_2(t)) \left(\frac{d}{dt} \beta_2(t) \right) \left(\frac{d}{dt} \rho(t) \right) \sin(\beta_2(t)) \\
& + 2. m_b R^2 \sin(\beta_2(t)) \left(\frac{d}{dt} \beta_2(t) \right) \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t)^2 \cos(\beta_2(t)) \\
& + 2. m_b R^2 \cos(\beta_2(t))^2 \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \Omega \cos(\Omega t) \\
& - 1. m_b R^2 \sin(\beta_2(t))^2 \cos(\Omega t) \left(\frac{d^2}{dt^2} \beta_2(t) \right) \sin(\Omega t)^2 \\
& - 4. m_b R^2 \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t)^2 \cos(\beta_1(t)) \left(\frac{d}{dt} \beta_1(t) \right) \cos(\Omega t)^2
\end{aligned}$$

$$\begin{aligned}
& \sin(\beta_1(t)) + m_t g_- l \sin(\rho(t)) \\
& - 2 \cdot m_b R^2 \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t)^4 \cos(\beta_1(t)) \left(\frac{d}{dt} \beta_1(t) \right) \sin(\beta_1(t)) \\
& + m_b R^2 \sin(\Omega t)^3 \Omega \cos(\beta_1(t))^2 \left(\frac{d}{dt} \beta_1(t) \right) \\
& - 2 \cdot m_b R^2 \sin(\Omega t) \Omega \sin(\beta_1(t))^2 \left(\frac{d}{dt} \beta_1(t) \right) \cos(\Omega t)^2 \\
& - 2 \cdot m_b R^2 \sin(\Omega t)^3 \Omega \sin(\beta_1(t))^2 \left(\frac{d}{dt} \beta_1(t) \right) \\
& - 1 \cdot m_b R^2 \cos(\beta_1(t))^2 \left(\frac{d}{dt} \beta_1(t) \right) \sin(\Omega t) \Omega \\
& + 2 \cdot m_b R^2 \cos(\Omega t) \cos(\beta_1(t)) \left(\frac{d}{dt} \beta_1(t) \right)^2 \sin(\Omega t)^2 \sin(\beta_1(t)) \\
& - 2 \cdot m_b R^2 \cos(\Omega t)^4 \cos(\beta_1(t)) \left(\frac{d}{dt} \beta_1(t) \right) \left(\frac{d}{dt} \rho(t) \right) \sin(\beta_1(t)) \\
& + m_b R^2 \cos(\Omega t) \Omega^2 \cos(\beta_1(t)) \sin(\Omega t)^2 \sin(\beta_1(t)) \\
& + 2 \cdot m_b R e \cos(\Omega t)^3 \Omega^2 \sin(\beta_1(t)) - 4 \cdot J B \sin(\Omega t) \Omega \left(\frac{d}{dt} \beta_1(t) \right) \\
& + 2 \cdot m_b R e \cos(\Omega t) \Omega^2 \sin(\Omega t)^2 \sin(\beta_1(t)) \\
& + 2 \cdot m_b R^2 \cos(\Omega t)^3 \cos(\beta_1(t)) \left(\frac{d}{dt} \beta_1(t) \right)^2 \sin(\beta_1(t)) \\
& - 2 \cdot m_b g_- R \cos(\beta_1(t)) \cos(\Omega t) \sin(\rho(t)) \\
& + 2 \cdot m_b g_- R \sin(\beta_1(t)) \cos(\rho(t)) \\
& + 2 \cdot m_b g_- R \cos(\beta_2(t)) \cos(\Omega t) \sin(\rho(t)) \\
& + 2 \cdot m_b g_- R \sin(\beta_2(t)) \cos(\rho(t)) + 4 \cdot m_b g_- l \sin(\rho(t)) \\
& + 8 \cdot m_b e \sin(\Omega t) \Omega \left(\frac{d}{dt} \rho(t) \right) R \cos(\Omega t) \cos(\beta_2(t)) \\
& + 2 \cdot m_b R \sin(\beta_2(t)) \left(\frac{d}{dt} \beta_2(t) \right)^2 e \cos(\Omega t)
\end{aligned}$$

$$\begin{aligned}
& + m_b R^2 \cos(\Omega t)^3 \Omega^2 \cos(\beta_1(t)) \sin(\beta_1(t)) \\
& + 2 \cdot m_b R \cos(\beta_2(t)) \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \Omega l - 4 \cdot k a \rho(t) \\
& - 1 \cdot m_b R \cos(\beta_1(t)) \left(\frac{d^2}{dt^2} \beta_1(t) \right) l \\
& + m_b R^2 \cos(\beta_1(t))^2 \left(\frac{d^2}{dt^2} \beta_1(t) \right) \cos(\Omega t) \\
& + 2 \cdot m_b R \cos(\beta_1(t)) \left(\frac{d^2}{dt^2} \beta_1(t) \right) e \cos(\Omega t) \\
& - 2 \cdot m_b R \cos(\beta_2(t)) \left(\frac{d^2}{dt^2} \beta_2(t) \right) e \cos(\Omega t) \\
& - 1 \cdot m_b R^2 \cos(\beta_2(t))^2 \left(\frac{d^2}{dt^2} \beta_2(t) \right) \cos(\Omega t) \\
& + m_b R^2 \cos(\Omega t)^3 \sin(\beta_1(t))^2 \left(\frac{d^2}{dt^2} \beta_1(t) \right) \\
& + m_b R^2 \cos(\Omega t) \sin(\beta_1(t))^2 \left(\frac{d^2}{dt^2} \beta_1(t) \right) \sin(\Omega t)^2 \\
& - 1 \cdot m_b R^2 \sin(\beta_2(t))^2 \cos(\Omega t)^3 \left(\frac{d^2}{dt^2} \beta_2(t) \right) \\
& - 1 \cdot m_b R \cos(\beta_2(t)) \left(\frac{d^2}{dt^2} \beta_2(t) \right) l \\
& + 2 \cdot m_b R^2 \sin(\beta_2(t)) \left(\frac{d}{dt} \beta_2(t) \right)^2 \cos(\Omega t) \cos(\beta_2(t)) \\
& - 4 \cdot m_b R^2 \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t)^2 \cos(\beta_2(t)) \left(\frac{d}{dt} \beta_2(t) \right) \cos(\Omega t)^2 \\
& \sin(\beta_2(t)) + 2 \cdot m_b R^2 \sin(\Omega t)^3 \Omega \sin(\beta_2(t))^2 \left(\frac{d}{dt} \beta_2(t) \right) \\
& - 2 \cdot m_b R^2 \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t)^4 \cos(\beta_2(t)) \left(\frac{d}{dt} \beta_2(t) \right) \sin(\beta_2(t)) \\
& - 1 \cdot m_b R^2 \sin(\Omega t)^3 \Omega \cos(\beta_2(t))^2 \left(\frac{d}{dt} \beta_2(t) \right) \\
& + 2 \cdot m_b R^2 \sin(\Omega t) \Omega \sin(\beta_2(t))^2 \left(\frac{d}{dt} \beta_2(t) \right) \cos(\Omega t)^2 \\
& - 1 \cdot m_b R^2 \cos(\Omega t) \Omega^2 \cos(\beta_2(t)) \sin(\Omega t)^2 \sin(\beta_2(t)) \\
& + 16 \cdot J B \cos(\Omega t) \left(\frac{d}{dt} \rho(t) \right) \sin(\Omega t) \Omega
\end{aligned}$$

$$\begin{aligned}
& + m_b R \sin(\beta_2(t)) \left(\frac{d}{dt} \beta_2(t) \right)^2 l \\
& + 4. m_b R \sin(\beta_2(t)) \left(\frac{d}{dt} \beta_2(t) \right) \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t)^2 e \Big) \Big) \Bigg) \Bigg/ \left(m_t l^2 \right. \\
& + 16. JT + 8. m_b l^2 + 32. m_b e^2 \cos(\Omega t)^2 + 16. JB \sin(\Omega t)^2 \sin(\beta_1(t))^2 \\
& + 16. JB \sin(\Omega t)^2 \sin(\beta_2(t))^2 + 32. JB \cos(\Omega t)^2 \\
& + 4. m_b R^2 \sin(\Omega t)^4 \sin(\beta_1(t))^2 + 4. m_b R^2 \cos(\Omega t)^4 \sin(\beta_1(t))^2 \\
& + 4. m_b R^2 \cos(\beta_1(t))^2 \cos(\Omega t)^2 \\
& + 8. m_b R^2 \sin(\Omega t)^2 \sin(\beta_1(t))^2 \cos(\Omega t)^2 \\
& - 8. m_b l R \cos(\Omega t) \cos(\beta_1(t)) + 16. m_b e \cos(\Omega t)^2 R \cos(\beta_1(t)) \\
& + 4. m_b R^2 \sin(\Omega t)^4 \sin(\beta_2(t))^2 + 4. m_b R^2 \sin(\beta_2(t))^2 \cos(\Omega t)^4 \\
& + 4. m_b R^2 \cos(\beta_2(t))^2 \cos(\Omega t)^2 \\
& + 8. m_b R^2 \sin(\Omega t)^2 \sin(\beta_2(t))^2 \cos(\Omega t)^2 \\
& + 8. m_b l R \cos(\Omega t) \cos(\beta_2(t)) + 16. m_b e \cos(\Omega t)^2 R \cos(\beta_2(t)) \Bigg)
\end{aligned}$$

```
> `starting length` = length(%), `converting to horner`=
length(convert(% ,horner)), factoring=length(factor(%));
starting length = 10551, converting to horner = 8324, factoring = 10599 (14.3.2.6)
```

```
> eq_rho[full] := convert(eq_rho[full], horner);
```

$$eq_rho_{full} := \left(4. \left(-4. ka \rho(t) + \left(\left(-4. \left(\frac{d^2}{dt^2} \beta_2(t) \right) + 4. \left(\frac{d^2}{dt^2} \beta_1(t) \right) \right) \cos(\Omega t) \right) \right) \right)$$

$$\begin{aligned}
& -8 \cdot \sin(\Omega t)^2 \sin(\beta_1(t)) \left(\frac{d}{dt} \rho(t) \right) \cos(\beta_1(t)) \left(\frac{d}{dt} \beta_1(t) \right) \\
& -8 \cdot \sin(\Omega t)^2 \sin(\beta_2(t)) \left(\frac{d}{dt} \rho(t) \right) \cos(\beta_2(t)) \left(\frac{d}{dt} \beta_2(t) \right) \Big) JB \\
& + (4 \cdot m_b g_- \sin(\rho(t)) + m_t g_- \sin(\rho(t))) I + \left(\left(\left(-4 \cdot \left(\frac{d}{dt} \beta_1(t) \right) \right. \right. \right. \right. \\
& + \left(16 \cdot -8 \cdot \sin(\beta_2(t))^2 \right) \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) \\
& \left. \left. \left. \left. + 4 \cdot \cos(\beta_1(t))^2 \left(\frac{d}{dt} \beta_1(t) \right) + \left(-4 \cdot \left(\frac{d}{dt} \beta_1(t) \right) \right. \right. \right. \right.
\end{aligned}$$

$$\begin{aligned}
& -8 \cdot \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) \left(\sin(\beta_1(t))^2 \right) \sin(\Omega t) + \left(-4 \cdot \cos(\beta_2(t))^2 + 4 \cdot \sin(\beta_2(t))^2 \right) \sin(\Omega t) \left(\frac{d}{dt} \beta_2(t) \right) \Big) JB + \Big(\\
& -4 \cdot \cos(\Omega t) \sin(\beta_2(t)) \cos(\beta_2(t)) + 4 \cdot \cos(\Omega t) \sin(\beta_1(t)) \cos(\beta_1(t)) \Big) \\
& JB \Omega + \left(\left(2 \cdot \sin(\beta_2(t)) \cos(\rho(t)) + 2 \cdot \cos(\beta_2(t)) \cos(\Omega t) \sin(\rho(t)) \right) g_m_b + \left(\right. \right. \\
& + 2 \cdot \sin(\beta_1(t)) \cos(\rho(t)) - 2 \cdot \cos(\beta_1(t)) \cos(\Omega t) \sin(\rho(t)) \Big) g_m_b + \left(\right. \\
& -1 \cdot \cos(\beta_1(t)) \left(\frac{d^2}{dt^2} \beta_1(t) \right) - 1 \cdot \cos(\beta_2(t)) \left(\frac{d^2}{dt^2} \beta_2(t) \right) + \left(\right. \\
& -2 \cdot \left(\frac{d}{dt} \rho(t) \right) \left(\frac{d}{dt} \beta_1(t) \right) \cos(\Omega t) + \left(\frac{d}{dt} \beta_1(t) \right)^2 \Big) \sin(\beta_1(t)) \\
& + \left(2 \cdot \sin(\beta_2(t)) \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) \right. \\
& \left. \left. + \sin(\beta_2(t)) \left(\frac{d}{dt} \beta_2(t) \right) \right) \left(\frac{d}{dt} \beta_2(t) \right) \right) m_b l + \left(\right. \\
& -2 \cdot \cos(\beta_1(t)) \left(\frac{d}{dt} \rho(t) \right) + 2 \cdot \cos(\beta_2(t)) \left(\frac{d}{dt} \rho(t) \right) \Big) \sin(\Omega t) m_b l \Omega \\
& + \left(\left(\left(-1 \cdot \cos(\beta_2(t))^2 \left(\frac{d^2}{dt^2} \beta_2(t) \right) \right. \right. \right. \\
& - 1 \cdot \sin(\beta_2(t))^2 \left(\frac{d^2}{dt^2} \beta_2(t) \right) \cos(\Omega t)^2 \Big) \cos(\Omega t) \\
& + \cos(\beta_1(t))^2 \left(\frac{d^2}{dt^2} \beta_1(t) \right) \cos(\Omega t) + \left(\left(-2 \cdot \left(\frac{d}{dt} \beta_1(t) \right)^2 \right. \right. \\
& + \left(2 \cdot \left(\frac{d}{dt} \rho(t) \right) \left(\frac{d}{dt} \beta_1(t) \right) + \left(2 \cdot \left(\frac{d}{dt} \beta_1(t) \right)^2 \right. \right. \\
& - 2 \cdot \left(\frac{d}{dt} \rho(t) \right) \left(\frac{d}{dt} \beta_1(t) \right) \cos(\Omega t) \Big) \cos(\Omega t) \Big) \cos(\Omega t) \Big) \\
& \cos(\Omega t) \cos(\beta_1(t)) + \cos(\Omega t)^3 \left(\frac{d^2}{dt^2} \beta_1(t) \right) \sin(\beta_1(t)) \Big) \sin(\beta_1(t)) + \Big(\\
& -1 \cdot \sin(\beta_2(t))^2 \cos(\Omega t) \left(\frac{d^2}{dt^2} \beta_2(t) \right) + \left(\left(2 \cdot \left(\frac{d}{dt} \beta_1(t) \right)^2 \right. \right. \\
& - 4 \cdot \left(\frac{d}{dt} \rho(t) \right) \left(\frac{d}{dt} \beta_1(t) \right) \cos(\Omega t) \Big) \cos(\Omega t) \cos(\beta_1(t))
\end{aligned}$$

$$\begin{aligned}
& + \cos(\Omega t) \left(\frac{d^2}{dt^2} \beta_1(t) \right) \sin(\beta_1(t)) \right) \sin(\beta_1(t)) \\
& - 2 \cdot \sin(\Omega t)^2 \sin(\beta_1(t)) \left(\frac{d}{dt} \rho(t) \right) \cos(\beta_1(t)) \left(\frac{d}{dt} \beta_1(t) \right) \right) \sin(\Omega t)^2 \\
& + \left(\left(2 \cdot \left(\frac{d}{dt} \rho(t) \right) \cos(\beta_2(t)) \sin(\beta_2(t)) \right. \right. \\
& - 2 \cdot \left(\frac{d}{dt} \rho(t) \right) \sin(\beta_2(t)) \cos(\Omega t)^2 \cos(\beta_2(t)) \right) \cos(\Omega t)^2 + \left(\right. \\
& - 4 \cdot \left(\frac{d}{dt} \rho(t) \right) \sin(\beta_2(t)) \cos(\Omega t)^2 \cos(\beta_2(t)) \\
& - 2 \cdot \sin(\Omega t)^2 \sin(\beta_2(t)) \left(\frac{d}{dt} \rho(t) \right) \cos(\beta_2(t)) \right) \sin(\Omega t)^2 \\
& + \left(\left(2 \cdot \cos(\beta_2(t)) \sin(\beta_2(t)) \right. \right. \\
& - 2 \cdot \cos(\Omega t)^2 \sin(\beta_2(t)) \cos(\beta_2(t)) \right) \cos(\Omega t) \\
& - 2 \cdot \cos(\Omega t) \cos(\beta_2(t)) \sin(\Omega t)^2 \sin(\beta_2(t)) \left(\frac{d}{dt} \beta_2(t) \right) \right) \\
& \left(\frac{d}{dt} \beta_2(t) \right) m_b + \left(\left(\left(2 \cdot \cos(\beta_2(t))^2 \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) + \left(\right. \right. \right. \right. \right. \\
& - 1 \cdot \left(\frac{d}{dt} \beta_1(t) \right) + \left(2 \cdot \left(\frac{d}{dt} \rho(t) \right) + \left(\frac{d}{dt} \beta_1(t) \right) \cos(\Omega t) \right) \cos(\Omega t) \right) \\
& \cos(\beta_1(t))^2 - 2 \cdot \sin(\beta_1(t))^2 \left(\frac{d}{dt} \beta_1(t) \right) \cos(\Omega t)^2 + \left(\right. \\
& - 2 \cdot \sin(\beta_1(t))^2 \left(\frac{d}{dt} \beta_1(t) \right) + \cos(\beta_1(t))^2 \left(\frac{d}{dt} \beta_1(t) \right) \right) \sin(\Omega t)^2 \right) \\
& \sin(\Omega t) + \left(\cos(\beta_2(t))^2 + \left(2 \cdot \sin(\beta_2(t))^2 - 1 \cdot \cos(\beta_2(t))^2 \right) \cos(\Omega t)^2 \right. \\
& + \left. \left(2 \cdot \sin(\beta_2(t))^2 - 1 \cdot \cos(\beta_2(t))^2 \right) \sin(\Omega t)^2 \right) \sin(\Omega t) \left(\frac{d}{dt} \beta_2(t) \right) \right) \\
m_b & + \left(\cos(\Omega t)^3 \cos(\beta_1(t)) \sin(\beta_1(t)) \right. \\
& - 1 \cdot \cos(\Omega t)^3 \cos(\beta_2(t)) \sin(\beta_2(t)) + \left(\right. \\
& - 1 \cdot \cos(\Omega t) \sin(\beta_2(t)) \cos(\beta_2(t)) + \cos(\Omega t) \sin(\beta_1(t)) \cos(\beta_1(t)) \left. \right)
\end{aligned}$$

$$\begin{aligned}
& \sin(\Omega t)^2 \left(m_b \Omega \right) \Omega \right) R + \left(\left(\left(2. \cos(\beta_1(t)) \left(\frac{d^2}{dt^2} \beta_1(t) \right) \cos(\Omega t) \right. \right. \right. \right. \\
& - 2. \cos(\beta_2(t)) \left(\frac{d^2}{dt^2} \beta_2(t) \right) \cos(\Omega t) + \left(-2. \left(\frac{d}{dt} \beta_1(t) \right)^2 \right. \\
& + 4. \left(\frac{d}{dt} \rho(t) \right) \left(\frac{d}{dt} \beta_1(t) \right) \cos(\Omega t) \left. \right) \cos(\Omega t) \sin(\beta_1(t)) \\
& + \left(4. \sin(\beta_2(t)) \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t)^2 \right. \\
& + 2. \sin(\beta_2(t)) \cos(\Omega t) \left(\frac{d}{dt} \beta_2(t) \right) \left. \right) \left(\frac{d}{dt} \beta_2(t) \right) \left. \right) m_b \\
& + \left(\left(\left(8. \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) \cos(\beta_2(t)) + \left(-2. \left(\frac{d}{dt} \beta_1(t) \right) \right. \right. \right. \right. \\
& + \left(8. \left(\frac{d}{dt} \rho(t) \right) + 2. \left(\frac{d}{dt} \beta_1(t) \right) \cos(\Omega t) \right) \cos(\Omega t) \left. \right) \cos(\beta_1(t)) \\
& + 2. \sin(\Omega t)^2 \cos(\beta_1(t)) \left(\frac{d}{dt} \beta_1(t) \right) \left. \right) \sin(\Omega t) + \left(\right. \\
& - 2. \cos(\Omega t)^2 \cos(\beta_2(t)) + 2. \cos(\beta_2(t)) - 2. \cos(\beta_2(t)) \sin(\Omega t)^2 \left. \right) \\
& \sin(\Omega t) \left(\frac{d}{dt} \beta_2(t) \right) \left. \right) m_b + \left(-2. \cos(\Omega t)^3 \sin(\beta_2(t)) \right. \\
& + 2. \cos(\Omega t)^3 \sin(\beta_1(t)) + \left(2. \cos(\Omega t) \sin(\beta_1(t)) \right. \\
& - 2. \sin(\beta_2(t)) \cos(\Omega t) \left. \right) \sin(\Omega t)^2 \left(m_b \Omega \right) \Omega \right) R \\
& + 16. m_b \sin(\Omega t) \Omega \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) e \left. \right) e \left. \right) \Bigg/ (16. JT \\
& + \left(32. \cos(\Omega t)^2 + \left(16. \sin(\beta_2(t))^2 + 16. \sin(\beta_1(t))^2 \right) \sin(\Omega t)^2 \right) JB \\
& + (8. m_b + m_t) l^2 + \left((-8. \cos(\Omega t) \cos(\beta_1(t)) \right. \\
& + 8. \cos(\Omega t) \cos(\beta_2(t))) m_b l + \left((4. \cos(\beta_2(t))^2 \right. \\
& + 4. \cos(\Omega t)^2 \sin(\beta_2(t))^2) \cos(\Omega t)^2 + 4. \cos(\beta_1(t))^2 \cos(\Omega t)^2 \\
& + 4. \cos(\Omega t)^4 \sin(\beta_1(t))^2 + \left(8. \cos(\Omega t)^2 \sin(\beta_2(t))^2 \right. \\
& + 8. \sin(\beta_1(t))^2 \cos(\Omega t)^2 + \left(4. \sin(\beta_2(t))^2 + 4. \sin(\beta_1(t))^2 \right) \sin(\Omega t)^2 \right. \\
& \sin(\Omega t)^2 \left. \right) m_b R \Bigg) R + \left((16. \cos(\Omega t)^2 \cos(\beta_1(t)) \right. \\
& + 16. \cos(\Omega t)^2 \cos(\beta_2(t))) m_b R + 32. m_b \cos(\Omega t)^2 e \left. \right) e
\end{aligned}$$

simplify expression for matlab en lose time dependencie notation and d/dt

```
> T1_eq_rho[full]:= subs({diff(diff(beta[1](t),t),t)=
```

```

bb_FF_1, diff(diff(beta[2](t),t),t)=bb_FF_2, diff(diff(rho(t),t),t)=aa_FF}, eq_rho[full]);
T1_eq_rhofull:=4. \left( -4. ka \rho(t) + \left( \left( 4. (4. JB aa_FF \cos(om t) - 4. JB aa_F \sin(om t) om
- 2. m_b aa_F \sin(om t) om R \cos(bb_2) e
- 1. m_b R^2 \cos(bb_2) \sin(bb_2) bb_F_2^2
+ m_b R^2 \sin(bb_2) aa_F^2 \cos(om t)^2 \cos(bb_2)
- 1. m_b R^2 aa_F^2 \sin(om t)^4 \sin(bb_2) \cos(bb_2)
- 2. m_b R^2 aa_F^2 \sin(om t)^2 \sin(bb_2) \cos(om t)^2 \cos(bb_2)
- 1. m_b R^2 \sin(om t)^3 om \cos(bb_2)^2 aa_F
- 1. m_b R^2 \sin(om t) om \cos(bb_2)^2 aa_F \cos(om t)^2
- 2. m_b R e \sin(om t)^3 om aa_F \cos(bb_2)
- 2. m_b R e \sin(om t) om aa_F \cos(om t)^2 \cos(bb_2)
- 4. JB \sin(om t) om aa_F \cos(bb_2)^2
- 4. aa_F^2 \sin(om t)^2 \sin(bb_2) JB \cos(bb_2)
+ 2. m_b R e \cos(om t)^2 om^2 \sin(bb_2)
+ m_b R^2 \sin(om t)^2 om^2 \cos(bb_2) \sin(bb_2)

```

$$\begin{aligned}
& + 2 \cdot m_b R e \sin(om t)^2 om^2 \sin(bb_2) \\
& - 2 \cdot m_b g_- R \sin(bb_2) \cos(om t) \cos(aa) \\
& - 2 \cdot m_b g_- R \cos(bb_2) \sin(aa) + m_b R^2 aa_{FF} \sin(bb_2)^2 \cos(om t)^3 \\
& + m_b R^2 aa_{FF} \sin(bb_2)^2 \cos(om t) \sin(om t)^2 \\
& + 2 \cdot m_b aa_{FF} \cos(om t) R \cos(bb_2) e + R m_b l aa_{FF} \cos(bb_2) \\
& + m_b R \sin(bb_2) l aa_F^2 \cos(om t) \\
& + 2 \cdot m_b R \sin(bb_2) e \cos(om t)^2 aa_F^2 \\
& + m_b R^2 \sin(om t)^2 \sin(bb_2) \cos(bb_2) bb_F^2 \\
& + m_b R^2 \cos(om t) aa_{FF} \cos(bb_2)^2 \\
& + m_b R^2 \cos(om t)^2 \sin(bb_2) \cos(bb_2) bb_F^2 \\
& + m_b R^2 \cos(om t)^2 om^2 \cos(bb_2) \sin(bb_2) \\
& - 1 \cdot m_b R^2 \sin(om t) om aa_F \cos(bb_2)^2 \\
& + 4 \cdot JB aa_F \sin(om t) \sin(bb_2)^2 om + 4 \cdot kb bb_2 \\
& - 1 \cdot m_b R^2 aa_F^2 \cos(om t)^4 \sin(bb_2) \cos(bb_2) \\
& + 4 \cdot JB om^2 \cos(bb_2) \sin(bb_2)) \Big) / (4 \cdot JB + R^2 m_b \cos(om t)^2 \sin(bb_2)^2)
\end{aligned}$$

$$\begin{aligned}
& + R^2 m_b \sin(\omega_m t)^2 \sin(bb_2)^2 + R^2 m_b \cos(bb_2)^2) - (4. (\\
& - 4. JB aa_{\underline{F}} F \cos(\omega_m t) + m_b R^2 \sin(\omega_m t) \omega_m \cos(bb_1)^2 \cos(\omega_m t)^2 aa_{\underline{F}} \\
& - 2. m_b R^2 aa_{\underline{F}}^2 \sin(\omega_m t)^2 \sin(bb_1) \cos(bb_1) \cos(\omega_m t)^2 \\
& + m_b R^2 \sin(\omega_m t)^3 \omega_m \cos(bb_1)^2 aa_{\underline{F}} \\
& + 2. m_b R e \sin(\omega_m t)^3 \omega_m aa_{\underline{F}} \cos(bb_1) \\
& - 1. m_b R^2 \cos(bb_1)^2 aa_{\underline{F}} F \cos(\omega_m t) + R m_b l aa_{\underline{F}} F \cos(bb_1) \\
& - 1. m_b R^2 \cos(\omega_m t)^3 \sin(bb_1)^2 aa_{\underline{F}} F \\
& - 2. m_b aa_{\underline{F}} F \cos(\omega_m t) R \cos(bb_1) e \\
& + 2. m_b R e \sin(\omega_m t) \omega_m \cos(bb_1) \cos(\omega_m t)^2 aa_{\underline{F}} \\
& + m_b R^2 \sin(bb_1) aa_{\underline{F}}^2 \cos(\omega_m t)^2 \cos(bb_1) \\
& - 4. JB aa_{\underline{F}} \sin(\omega_m t) \sin(bb_1)^2 \omega_m \\
& - 1. m_b R \sin(bb_1) l aa_{\underline{F}}^2 \cos(\omega_m t) \\
& + 2. m_b R \sin(bb_1) e \cos(\omega_m t)^2 aa_{\underline{F}}^2 \\
& + m_b R^2 \sin(\omega_m t)^2 \omega_m^2 \cos(bb_1) \sin(bb_1) \\
& + 2. m_b R e \sin(\omega_m t)^2 \omega_m^2 \sin(bb_1)
\end{aligned}$$

$$\begin{aligned}
& -1. m_b R^2 \sin(bb_I)^2 \sin(om t)^2 aa_FF \cos(om t) \\
& + 4. JB \cos(bb_I)^2 aa_F \sin(om t) om \\
& + m_b R^2 \cos(om t)^2 om^2 \cos(bb_I) \sin(bb_I) \\
& + 2. m_b R e \cos(om t)^2 om^2 \sin(bb_I) \\
& + 2. m_b g_R \sin(bb_I) \cos(om t) \cos(aa) \\
& - 2. m_b g_R \cos(bb_I) \sin(aa) + 4. kb bb_I \\
& + 2. m_b aa_F \sin(om t) om R \cos(bb_I) e \\
& + m_b R^2 \cos(om t)^2 \sin(bb_I) \cos(bb_I) bb_F_I^2 \\
& + 4. JB om^2 \cos(bb_I) \sin(bb_I) + 4. JB aa_F \sin(om t) om \\
& - 4. aa_F^2 \sin(om t)^2 \sin(bb_I) JB \cos(bb_I) \\
& - 1. m_b R^2 aa_F^2 \sin(om t)^4 \sin(bb_I) \cos(bb_I) \\
& + m_b R^2 \cos(bb_I)^2 aa_F \sin(om t) om \\
& - 1. m_b R^2 \cos(bb_I) \sin(bb_I) bb_F_I^2 \\
& + m_b R^2 \sin(bb_I) \sin(om t)^2 \cos(bb_I) bb_F_I^2 \\
& - 1. m_b R^2 \cos(om t)^4 \sin(bb_I) aa_F^2 \cos(bb_I))) / (4. JB
\end{aligned}$$

$$\begin{aligned}
& + R^2 m_b \sin(om t)^2 \sin(bb_I)^2 + R^2 m_b \cos(bb_I)^2 \\
& + R^2 m_b \cos(om t)^2 \sin(bb_I)^2) \cos(\Omega t) \\
& - 8. \sin(\Omega t)^2 \sin(\beta_1(t)) \left(\frac{d}{dt} \rho(t) \right) \cos(\beta_1(t)) \left(\frac{d}{dt} \beta_1(t) \right) \\
& - 8. \sin(\Omega t)^2 \sin(\beta_2(t)) \left(\frac{d}{dt} \rho(t) \right) \cos(\beta_2(t)) \left(\frac{d}{dt} \beta_2(t) \right) \Big) JB \\
& + (4. m_b g_- \sin(\rho(t)) + m_t g_- \sin(\rho(t))) l + \left(\left(\left(-4. \left(\frac{d}{dt} \beta_1(t) \right) \right. \right. \right. \right. \\
& + \left(16. - 8. \sin(\beta_2(t))^2 \right) \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) \\
& + 4. \cos(\beta_1(t))^2 \left(\frac{d}{dt} \beta_1(t) \right) + \left(-4. \left(\frac{d}{dt} \beta_1(t) \right) \right. \\
& - 8. \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) \Big) \sin(\beta_1(t))^2 \Big) \sin(\Omega t) + \left(-4. \cos(\beta_2(t))^2 + 4. \right. \\
& + 4. \sin(\beta_2(t))^2 \Big) \sin(\Omega t) \left(\frac{d}{dt} \beta_2(t) \right) \Big) JB + \Big(\\
& - 4. \cos(\Omega t) \sin(\beta_2(t)) \cos(\beta_2(t)) + 4. \cos(\Omega t) \sin(\beta_1(t)) \cos(\beta_1(t)) \Big) \\
& JB \Omega \Big) \Omega + \left(\left(2. \sin(\beta_2(t)) \cos(\rho(t)) + 2. \cos(\beta_2(t)) \cos(\Omega t) \sin(\rho(t)) \right. \right. \\
& + 2. \sin(\beta_1(t)) \cos(\rho(t)) - 2. \cos(\beta_1(t)) \cos(\Omega t) \sin(\rho(t)) \Big) g_- m_b \\
& + \left(\left(1. \cos(\beta_1(t)) (-4. JB aa_FF \cos(om t) \right. \right. \\
& + m_b R^2 \sin(om t) om \cos(bb_I)^2 \cos(om t)^2 aa_F \\
& - 2. m_b R^2 aa_F^2 \sin(om t)^2 \sin(bb_I) \cos(bb_I) \cos(om t)^2
\end{aligned}$$

$$\begin{aligned}
& + m_b R^2 \sin(\omega_m t)^3 \omega_m \cos(bb_I)^2 aa_F \\
& + 2. m_b R e \sin(\omega_m t)^3 \omega_m aa_F \cos(bb_I) \\
& - 1. m_b R^2 \cos(bb_I)^2 aa_FF \cos(\omega_m t) + R m_b l aa_FF \cos(bb_I) \\
& - 1. m_b R^2 \cos(\omega_m t)^3 \sin(bb_I)^2 aa_FF \\
& - 2. m_b aa_FF \cos(\omega_m t) R \cos(bb_I) e \\
& + 2. m_b R e \sin(\omega_m t) \omega_m \cos(bb_I) \cos(\omega_m t)^2 aa_F \\
& + m_b R^2 \sin(bb_I) aa_F^2 \cos(\omega_m t)^2 \cos(bb_I) \\
& - 4. JB aa_F \sin(\omega_m t) \sin(bb_I)^2 \omega_m \\
& - 1. m_b R \sin(bb_I) l aa_F^2 \cos(\omega_m t) \\
& + 2. m_b R \sin(bb_I) e \cos(\omega_m t)^2 aa_F^2 \\
& + m_b R^2 \sin(\omega_m t)^2 \omega_m^2 \cos(bb_I) \sin(bb_I) \\
& + 2. m_b R e \sin(\omega_m t)^2 \omega_m^2 \sin(bb_I) \\
& - 1. m_b R^2 \sin(bb_I)^2 \sin(\omega_m t)^2 aa_FF \cos(\omega_m t) \\
& + 4. JB \cos(bb_I)^2 aa_F \sin(\omega_m t) \omega_m \\
& + m_b R^2 \cos(\omega_m t)^2 \omega_m^2 \cos(bb_I) \sin(bb_I)
\end{aligned}$$

$$+ 2 \cdot m_b R e \cos(om t)^2 om^2 \sin(bb_I)$$

$$+ 2 \cdot m_b g_R \sin(bb_I) \cos(om t) \cos(aa)$$

$$- 2 \cdot m_b g_R \cos(bb_I) \sin(aa) + 4 \cdot kb bb_I$$

$$+ 2 \cdot m_b aa_F \sin(om t) om R \cos(bb_I) e$$

$$+ m_b R^2 \cos(om t)^2 \sin(bb_I) \cos(bb_I) bb_F_I^2$$

$$+ 4 \cdot JB om^2 \cos(bb_I) \sin(bb_I) + 4 \cdot JB aa_F \sin(om t) om$$

$$- 4 \cdot aa_F^2 \sin(om t)^2 \sin(bb_I) JB \cos(bb_I)$$

$$- 1 \cdot m_b R^2 aa_F^2 \sin(om t)^4 \sin(bb_I) \cos(bb_I)$$

$$+ m_b R^2 \cos(bb_I)^2 aa_F \sin(om t) om$$

$$- 1 \cdot m_b R^2 \cos(bb_I) \sin(bb_I) bb_F_I^2$$

$$+ m_b R^2 \sin(bb_I) \sin(om t)^2 \cos(bb_I) bb_F_I^2$$

$$- 1 \cdot m_b R^2 \cos(om t)^4 \sin(bb_I) aa_F^2 \cos(bb_I))) \Big/ (4 \cdot JB$$

$$+ R^2 m_b \sin(om t)^2 \sin(bb_I)^2 + R^2 m_b \cos(bb_I)^2$$

$$+ R^2 m_b \cos(om t)^2 \sin(bb_I)^2)$$

$$+ \left(1 \cdot \cos(\beta_2(t)) (4 \cdot JB aa_FF \cos(om t) - 4 \cdot JB aa_F \sin(om t) om - 2 \cdot m_b aa_F \sin(om t) om \right)$$

$$\begin{aligned}
& + m_b R^2 \sin(bb_2) aa_F^2 \cos(om t)^2 \cos(bb_2) \\
& - 1. m_b R^2 aa_F^2 \sin(om t)^4 \sin(bb_2) \cos(bb_2) \\
& - 2. m_b R^2 aa_F^2 \sin(om t)^2 \sin(bb_2) \cos(om t)^2 \cos(bb_2) \\
& - 1. m_b R^2 \sin(om t)^3 om \cos(bb_2)^2 aa_F \\
& - 1. m_b R^2 \sin(om t) om \cos(bb_2)^2 aa_F \cos(om t)^2 \\
& - 2. m_b R e \sin(om t)^3 om aa_F \cos(bb_2) \\
& - 2. m_b R e \sin(om t) om aa_F \cos(om t)^2 \cos(bb_2) \\
& - 4. JB \sin(om t) om aa_F \cos(bb_2)^2 \\
& - 4. aa_F^2 \sin(om t)^2 \sin(bb_2) JB \cos(bb_2) \\
& + 2. m_b R e \cos(om t)^2 om^2 \sin(bb_2) \\
& + m_b R^2 \sin(om t)^2 om^2 \cos(bb_2) \sin(bb_2) \\
& + 2. m_b R e \sin(om t)^2 om^2 \sin(bb_2) \\
& - 2. m_b g_R \sin(bb_2) \cos(om t) \cos(aa) \\
& - 2. m_b g_R \cos(bb_2) \sin(aa) + m_b R^2 aa_FF \sin(bb_2)^2 \cos(om t)^3 \\
& + m_b R^2 aa_FF \sin(bb_2)^2 \cos(om t) \sin(om t)^2
\end{aligned}$$

$$\begin{aligned}
& + 2 \cdot m_b aa_FF \cos(om t) R \cos(bb_2) e + R m_b l aa_FF \cos(bb_2) \\
& + m_b R \sin(bb_2) l aa_F^2 \cos(om t) \\
& + 2 \cdot m_b R \sin(bb_2) e \cos(om t)^2 aa_F^2 \\
& + m_b R^2 \sin(om t)^2 \sin(bb_2) \cos(bb_2) bb_F_2^2 \\
& + m_b R^2 \cos(om t) aa_FF \cos(bb_2)^2 \\
& + m_b R^2 \cos(om t)^2 \sin(bb_2) \cos(bb_2) bb_F_2^2 \\
& + m_b R^2 \cos(om t)^2 om^2 \cos(bb_2) \sin(bb_2) \\
& - 1 \cdot m_b R^2 \sin(om t) om aa_F \cos(bb_2)^2 \\
& + 4 \cdot JB aa_F \sin(om t) \sin(bb_2)^2 om + 4 \cdot kb bb_2 \\
& - 1 \cdot m_b R^2 aa_F^2 \cos(om t)^4 \sin(bb_2) \cos(bb_2) \\
& + 4 \cdot JB om^2 \cos(bb_2) \sin(bb_2))) / (4 \cdot JB + R^2 m_b \cos(om t)^2 \sin(bb_2)^2 \\
& + R^2 m_b \sin(om t)^2 \sin(bb_2)^2 + R^2 m_b \cos(bb_2)^2) + \left(\right. \\
& \left. - 2 \cdot \left(\frac{d}{dt} \rho(t) \right) \left(\frac{d}{dt} \beta_1(t) \right) \cos(\Omega t) + \left(\frac{d}{dt} \beta_1(t) \right)^2 \right) \sin(\beta_1(t)) \\
& + \left(2 \cdot \sin(\beta_2(t)) \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) \right. \\
& \left. + \sin(\beta_2(t)) \left(\frac{d}{dt} \beta_2(t) \right) \right) \left(\frac{d}{dt} \beta_2(t) \right) m_b l + \left(\right.
\end{aligned}$$

$$\begin{aligned}
& -2 \cdot \cos(\beta_1(t)) \left(\frac{d}{dt} \rho(t) \right) + 2 \cdot \cos(\beta_2(t)) \left(\frac{d}{dt} \rho(t) \right) \right) \sin(\Omega t) m_b l \Omega \\
& + \left(\left(\left(\left(1 \cdot \cos(\beta_2(t))^2 (4 \cdot JB aa_FF \cos(om t) \right. \right. \right. \right. \right. \right. \right. \\
& \left. \left. \left. \left. \left. \left. \left. \left. - 4 \cdot JB aa_F \sin(om t) om - 2 \cdot m_b aa_F \sin(om t) om R \cos(bb_2) e \right. \right. \right. \right. \right. \right. \right. \\
& \left. \left. \left. \left. \left. \left. \left. \left. - 1 \cdot m_b R^2 \cos(bb_2) \sin(bb_2) bb_F_2^2 \right. \right. \right. \right. \right. \right. \right. \\
& \left. \left. \left. \left. \left. \left. \left. \left. + m_b R^2 \sin(bb_2) aa_F^2 \cos(om t)^2 \cos(bb_2) \right. \right. \right. \right. \right. \right. \right. \\
& \left. \left. \left. \left. \left. \left. \left. \left. - 1 \cdot m_b R^2 aa_F^2 \sin(om t)^4 \sin(bb_2) \cos(bb_2) \right. \right. \right. \right. \right. \right. \right. \\
& \left. \left. \left. \left. \left. \left. \left. \left. - 2 \cdot m_b R^2 aa_F^2 \sin(om t)^2 \sin(bb_2) \cos(om t)^2 \cos(bb_2) \right. \right. \right. \right. \right. \right. \right. \\
& \left. \left. \left. \left. \left. \left. \left. \left. - 1 \cdot m_b R^2 \sin(om t)^3 om \cos(bb_2)^2 aa_F \right. \right. \right. \right. \right. \right. \right. \\
& \left. \left. \left. \left. \left. \left. \left. \left. - 1 \cdot m_b R^2 \sin(om t) om \cos(bb_2)^2 aa_F \cos(om t)^2 \right. \right. \right. \right. \right. \right. \right. \\
& \left. \left. \left. \left. \left. \left. \left. \left. - 2 \cdot m_b R e \sin(om t)^3 om aa_F \cos(bb_2) \right. \right. \right. \right. \right. \right. \right. \\
& \left. \left. \left. \left. \left. \left. \left. \left. - 2 \cdot m_b R e \sin(om t) om aa_F \cos(om t)^2 \cos(bb_2) \right. \right. \right. \right. \right. \right. \right. \\
& \left. \left. \left. \left. \left. \left. \left. \left. - 4 \cdot JB \sin(om t) om aa_F \cos(bb_2)^2 \right. \right. \right. \right. \right. \right. \right. \\
& \left. \left. \left. \left. \left. \left. \left. \left. - 4 \cdot aa_F^2 \sin(om t)^2 \sin(bb_2) JB \cos(bb_2) \right. \right. \right. \right. \right. \right. \right. \\
& \left. \left. \left. \left. \left. \left. \left. \left. + 2 \cdot m_b R e \cos(om t)^2 om^2 \sin(bb_2) \right. \right. \right. \right. \right. \right. \right. \\
& \left. \left. \left. \left. \left. \left. \left. \left. + m_b R^2 \sin(om t)^2 om^2 \cos(bb_2) \sin(bb_2) \right. \right. \right. \right. \right. \right. \right.
\end{aligned}$$

$$\begin{aligned}
& + 2 \cdot m_b R e \sin(om t)^2 om^2 \sin(bb_2) \\
& - 2 \cdot m_b g_- R \sin(bb_2) \cos(om t) \cos(aa) \\
& - 2 \cdot m_b g_- R \cos(bb_2) \sin(aa) + m_b R^2 aa_{FF} \sin(bb_2)^2 \cos(om t)^3 \\
& + m_b R^2 aa_{FF} \sin(bb_2)^2 \cos(om t) \sin(om t)^2 \\
& + 2 \cdot m_b aa_{FF} \cos(om t) R \cos(bb_2) e + R m_b l aa_{FF} \cos(bb_2) \\
& + m_b R \sin(bb_2) l aa_F^2 \cos(om t) \\
& + 2 \cdot m_b R \sin(bb_2) e \cos(om t)^2 aa_F^2 \\
& + m_b R^2 \sin(om t)^2 \sin(bb_2) \cos(bb_2) bb_F^2 \\
& + m_b R^2 \cos(om t) aa_{FF} \cos(bb_2)^2 \\
& + m_b R^2 \cos(om t)^2 \sin(bb_2) \cos(bb_2) bb_F^2 \\
& + m_b R^2 \cos(om t)^2 om^2 \cos(bb_2) \sin(bb_2) \\
& - 1 \cdot m_b R^2 \sin(om t) om aa_F \cos(bb_2)^2 \\
& + 4 \cdot JB aa_F \sin(om t) \sin(bb_2)^2 om + 4 \cdot kb bb_2 \\
& - 1 \cdot m_b R^2 aa_F^2 \cos(om t)^4 \sin(bb_2) \cos(bb_2) \\
& + 4 \cdot JB om^2 \cos(bb_2) \sin(bb_2))) / (4 \cdot JB + R^2 m_b \cos(om t)^2 \sin(bb_2)^2)
\end{aligned}$$

$$+ R^2 m_b \sin(\omega m t)^2 \sin(bb_2)^2 + R^2 m_b \cos(bb_2)^2)$$

$$+ \left(1. \sin(\beta_2(t))^2 (4. JB aa_FF \cos(\omega m t) - 4. JB aa_F \sin(\omega m t) \omega m - 2. m_b aa_F \sin(\omega m t) \omega m \right.$$

$$- 1. m_b R^2 aa_F^2 \sin(\omega m t)^4 \sin(bb_2) \cos(bb_2)$$

$$- 2. m_b R^2 aa_F^2 \sin(\omega m t)^2 \sin(bb_2) \cos(\omega m t)^2 \cos(bb_2)$$

$$- 1. m_b R^2 \sin(\omega m t)^3 \omega m \cos(bb_2)^2 aa_F$$

$$- 1. m_b R^2 \sin(\omega m t) \omega m \cos(bb_2)^2 aa_F \cos(\omega m t)^2$$

$$- 2. m_b R e \sin(\omega m t)^3 \omega m aa_F \cos(bb_2)$$

$$- 2. m_b R e \sin(\omega m t) \omega m aa_F \cos(\omega m t)^2 \cos(bb_2)$$

$$- 4. JB \sin(\omega m t) \omega m aa_F \cos(bb_2)^2$$

$$- 4. aa_F^2 \sin(\omega m t)^2 \sin(bb_2) JB \cos(bb_2)$$

$$+ 2. m_b R e \cos(\omega m t)^2 \omega m^2 \sin(bb_2)$$

$$+ m_b R^2 \sin(\omega m t)^2 \omega m^2 \cos(bb_2) \sin(bb_2)$$

$$+ 2. m_b R e \sin(\omega m t)^2 \omega m^2 \sin(bb_2)$$

$$- 2. m_b g_R \sin(bb_2) \cos(\omega m t) \cos(aa)$$

$$- 2. m_b g_R \cos(bb_2) \sin(aa) + m_b R^2 aa_FF \sin(bb_2)^2 \cos(\omega m t)^3$$

$$\begin{aligned}
& + m_b R^2 aa_FF \sin(bb_2)^2 \cos(om t) \sin(om t)^2 \\
& + 2. m_b aa_FF \cos(om t) R \cos(bb_2) e + R m_b l aa_FF \cos(bb_2) \\
& + m_b R \sin(bb_2) l aa_F^2 \cos(om t) \\
& + 2. m_b R \sin(bb_2) e \cos(om t)^2 aa_F^2 \\
& + m_b R^2 \sin(om t)^2 \sin(bb_2) \cos(bb_2) bb_F_2^2 \\
& + m_b R^2 \cos(om t) aa_FF \cos(bb_2)^2 \\
& + m_b R^2 \cos(om t)^2 \sin(bb_2) \cos(bb_2) bb_F_2^2 \\
& + m_b R^2 \cos(om t)^2 om^2 \cos(bb_2) \sin(bb_2) \\
& - 1. m_b R^2 \sin(om t) om aa_F \cos(bb_2)^2 \\
& + 4. JB aa_F \sin(om t) \sin(bb_2)^2 om + 4. kb bb_2 \\
& - 1. m_b R^2 aa_F^2 \cos(om t)^4 \sin(bb_2) \cos(bb_2) \\
& + 4. JB om^2 \cos(bb_2) \sin(bb_2)) \cos(\Omega t)^2 \Big) \Big/ (4. JB \\
& + R^2 m_b \cos(om t)^2 \sin(bb_2)^2 + R^2 m_b \sin(om t)^2 \sin(bb_2)^2 \\
& + R^2 m_b \cos(bb_2)^2) \cos(\Omega t) - \left(1. \cos(\beta_1(t))^2 (\right. \\
& \left. - 4. JB aa_FF \cos(om t) + m_b R^2 \sin(om t) om \cos(bb_1)^2 \cos(om t)^2 aa_F
\end{aligned}$$

$$\begin{aligned}
& -2 \cdot m_b R^2 aa_F^2 \sin(om t)^2 \sin(bb_1) \cos(bb_1) \cos(om t)^2 \\
& + m_b R^2 \sin(om t)^3 om \cos(bb_1)^2 aa_F \\
& + 2 \cdot m_b R e \sin(om t)^3 om aa_F \cos(bb_1) \\
& - 1 \cdot m_b R^2 \cos(bb_1)^2 aa_FF \cos(om t) + R m_b l aa_FF \cos(bb_1) \\
& - 1 \cdot m_b R^2 \cos(om t)^3 \sin(bb_1)^2 aa_FF \\
& - 2 \cdot m_b aa_FF \cos(om t) R \cos(bb_1) e \\
& + 2 \cdot m_b R e \sin(om t) om \cos(bb_1) \cos(om t)^2 aa_F \\
& + m_b R^2 \sin(bb_1) aa_F^2 \cos(om t)^2 \cos(bb_1) \\
& - 4 \cdot JB aa_F \sin(om t) \sin(bb_1)^2 om \\
& - 1 \cdot m_b R \sin(bb_1) l aa_F^2 \cos(om t) \\
& + 2 \cdot m_b R \sin(bb_1) e \cos(om t)^2 aa_F^2 \\
& + m_b R^2 \sin(om t)^2 om^2 \cos(bb_1) \sin(bb_1) \\
& + 2 \cdot m_b R e \sin(om t)^2 om^2 \sin(bb_1) \\
& - 1 \cdot m_b R^2 \sin(bb_1)^2 \sin(om t)^2 aa_FF \cos(om t) \\
& + 4 \cdot JB \cos(bb_1)^2 aa_F \sin(om t) om
\end{aligned}$$

$$\begin{aligned}
& + m_b R^2 \cos(om t)^2 om^2 \cos(bb_I) \sin(bb_I) \\
& + 2. m_b R e \cos(om t)^2 om^2 \sin(bb_I) \\
& + 2. m_b g_R \sin(bb_I) \cos(om t) \cos(aa) \\
& - 2. m_b g_R \cos(bb_I) \sin(aa) + 4. kb bb_I \\
& + 2. m_b aa_F \sin(om t) om R \cos(bb_I) e \\
& + m_b R^2 \cos(om t)^2 \sin(bb_I) \cos(bb_I) bb_F_I^2 \\
& + 4. JB om^2 \cos(bb_I) \sin(bb_I) + 4. JB aa_F \sin(om t) om \\
& - 4. aa_F^2 \sin(om t)^2 \sin(bb_I) JB \cos(bb_I) \\
& - 1. m_b R^2 aa_F^2 \sin(om t)^4 \sin(bb_I) \cos(bb_I) \\
& + m_b R^2 \cos(bb_I)^2 aa_F \sin(om t) om \\
& - 1. m_b R^2 \cos(bb_I) \sin(bb_I) bb_F_I^2 \\
& + m_b R^2 \sin(bb_I) \sin(om t)^2 \cos(bb_I) bb_F_I^2 \\
& - 1. m_b R^2 \cos(om t)^4 \sin(bb_I) aa_F^2 \cos(bb_I) \cos(\Omega t) \Big) \Big/ (4. JB \\
& + R^2 m_b \sin(om t)^2 \sin(bb_I)^2 + R^2 m_b \cos(bb_I)^2 \\
& + R^2 m_b \cos(om t)^2 \sin(bb_I)^2) + \left(\left(-2. \left(\frac{d}{dt} \beta_1(t) \right)^2 \right. \right. \\
& \left. \left. + R^2 m_b \sin(om t)^2 \sin(bb_I)^2 + R^2 m_b \cos(bb_I)^2 \right) \right. \\
& \left. \left. + R^2 m_b \cos(om t)^2 \sin(bb_I)^2 \right) \right) \Big)
\end{aligned}$$

$$\begin{aligned}
& + \left(2 \cdot \left(\frac{d}{dt} \rho(t) \right) \left(\frac{d}{dt} \beta_1(t) \right) + \left(2 \cdot \left(\frac{d}{dt} \beta_1(t) \right)^2 \right. \right. \\
& - 2 \cdot \left(\frac{d}{dt} \rho(t) \right) \left(\frac{d}{dt} \beta_1(t) \right) \cos(\Omega t) \Big) \cos(\Omega t) \Big) \cos(\Omega t) \Big) \\
& \cos(\Omega t) \cos(\beta_1(t)) - \left(1 \cdot \cos(\Omega t)^3 (-4 \cdot JB aa_FF \cos(om t) \right. \\
& + m_b R^2 \sin(om t) om \cos(bb_I)^2 \cos(om t)^2 aa_F \\
& - 2 \cdot m_b R^2 aa_F^2 \sin(om t)^2 \sin(bb_I) \cos(bb_I) \cos(om t)^2 \\
& + m_b R^2 \sin(om t)^3 om \cos(bb_I)^2 aa_F \\
& + 2 \cdot m_b R e \sin(om t)^3 om aa_F \cos(bb_I) \\
& - 1 \cdot m_b R^2 \cos(bb_I)^2 aa_FF \cos(om t) + R m_b l aa_FF \cos(bb_I) \\
& - 1 \cdot m_b R^2 \cos(om t)^3 \sin(bb_I)^2 aa_FF \\
& - 2 \cdot m_b aa_FF \cos(om t) R \cos(bb_I) e \\
& + 2 \cdot m_b R e \sin(om t) om \cos(bb_I) \cos(om t)^2 aa_F \\
& + m_b R^2 \sin(bb_I) aa_F^2 \cos(om t)^2 \cos(bb_I) \\
& - 4 \cdot JB aa_F \sin(om t) \sin(bb_I)^2 om \\
& - 1 \cdot m_b R \sin(bb_I) l aa_F^2 \cos(om t) \\
& + 2 \cdot m_b R \sin(bb_I) e \cos(om t)^2 aa_F^2
\end{aligned}$$

$$+ m_b R^2 \sin(\omega m t)^2 \omega m^2 \cos(bb_I) \sin(bb_I)$$

$$+ 2. m_b R e \sin(\omega m t)^2 \omega m^2 \sin(bb_I)$$

$$- 1. m_b R^2 \sin(bb_I)^2 \sin(\omega m t)^2 a a_F F \cos(\omega m t)$$

$$+ 4. J B \cos(bb_I)^2 a a_F \sin(\omega m t) \omega m$$

$$+ m_b R^2 \cos(\omega m t)^2 \omega m^2 \cos(bb_I) \sin(bb_I)$$

$$+ 2. m_b R e \cos(\omega m t)^2 \omega m^2 \sin(bb_I)$$

$$+ 2. m_b g_R \sin(bb_I) \cos(\omega m t) \cos(a a)$$

$$- 2. m_b g_R \cos(bb_I) \sin(a a) + 4. k b b b_I$$

$$+ 2. m_b a a_F \sin(\omega m t) \omega m R \cos(bb_I) e$$

$$+ m_b R^2 \cos(\omega m t)^2 \sin(bb_I) \cos(bb_I) b b_F_I^2$$

$$+ 4. J B \omega m^2 \cos(bb_I) \sin(bb_I) + 4. J B a a_F \sin(\omega m t) \omega m$$

$$- 4. a a_F^2 \sin(\omega m t)^2 \sin(bb_I) J B \cos(bb_I)$$

$$- 1. m_b R^2 a a_F^2 \sin(\omega m t)^4 \sin(bb_I) \cos(bb_I)$$

$$+ m_b R^2 \cos(bb_I)^2 a a_F \sin(\omega m t) \omega m$$

$$- 1. m_b R^2 \cos(bb_I) \sin(bb_I) b b_F_I^2$$

$$\begin{aligned}
& + m_b R^2 \sin(bb_1) \sin(om t)^2 \cos(bb_1) bb_F_1^2 \\
& - 1. m_b R^2 \cos(om t)^4 \sin(bb_1) aa_F^2 \cos(bb_1) \sin(\beta_1(t)) \Big) / (4. JB \\
& + R^2 m_b \sin(om t)^2 \sin(bb_1)^2 + R^2 m_b \cos(bb_1)^2 \\
& + R^2 m_b \cos(om t)^2 \sin(bb_1)^2) \sin(\beta_1(t)) \\
& + \left(\left(1. \sin(\beta_2(t))^2 \cos(\Omega t) (4. JB aa_FF \cos(om t) \right. \right. \\
& - 4. JB aa_F \sin(om t) om - 2. m_b aa_F \sin(om t) om R \cos(bb_2) e \\
& - 1. m_b R^2 \cos(bb_2) \sin(bb_2) bb_F_2^2 \\
& + m_b R^2 \sin(bb_2) aa_F^2 \cos(om t)^2 \cos(bb_2) \\
& - 1. m_b R^2 aa_F^2 \sin(om t)^4 \sin(bb_2) \cos(bb_2) \\
& - 2. m_b R^2 aa_F^2 \sin(om t)^2 \sin(bb_2) \cos(om t)^2 \cos(bb_2) \\
& - 1. m_b R^2 \sin(om t)^3 om \cos(bb_2)^2 aa_F \\
& - 1. m_b R^2 \sin(om t) om \cos(bb_2)^2 aa_F \cos(om t)^2 \\
& - 2. m_b R e \sin(om t)^3 om aa_F \cos(bb_2) \\
& - 2. m_b R e \sin(om t) om aa_F \cos(om t)^2 \cos(bb_2) \\
& - 4. JB \sin(om t) om aa_F \cos(bb_2)^2 \\
& - 4. aa_F^2 \sin(om t)^2 \sin(bb_2) JB \cos(bb_2)
\end{aligned}$$

$$\begin{aligned}
& + 2 \cdot m_b R e \cos(om t)^2 om^2 \sin(bb_2) \\
& + m_b R^2 \sin(om t)^2 om^2 \cos(bb_2) \sin(bb_2) \\
& + 2 \cdot m_b R e \sin(om t)^2 om^2 \sin(bb_2) \\
& - 2 \cdot m_b g_- R \sin(bb_2) \cos(om t) \cos(aa) \\
& - 2 \cdot m_b g_- R \cos(bb_2) \sin(aa) + m_b R^2 aa_{FF} \sin(bb_2)^2 \cos(om t)^3 \\
& + m_b R^2 aa_{FF} \sin(bb_2)^2 \cos(om t) \sin(om t)^2 \\
& + 2 \cdot m_b aa_{FF} \cos(om t) R \cos(bb_2) e + R m_b l aa_{FF} \cos(bb_2) \\
& + m_b R \sin(bb_2) l aa_F^2 \cos(om t) \\
& + 2 \cdot m_b R \sin(bb_2) e \cos(om t)^2 aa_F^2 \\
& + m_b R^2 \sin(om t)^2 \sin(bb_2) \cos(bb_2) bb_F^2 \\
& + m_b R^2 \cos(om t) aa_{FF} \cos(bb_2)^2 \\
& + m_b R^2 \cos(om t)^2 \sin(bb_2) \cos(bb_2) bb_F^2 \\
& + m_b R^2 \cos(om t)^2 om^2 \cos(bb_2) \sin(bb_2) \\
& - 1 \cdot m_b R^2 \sin(om t) om aa_F \cos(bb_2)^2 \\
& + 4 \cdot JB aa_F \sin(om t) \sin(bb_2)^2 om + 4 \cdot kb bb_2 \\
& - 1 \cdot m_b R^2 aa_F^2 \cos(om t)^4 \sin(bb_2) \cos(bb_2)
\end{aligned}$$

$$\begin{aligned}
& + 4. JB \, om^2 \cos(bb_2) \sin(bb_2))) \Big/ (4. JB + R^2 m_b \cos(om t)^2 \sin(bb_2)^2 \\
& + R^2 m_b \sin(om t)^2 \sin(bb_2)^2 + R^2 m_b \cos(bb_2)^2) + \left(\left(2. \left(\frac{d}{dt} \beta_1(t) \right)^2 \right. \right. \\
& - 4. \left(\frac{d}{dt} \rho(t) \right) \left(\frac{d}{dt} \beta_1(t) \right) \cos(\Omega t) \cos(\beta_1(t)) \\
& - \left(1. \cos(\Omega t) (-4. JB aa_FF \cos(om t) + m_b R^2 \sin(om t) om \cos(bb_1)^2 \cos(om t)^2 aa_F - 2 \right. \\
& \quad \left. \left. + m_b R^2 \sin(om t)^3 om \cos(bb_1)^2 aa_F \right. \right. \\
& \quad \left. \left. + 2. m_b R e \sin(om t)^3 om aa_F \cos(bb_1) \right. \right. \\
& \quad \left. \left. - 1. m_b R^2 \cos(bb_1)^2 aa_FF \cos(om t) + R m_b l aa_FF \cos(bb_1) \right. \right. \\
& \quad \left. \left. - 1. m_b R^2 \cos(om t)^3 \sin(bb_1)^2 aa_FF \right. \right. \\
& \quad \left. \left. - 2. m_b aa_FF \cos(om t) R \cos(bb_1) e \right. \right. \\
& \quad \left. \left. + 2. m_b R e \sin(om t) om \cos(bb_1) \cos(om t)^2 aa_F \right. \right. \\
& \quad \left. \left. + m_b R^2 \sin(bb_1) aa_F^2 \cos(om t)^2 \cos(bb_1) \right. \right. \\
& \quad \left. \left. - 4. JB aa_F \sin(om t) \sin(bb_1)^2 om \right. \right. \\
& \quad \left. \left. - 1. m_b R \sin(bb_1) l aa_F^2 \cos(om t) \right. \right. \\
& \quad \left. \left. + 2. m_b R \sin(bb_1) e \cos(om t)^2 aa_F^2 \right. \right. \\
& \quad \left. \left. + m_b R^2 \sin(om t)^2 om^2 \cos(bb_1) \sin(bb_1) \right. \right. \\
& \quad \left. \left. + 2. m_b R e \sin(om t)^2 om^2 \sin(bb_1) \right. \right)
\end{aligned}$$

$$\begin{aligned}
& -1. m_b R^2 \sin(bb_I)^2 \sin(om t)^2 aa_FF \cos(om t) \\
& + 4. JB \cos(bb_I)^2 aa_F \sin(om t) om \\
& + m_b R^2 \cos(om t)^2 om^2 \cos(bb_I) \sin(bb_I) \\
& + 2. m_b R e \cos(om t)^2 om^2 \sin(bb_I) \\
& + 2. m_b g_R \sin(bb_I) \cos(om t) \cos(aa) \\
& - 2. m_b g_R \cos(bb_I) \sin(aa) + 4. kb bb_I \\
& + 2. m_b aa_F \sin(om t) om R \cos(bb_I) e \\
& + m_b R^2 \cos(om t)^2 \sin(bb_I) \cos(bb_I) bb_F_I^2 \\
& + 4. JB om^2 \cos(bb_I) \sin(bb_I) + 4. JB aa_F \sin(om t) om \\
& - 4. aa_F^2 \sin(om t)^2 \sin(bb_I) JB \cos(bb_I) \\
& - 1. m_b R^2 aa_F^2 \sin(om t)^4 \sin(bb_I) \cos(bb_I) \\
& + m_b R^2 \cos(bb_I)^2 aa_F \sin(om t) om \\
& - 1. m_b R^2 \cos(bb_I) \sin(bb_I) bb_F_I^2 \\
& + m_b R^2 \sin(bb_I) \sin(om t)^2 \cos(bb_I) bb_F_I^2 \\
& - 1. m_b R^2 \cos(om t)^4 \sin(bb_I) aa_F^2 \cos(bb_I) \sin(\beta_1(t)) \Big) \Big/ (4. JB \\
& + R^2 m_b \sin(om t)^2 \sin(bb_I)^2 + R^2 m_b \cos(bb_I)^2
\end{aligned}$$

$$\begin{aligned}
& + R^2 m_b \cos(om t)^2 \sin(bb_1)^2) \sin(\beta_1(t)) \\
& - 2. \sin(\Omega t)^2 \sin(\beta_1(t)) \left(\frac{d}{dt} \rho(t) \right) \cos(\beta_1(t)) \left(\frac{d}{dt} \beta_1(t) \right) \sin(\Omega t)^2 \\
& + \left(\left(2. \left(\frac{d}{dt} \rho(t) \right) \cos(\beta_2(t)) \sin(\beta_2(t)) \right. \right. \\
& - 2. \left(\frac{d}{dt} \rho(t) \right) \sin(\beta_2(t)) \cos(\Omega t)^2 \cos(\beta_2(t)) \left. \right) \cos(\Omega t)^2 + \left(\right. \\
& - 4. \left(\frac{d}{dt} \rho(t) \right) \sin(\beta_2(t)) \cos(\Omega t)^2 \cos(\beta_2(t)) \\
& - 2. \sin(\Omega t)^2 \sin(\beta_2(t)) \left(\frac{d}{dt} \rho(t) \right) \cos(\beta_2(t)) \left. \right) \sin(\Omega t)^2 \\
& + \left(\left(2. \cos(\beta_2(t)) \sin(\beta_2(t)) \right. \right. \\
& - 2. \cos(\Omega t)^2 \sin(\beta_2(t)) \cos(\beta_2(t)) \left. \right) \cos(\Omega t) \\
& - 2. \cos(\Omega t) \cos(\beta_2(t)) \sin(\Omega t)^2 \sin(\beta_2(t)) \left. \right) \left(\frac{d}{dt} \beta_2(t) \right) \\
& \left(\frac{d}{dt} \beta_2(t) \right) m_b + \left(\left(\left(2. \cos(\beta_2(t))^2 \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) + \left(\right. \right. \right. \right. \\
& - 1. \left(\frac{d}{dt} \beta_1(t) \right) + \left(2. \left(\frac{d}{dt} \rho(t) \right) + \left(\frac{d}{dt} \beta_1(t) \right) \cos(\Omega t) \right) \cos(\Omega t) \\
& \cos(\beta_1(t))^2 - 2. \sin(\beta_1(t))^2 \left(\frac{d}{dt} \beta_1(t) \right) \cos(\Omega t)^2 + \left(\right. \\
& - 2. \sin(\beta_1(t))^2 \left(\frac{d}{dt} \beta_1(t) \right) + \cos(\beta_1(t))^2 \left(\frac{d}{dt} \beta_1(t) \right) \left. \right) \sin(\Omega t)^2 \\
& \sin(\Omega t) + \left(\cos(\beta_2(t))^2 + \left(2. \sin(\beta_2(t))^2 - 1. \cos(\beta_2(t))^2 \right) \cos(\Omega t)^2 \right. \\
& + \left(2. \sin(\beta_2(t))^2 - 1. \cos(\beta_2(t))^2 \right) \sin(\Omega t)^2 \left. \right) \sin(\Omega t) \left(\frac{d}{dt} \beta_2(t) \right) \\
& m_b + \left(\cos(\Omega t)^3 \cos(\beta_1(t)) \sin(\beta_1(t)) \right.
\end{aligned}$$

$$\begin{aligned}
& -1. \cos(\Omega t)^3 \cos(\beta_2(t)) \sin(\beta_2(t)) + (\\
& -1. \cos(\Omega t) \sin(\beta_2(t)) \cos(\beta_2(t)) + \cos(\Omega t) \sin(\beta_1(t)) \cos(\beta_1(t))) \\
& \sin(\Omega t)^2 m_b \Omega) \Omega) R + \left(\left(\left(-2. \cos(\beta_1(t)) (\right. \right. \right. \\
& -4. JB aa_{FF} \cos(om t) + m_b R^2 \sin(om t) om \cos(bb_I)^2 \cos(om t)^2 aa_F \\
& -2. m_b R^2 aa_F^2 \sin(om t)^2 \sin(bb_I) \cos(bb_I) \cos(om t)^2 \\
& + m_b R^2 \sin(om t)^3 om \cos(bb_I)^2 aa_F \\
& + 2. m_b R e \sin(om t)^3 om aa_F \cos(bb_I) \\
& -1. m_b R^2 \cos(bb_I)^2 aa_{FF} \cos(om t) + R m_b l aa_{FF} \cos(bb_I) \\
& -1. m_b R^2 \cos(om t)^3 \sin(bb_I)^2 aa_{FF} \\
& -2. m_b aa_{FF} \cos(om t) R \cos(bb_I) e \\
& + 2. m_b R e \sin(om t) om \cos(bb_I) \cos(om t)^2 aa_F \\
& + m_b R^2 \sin(bb_I) aa_F^2 \cos(om t)^2 \cos(bb_I) \\
& -4. JB aa_F \sin(om t) \sin(bb_I)^2 om \\
& -1. m_b R \sin(bb_I) l aa_F^2 \cos(om t) \\
& + 2. m_b R \sin(bb_I) e \cos(om t)^2 aa_F^2 \\
& + m_b R^2 \sin(om t)^2 om^2 \cos(bb_I) \sin(bb_I)
\end{aligned}$$

$$\begin{aligned}
& + 2 \cdot m_b R e \sin(\omega m t)^2 \omega m^2 \sin(bb_1) \\
& - 1 \cdot m_b R^2 \sin(bb_1)^2 \sin(\omega m t)^2 a a_F F \cos(\omega m t) \\
& + 4 \cdot J B \cos(bb_1)^2 a a_F \sin(\omega m t) \omega m \\
& + m_b R^2 \cos(\omega m t)^2 \omega m^2 \cos(bb_1) \sin(bb_1) \\
& + 2 \cdot m_b R e \cos(\omega m t)^2 \omega m^2 \sin(bb_1) \\
& + 2 \cdot m_b g_- R \sin(bb_1) \cos(\omega m t) \cos(aa) \\
& - 2 \cdot m_b g_- R \cos(bb_1) \sin(aa) + 4 \cdot k b b_1 \\
& + 2 \cdot m_b a a_F \sin(\omega m t) \omega m R \cos(bb_1) e \\
& + m_b R^2 \cos(\omega m t)^2 \sin(bb_1) \cos(bb_1) b b_F I^2 \\
& + 4 \cdot J B \omega m^2 \cos(bb_1) \sin(bb_1) + 4 \cdot J B a a_F \sin(\omega m t) \omega m \\
& - 4 \cdot a a_F^2 \sin(\omega m t)^2 \sin(bb_1) J B \cos(bb_1) \\
& - 1 \cdot m_b R^2 a a_F^2 \sin(\omega m t)^4 \sin(bb_1) \cos(bb_1) \\
& + m_b R^2 \cos(bb_1)^2 a a_F \sin(\omega m t) \omega m \\
& - 1 \cdot m_b R^2 \cos(bb_1) \sin(bb_1) b b_F I^2 \\
& + m_b R^2 \sin(bb_1) \sin(\omega m t)^2 \cos(bb_1) b b_F I^2 \\
& - 1 \cdot m_b R^2 \cos(\omega m t)^4 \sin(bb_1) a a_F^2 \cos(bb_1) \cos(\Omega t) \Big) \Big/ (4 \cdot J B
\end{aligned}$$

$$\begin{aligned}
& + R^2 m_b \sin(\omega_m t)^2 \sin(bb_1)^2 + R^2 m_b \cos(bb_1)^2 \\
& + R^2 m_b \cos(\omega_m t)^2 \sin(bb_1)^2 \\
& + (2. \cos(\beta_2(t)) (4. JB aa_{FF} \cos(\omega_m t) - 4. JB aa_F \sin(\omega_m t) \omega_m - 2. m_b aa_F \sin(\omega_m t) \omega_m \\
& + m_b R^2 \sin(bb_2) aa_F^2 \cos(\omega_m t)^2 \cos(bb_2) \\
& - 1. m_b R^2 aa_F^2 \sin(\omega_m t)^4 \sin(bb_2) \cos(bb_2) \\
& - 2. m_b R^2 aa_F^2 \sin(\omega_m t)^2 \sin(bb_2) \cos(\omega_m t)^2 \cos(bb_2) \\
& - 1. m_b R^2 \sin(\omega_m t)^3 \omega_m \cos(bb_2)^2 aa_F \\
& - 1. m_b R^2 \sin(\omega_m t) \omega_m \cos(bb_2)^2 aa_F \cos(\omega_m t)^2 \\
& - 2. m_b R e \sin(\omega_m t)^3 \omega_m aa_F \cos(bb_2) \\
& - 2. m_b R e \sin(\omega_m t) \omega_m aa_F \cos(\omega_m t)^2 \cos(bb_2) \\
& - 4. JB \sin(\omega_m t) \omega_m aa_F \cos(bb_2)^2 \\
& - 4. aa_F^2 \sin(\omega_m t)^2 \sin(bb_2) JB \cos(bb_2) \\
& + 2. m_b R e \cos(\omega_m t)^2 \omega_m^2 \sin(bb_2) \\
& + m_b R^2 \sin(\omega_m t)^2 \omega_m^2 \cos(bb_2) \sin(bb_2) \\
& + 2. m_b R e \sin(\omega_m t)^2 \omega_m^2 \sin(bb_2) \\
& - 2. m_b g_R \sin(bb_2) \cos(\omega_m t) \cos(aa) \\
& - 2. m_b g_R \cos(bb_2) \sin(aa) + m_b R^2 aa_{FF} \sin(bb_2)^2 \cos(\omega_m t)^3 \\
& + m_b R^2 aa_{FF} \sin(bb_2)^2 \cos(\omega_m t) \sin(\omega_m t)^2 \\
& + 2. m_b aa_{FF} \cos(\omega_m t) R \cos(bb_2) e + R m_b l aa_{FF} \cos(bb_2)
\end{aligned}$$

$$\begin{aligned}
& + m_b R \sin(bb_2) l aa_F^2 \cos(om t) \\
& + 2. m_b R \sin(bb_2) e \cos(om t)^2 aa_F^2 \\
& + m_b R^2 \sin(om t)^2 \sin(bb_2) \cos(bb_2) bb_F_2^2 \\
& + m_b R^2 \cos(om t) aa_FF \cos(bb_2)^2 \\
& + m_b R^2 \cos(om t)^2 \sin(bb_2) \cos(bb_2) bb_F_2^2 \\
& + m_b R^2 \cos(om t)^2 om^2 \cos(bb_2) \sin(bb_2) \\
& - 1. m_b R^2 \sin(om t) om aa_F \cos(bb_2)^2 \\
& + 4. JB aa_F \sin(om t) \sin(bb_2)^2 om + 4. kb bb_2 \\
& - 1. m_b R^2 aa_F^2 \cos(om t)^4 \sin(bb_2) \cos(bb_2) \\
& + 4. JB om^2 \cos(bb_2) \sin(bb_2)) \cos(\Omega t)) / (4. JB \\
& + R^2 m_b \cos(om t)^2 \sin(bb_2)^2 + R^2 m_b \sin(om t)^2 \sin(bb_2)^2 \\
& + R^2 m_b \cos(bb_2)^2) + \left(-2. \left(\frac{d}{dt} \beta_1(t) \right)^2 \right. \\
& + 4. \left(\frac{d}{dt} \rho(t) \right) \left(\frac{d}{dt} \beta_1(t) \right) \cos(\Omega t) \sin(\beta_1(t)) \\
& + \left(4. \sin(\beta_2(t)) \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t)^2 \right. \\
& + 2. \sin(\beta_2(t)) \cos(\Omega t) \left(\frac{d}{dt} \beta_2(t) \right) \left. \right) \left(\frac{d}{dt} \beta_2(t) \right) m_b \\
& + \left(\left(\left(8. \left(\frac{d}{dt} \rho(t) \right) \cos(\Omega t) \cos(\beta_2(t)) + \left(-2. \left(\frac{d}{dt} \beta_1(t) \right) \right. \right. \right. \right. \\
& + \left(8. \left(\frac{d}{dt} \rho(t) \right) + 2. \left(\frac{d}{dt} \beta_1(t) \right) \cos(\Omega t) \right) \cos(\Omega t) \left. \right) \cos(\beta_1(t)) \\
& + 2. \sin(\Omega t)^2 \cos(\beta_1(t)) \left(\frac{d}{dt} \beta_1(t) \right) \left. \right) \sin(\Omega t) + \left(\right. \\
& \left. - 2. \cos(\Omega t)^2 \cos(\beta_2(t)) + 2. \cos(\beta_2(t)) - 2. \cos(\beta_2(t)) \sin(\Omega t)^2 \right) \\
& \sin(\Omega t) \left(\frac{d}{dt} \beta_2(t) \right) m_b + \left(-2. \cos(\Omega t)^3 \sin(\beta_2(t)) \right)
\end{aligned}$$

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+ 2. cos(Ω t)³ sin(β₁(t)) + (2. cos(Ω t) sin(β₁(t))
- 2. sin(β₂(t)) cos(Ω t) sin(Ω t)²) m_b Ω) Ω) R
+ 16. m_b sin(Ω t) Ω (d/dt ρ(t) cos(Ω t) e) e) ) / (16. JT
+ (32. cos(Ω t)² + (16. sin(β₂(t))² + 16. sin(β₁(t))²) sin(Ω t)²) JB
+ (8. m_b + m_t) l² + ((-8. cos(Ω t) cos(β₁(t))
+ 8. cos(Ω t) cos(β₂(t))) m_b l + ((4. cos(β₂(t))²
+ 4. cos(Ω t)² sin(β₂(t))²) cos(Ω t)² + 4. cos(β₁(t))² cos(Ω t)²
+ 4. cos(Ω t)⁴ sin(β₁(t))² + (8. cos(Ω t)² sin(β₂(t))²
+ 8. sin(β₁(t))² cos(Ω t)² + (4. sin(β₂(t))² + 4. sin(β₁(t))²) sin(Ω t)²)
sin(Ω t)²) m_b R) R + ((16. cos(Ω t)² cos(β₁(t))
+ 16. cos(Ω t)² cos(β₂(t))) m_b R + 32. m_b cos(Ω t)² e) e)

> length(%); 35035 (14.3.3.2)
> T2_eq_rho[full]:= subs({diff(beta[1](t),t)=bb_F_1,diff(beta[2](t),t)=bb_F_2, diff(rho(t),t)=aa_F},T1_eq_rho[full]);
T2_eq_rho_full := 4. ( -4. ka ρ(t) + ((4. (4. JB aa_FF cos(om t) - 4. JB aa_F sin(om t) om
- 2. m_b aa_F sin(om t) om R cos(bb_2) e
- 1. m_b R² cos(bb_2) sin(bb_2) bb_F_2²
+ m_b R² sin(bb_2) aa_F² cos(om t)² cos(bb_2)
- 1. m_b R² aa_F² sin(om t)⁴ sin(bb_2) cos(bb_2)
- 2. m_b R² aa_F² sin(om t)² sin(bb_2) cos(om t)² cos(bb_2)

```

$$\begin{aligned}
& -1. m_b R^2 \sin(\omega m t)^3 \omega m \cos(bb_2)^2 aa_F \\
& -1. m_b R^2 \sin(\omega m t) \omega m \cos(bb_2)^2 aa_F \cos(\omega m t)^2 \\
& -2. m_b R e \sin(\omega m t)^3 \omega m aa_F \cos(bb_2) \\
& -2. m_b R e \sin(\omega m t) \omega m aa_F \cos(\omega m t)^2 \cos(bb_2) \\
& -4. J B \sin(\omega m t) \omega m aa_F \cos(bb_2)^2 \\
& -4. aa_F^2 \sin(\omega m t)^2 \sin(bb_2) J B \cos(bb_2) \\
& +2. m_b R e \cos(\omega m t)^2 \omega m^2 \sin(bb_2) \\
& +m_b R^2 \sin(\omega m t)^2 \omega m^2 \cos(bb_2) \sin(bb_2) \\
& +2. m_b R e \sin(\omega m t)^2 \omega m^2 \sin(bb_2) \\
& -2. m_b g_R \sin(bb_2) \cos(\omega m t) \cos(aa) \\
& -2. m_b g_R \cos(bb_2) \sin(aa) + m_b R^2 aa_F F \sin(bb_2)^2 \cos(\omega m t)^3 \\
& +m_b R^2 aa_F F \sin(bb_2)^2 \cos(\omega m t) \sin(\omega m t)^2 \\
& +2. m_b aa_F F \cos(\omega m t) R \cos(bb_2) e + R m_b l aa_F F \cos(bb_2) \\
& +m_b R \sin(bb_2) l aa_F^2 \cos(\omega m t) \\
& +2. m_b R \sin(bb_2) e \cos(\omega m t)^2 aa_F^2
\end{aligned}$$

$$\begin{aligned}
& + m_b R^2 \sin(\omega_m t)^2 \sin(bb_2) \cos(bb_2) bb_F 2^2 \\
& + m_b R^2 \cos(\omega_m t) aa_FF \cos(bb_2)^2 \\
& + m_b R^2 \cos(\omega_m t)^2 \sin(bb_2) \cos(bb_2) bb_F 2^2 \\
& + m_b R^2 \cos(\omega_m t)^2 \omega_m^2 \cos(bb_2) \sin(bb_2) \\
& - 1. m_b R^2 \sin(\omega_m t) \omega_m aa_F \cos(bb_2)^2 \\
& + 4. JB aa_F \sin(\omega_m t) \sin(bb_2)^2 \omega_m + 4. kb bb_2 \\
& - 1. m_b R^2 aa_F^2 \cos(\omega_m t)^4 \sin(bb_2) \cos(bb_2) \\
& + 4. JB \omega_m^2 \cos(bb_2) \sin(bb_2))) / (4. JB + R^2 m_b \cos(\omega_m t)^2 \sin(bb_2)^2 \\
& + R^2 m_b \sin(\omega_m t)^2 \sin(bb_2)^2 + R^2 m_b \cos(bb_2)^2) - (4. (\\
& - 4. JB aa_FF \cos(\omega_m t) + m_b R^2 \sin(\omega_m t) \omega_m \cos(bb_1)^2 \cos(\omega_m t)^2 aa_F \\
& - 2. m_b R^2 aa_F^2 \sin(\omega_m t)^2 \sin(bb_1) \cos(bb_1) \cos(\omega_m t)^2 \\
& + m_b R^2 \sin(\omega_m t)^3 \omega_m \cos(bb_1)^2 aa_F \\
& + 2. m_b R e \sin(\omega_m t)^3 \omega_m aa_F \cos(bb_1) \\
& - 1. m_b R^2 \cos(bb_1)^2 aa_FF \cos(\omega_m t) + R m_b l aa_FF \cos(bb_1) \\
& - 1. m_b R^2 \cos(\omega_m t)^3 \sin(bb_1)^2 aa_FF
\end{aligned}$$

$$\begin{aligned}
& -2. m_b aa_FF \cos(om t) R \cos(bb_1) e \\
& + 2. m_b R e \sin(om t) om \cos(bb_1) \cos(om t)^2 aa_F \\
& + m_b R^2 \sin(bb_1) aa_F^2 \cos(om t)^2 \cos(bb_1) \\
& - 4. JB aa_F \sin(om t) \sin(bb_1)^2 om \\
& - 1. m_b R \sin(bb_1) l aa_F^2 \cos(om t) \\
& + 2. m_b R \sin(bb_1) e \cos(om t)^2 aa_F^2 \\
& + m_b R^2 \sin(om t)^2 om^2 \cos(bb_1) \sin(bb_1) \\
& + 2. m_b R e \sin(om t)^2 om^2 \sin(bb_1) \\
& - 1. m_b R^2 \sin(bb_1)^2 \sin(om t)^2 aa_FF \cos(om t) \\
& + 4. JB \cos(bb_1)^2 aa_F \sin(om t) om \\
& + m_b R^2 \cos(om t)^2 om^2 \cos(bb_1) \sin(bb_1) \\
& + 2. m_b R e \cos(om t)^2 om^2 \sin(bb_1) \\
& + 2. m_b g_R \sin(bb_1) \cos(om t) \cos(aa) \\
& - 2. m_b g_R \cos(bb_1) \sin(aa) + 4. kb bb_1 \\
& + 2. m_b aa_F \sin(om t) om R \cos(bb_1) e
\end{aligned}$$

$$\begin{aligned}
& + m_b R^2 \cos(\omega m t)^2 \sin(bb_I) \cos(bb_I) bb_F_I^2 \\
& + 4. JB \omega m^2 \cos(bb_I) \sin(bb_I) + 4. JB aa_F \sin(\omega m t) \omega m \\
& - 4. aa_F^2 \sin(\omega m t)^2 \sin(bb_I) JB \cos(bb_I) \\
& - 1. m_b R^2 aa_F^2 \sin(\omega m t)^4 \sin(bb_I) \cos(bb_I) \\
& + m_b R^2 \cos(bb_I)^2 aa_F \sin(\omega m t) \omega m \\
& - 1. m_b R^2 \cos(bb_I) \sin(bb_I) bb_F_I^2 \\
& + m_b R^2 \sin(bb_I) \sin(\omega m t)^2 \cos(bb_I) bb_F_I^2 \\
& - 1. m_b R^2 \cos(\omega m t)^4 \sin(bb_I) aa_F^2 \cos(bb_I))) / (4. JB \\
& + R^2 m_b \sin(\omega m t)^2 \sin(bb_I)^2 + R^2 m_b \cos(bb_I)^2 \\
& + R^2 m_b \cos(\omega m t)^2 \sin(bb_I)^2) \cos(\Omega t) \\
& - 8. \sin(\Omega t)^2 \sin(\beta_1(t)) aa_F \cos(\beta_1(t)) bb_F_I \\
& - 8. \sin(\Omega t)^2 \sin(\beta_2(t)) aa_F \cos(\beta_2(t)) bb_F_I \\
& + (4. m_b g_ \sin(\rho(t)) + m_t g_ \sin(\rho(t))) l + \left(\left(-4. bb_F_I + (16. \right. \right. \\
& \left. \left. - 8. \sin(\beta_2(t))^2 \right) aa_F \cos(\Omega t) + 4. \cos(\beta_1(t))^2 bb_F_I + (-4. bb_F_I \right. \\
& \left. - 8. aa_F \cos(\Omega t) \right) \sin(\beta_1(t))^2 \right) \sin(\Omega t) + \left(-4. \cos(\beta_2(t))^2 + 4. \right.
\end{aligned}$$

$$\begin{aligned}
& + 4 \cdot \sin(\beta_2(t))^2 \left(\sin(\Omega t) \, bb_F_2 \right) JB + \left(\right. \\
& - 4 \cdot \cos(\Omega t) \, \sin(\beta_2(t)) \cos(\beta_2(t)) + 4 \cdot \cos(\Omega t) \, \sin(\beta_1(t)) \cos(\beta_1(t)) \left. \right) \\
& JB \Omega \left(\Omega + \left(2 \cdot \sin(\beta_2(t)) \cos(\rho(t)) + 2 \cdot \cos(\beta_2(t)) \cos(\Omega t) \sin(\rho(t)) \right. \right. \\
& + 2 \cdot \sin(\beta_1(t)) \cos(\rho(t)) - 2 \cdot \cos(\beta_1(t)) \cos(\Omega t) \sin(\rho(t)) \left. \right) g_m_b \\
& + \left(1 \cdot \cos(\beta_1(t)) \left(-4 \cdot JB aa_FF \cos(om t) \right. \right. \\
& + m_b R^2 \sin(om t) \, om \cos(bb_1)^2 \cos(om t)^2 aa_F \\
& \left. \left. - 2 \cdot m_b R^2 aa_F^2 \sin(om t)^2 \sin(bb_1) \cos(bb_1) \cos(om t)^2 \right. \right. \\
& + m_b R^2 \sin(om t)^3 \, om \cos(bb_1)^2 aa_F \\
& \left. \left. + 2 \cdot m_b R e \sin(om t)^3 \, om aa_F \cos(bb_1) \right. \right. \\
& - 1 \cdot m_b R^2 \cos(bb_1)^2 aa_FF \cos(om t) + R m_b l aa_FF \cos(bb_1) \\
& - 1 \cdot m_b R^2 \cos(om t)^3 \sin(bb_1)^2 aa_FF \\
& - 2 \cdot m_b aa_FF \cos(om t) \, R \cos(bb_1) \, e \\
& + 2 \cdot m_b R e \sin(om t) \, om \cos(bb_1) \cos(om t)^2 aa_F \\
& + m_b R^2 \sin(bb_1) \, aa_F^2 \cos(om t)^2 \cos(bb_1) \\
& - 4 \cdot JB aa_F \sin(om t) \sin(bb_1)^2 \, om
\end{aligned}$$

$$\begin{aligned}
& -1. m_b R \sin(bb_I) l aa_F^2 \cos(om t) \\
& + 2. m_b R \sin(bb_I) e \cos(om t)^2 aa_F^2 \\
& + m_b R^2 \sin(om t)^2 om^2 \cos(bb_I) \sin(bb_I) \\
& + 2. m_b R e \sin(om t)^2 om^2 \sin(bb_I) \\
& - 1. m_b R^2 \sin(bb_I)^2 \sin(om t)^2 aa_FF \cos(om t) \\
& + 4. JB \cos(bb_I)^2 aa_F \sin(om t) om \\
& + m_b R^2 \cos(om t)^2 om^2 \cos(bb_I) \sin(bb_I) \\
& + 2. m_b R e \cos(om t)^2 om^2 \sin(bb_I) \\
& + 2. m_b g_R \sin(bb_I) \cos(om t) \cos(aa) \\
& - 2. m_b g_R \cos(bb_I) \sin(aa) + 4. kb bb_I \\
& + 2. m_b aa_F \sin(om t) om R \cos(bb_I) e \\
& + m_b R^2 \cos(om t)^2 \sin(bb_I) \cos(bb_I) bb_F_I^2 \\
& + 4. JB om^2 \cos(bb_I) \sin(bb_I) + 4. JB aa_F \sin(om t) om \\
& - 4. aa_F^2 \sin(om t)^2 \sin(bb_I) JB \cos(bb_I) \\
& - 1. m_b R^2 aa_F^2 \sin(om t)^4 \sin(bb_I) \cos(bb_I)
\end{aligned}$$

$$\begin{aligned}
& + m_b R^2 \cos(bb_1)^2 aa_F \sin(om t) om \\
& - 1. m_b R^2 \cos(bb_1) \sin(bb_1) bb_F_I^2 \\
& + m_b R^2 \sin(bb_1) \sin(om t)^2 \cos(bb_1) bb_F_I^2 \\
& - 1. m_b R^2 \cos(om t)^4 \sin(bb_1) aa_F^2 \cos(bb_1))) / (4. JB \\
& + R^2 m_b \sin(om t)^2 \sin(bb_1)^2 + R^2 m_b \cos(bb_1)^2 \\
& + R^2 m_b \cos(om t)^2 \sin(bb_1)^2) \\
& + \left(1. \cos(\beta_2(t)) (4. JB aa_FF \cos(om t) - 4. JB aa_F \sin(om t) om - 2. m_b aa_F \sin(om t) om \right. \\
& \left. + m_b R^2 \sin(bb_2) aa_F^2 \cos(om t)^2 \cos(bb_2) \right. \\
& \left. - 1. m_b R^2 aa_F^2 \sin(om t)^4 \sin(bb_2) \cos(bb_2) \right. \\
& \left. - 2. m_b R^2 aa_F^2 \sin(om t)^2 \sin(bb_2) \cos(om t)^2 \cos(bb_2) \right. \\
& \left. - 1. m_b R^2 \sin(om t)^3 om \cos(bb_2)^2 aa_F \right. \\
& \left. - 1. m_b R^2 \sin(om t) om \cos(bb_2)^2 aa_F \cos(om t)^2 \right. \\
& \left. - 2. m_b R e \sin(om t)^3 om aa_F \cos(bb_2) \right. \\
& \left. - 2. m_b R e \sin(om t) om aa_F \cos(om t)^2 \cos(bb_2) \right. \\
& \left. - 4. JB \sin(om t) om aa_F \cos(bb_2)^2 \right)
\end{aligned}$$

$$\begin{aligned}
& -4. aa_F^2 \sin(om t)^2 \sin(bb_2) JB \cos(bb_2) \\
& + 2. m_b R e \cos(om t)^2 om^2 \sin(bb_2) \\
& + m_b R^2 \sin(om t)^2 om^2 \cos(bb_2) \sin(bb_2) \\
& + 2. m_b R e \sin(om t)^2 om^2 \sin(bb_2) \\
& - 2. m_b g_R \sin(bb_2) \cos(om t) \cos(aa) \\
& - 2. m_b g_R \cos(bb_2) \sin(aa) + m_b R^2 aa_FF \sin(bb_2)^2 \cos(om t)^3 \\
& + m_b R^2 aa_FF \sin(bb_2)^2 \cos(om t) \sin(om t)^2 \\
& + 2. m_b aa_FF \cos(om t) R \cos(bb_2) e + R m_b l aa_FF \cos(bb_2) \\
& + m_b R \sin(bb_2) l aa_F^2 \cos(om t) \\
& + 2. m_b R \sin(bb_2) e \cos(om t)^2 aa_F^2 \\
& + m_b R^2 \sin(om t)^2 \sin(bb_2) \cos(bb_2) bb_F_2^2 \\
& + m_b R^2 \cos(om t) aa_FF \cos(bb_2)^2 \\
& + m_b R^2 \cos(om t)^2 \sin(bb_2) \cos(bb_2) bb_F_2^2 \\
& + m_b R^2 \cos(om t)^2 om^2 \cos(bb_2) \sin(bb_2) \\
& - 1. m_b R^2 \sin(om t) om aa_F \cos(bb_2)^2
\end{aligned}$$

$$\begin{aligned}
& + 4. JB aa_F \sin(om t) \sin(bb_2)^2 om + 4. kb bb_2 \\
& - 1. m_b R^2 aa_F^2 \cos(om t)^4 \sin(bb_2) \cos(bb_2) \\
& + 4. JB om^2 \cos(bb_2) \sin(bb_2))) / (4. JB + R^2 m_b \cos(om t)^2 \sin(bb_2)^2 \\
& + R^2 m_b \sin(om t)^2 \sin(bb_2)^2 + R^2 m_b \cos(bb_2)^2) + (\\
& - 2. aa_F bb_F_1 \cos(\Omega t) + bb_F_1^2) \sin(\beta_1(t)) \\
& + (2. \sin(\beta_2(t)) aa_F \cos(\Omega t) + \sin(\beta_2(t)) bb_F_2) bb_F_2) m_b l + (\\
& - 2. \cos(\beta_1(t)) aa_F + 2. \cos(\beta_2(t)) aa_F) \sin(\Omega t) m_b l \Omega \\
& + \left(\left(\left(1. \cos(\beta_2(t))^2 (4. JB aa_FF \cos(om t) - 4. JB aa_F \sin(om t) om \right. \right. \right. \right. \\
& - 2. m_b aa_F \sin(om t) om R \cos(bb_2) e \\
& - 1. m_b R^2 \cos(bb_2) \sin(bb_2) bb_F_2^2 \\
& + m_b R^2 \sin(bb_2) aa_F^2 \cos(om t)^2 \cos(bb_2) \\
& - 1. m_b R^2 aa_F^2 \sin(om t)^4 \sin(bb_2) \cos(bb_2) \\
& - 2. m_b R^2 aa_F^2 \sin(om t)^2 \sin(bb_2) \cos(om t)^2 \cos(bb_2) \\
& - 1. m_b R^2 \sin(om t)^3 om \cos(bb_2)^2 aa_F \\
& - 1. m_b R^2 \sin(om t) om \cos(bb_2)^2 aa_F \cos(om t)^2
\end{aligned}$$

$$\begin{aligned}
& -2 \cdot m_b R e \sin(\omega m t)^3 \omega m a a_F \cos(bb_2) \\
& -2 \cdot m_b R e \sin(\omega m t) \omega m a a_F \cos(\omega m t)^2 \cos(bb_2) \\
& -4 \cdot J B \sin(\omega m t) \omega m a a_F \cos(bb_2)^2 \\
& -4 \cdot a a_F^2 \sin(\omega m t)^2 \sin(bb_2) J B \cos(bb_2) \\
& +2 \cdot m_b R e \cos(\omega m t)^2 \omega m^2 \sin(bb_2) \\
& +m_b R^2 \sin(\omega m t)^2 \omega m^2 \cos(bb_2) \sin(bb_2) \\
& +2 \cdot m_b R e \sin(\omega m t)^2 \omega m^2 \sin(bb_2) \\
& -2 \cdot m_b g_R \sin(bb_2) \cos(\omega m t) \cos(aa) \\
& -2 \cdot m_b g_R \cos(bb_2) \sin(aa) +m_b R^2 a a_F F \sin(bb_2)^2 \cos(\omega m t)^3 \\
& +m_b R^2 a a_F F \sin(bb_2)^2 \cos(\omega m t) \sin(\omega m t)^2 \\
& +2 \cdot m_b a a_F F \cos(\omega m t) R \cos(bb_2) e +R m_b l a a_F F \cos(bb_2) \\
& +m_b R \sin(bb_2) l a a_F^2 \cos(\omega m t) \\
& +2 \cdot m_b R \sin(bb_2) e \cos(\omega m t)^2 a a_F^2 \\
& +m_b R^2 \sin(\omega m t)^2 \sin(bb_2) \cos(bb_2) b b_F_2^2 \\
& +m_b R^2 \cos(\omega m t) a a_F F \cos(bb_2)^2
\end{aligned}$$

$$+ m_b R^2 \cos(om t)^2 \sin(bb_2) \cos(bb_2) bb_F_2^2$$

$$+ m_b R^2 \cos(om t)^2 om^2 \cos(bb_2) \sin(bb_2)$$

$$- 1. m_b R^2 \sin(om t) om aa_F \cos(bb_2)^2$$

$$+ 4. JB aa_F \sin(om t) \sin(bb_2)^2 om + 4. kb bb_2$$

$$- 1. m_b R^2 aa_F^2 \cos(om t)^4 \sin(bb_2) \cos(bb_2)$$

$$+ 4. JB om^2 \cos(bb_2) \sin(bb_2))) / (4. JB + R^2 m_b \cos(om t)^2 \sin(bb_2)^2$$

$$+ R^2 m_b \sin(om t)^2 \sin(bb_2)^2 + R^2 m_b \cos(bb_2)^2)$$

$$+ \left(1. \sin(\beta_2(t))^2 (4. JB aa_FF \cos(om t) - 4. JB aa_F \sin(om t) om - 2. m_b aa_F \sin(om t) om^2 \cos(bb_2)) \right) / (4. JB + R^2 m_b \cos(om t)^2 \sin(bb_2)^2)$$

$$- 1. m_b R^2 aa_F^2 \sin(om t)^4 \sin(bb_2) \cos(bb_2)$$

$$- 2. m_b R^2 aa_F^2 \sin(om t)^2 \sin(bb_2) \cos(om t)^2 \cos(bb_2)$$

$$- 1. m_b R^2 \sin(om t)^3 om \cos(bb_2)^2 aa_F$$

$$- 1. m_b R^2 \sin(om t) om \cos(bb_2)^2 aa_F \cos(om t)^2$$

$$- 2. m_b R e \sin(om t)^3 om aa_F \cos(bb_2)$$

$$- 2. m_b R e \sin(om t) om aa_F \cos(om t)^2 \cos(bb_2)$$

$$- 4. JB \sin(om t) om aa_F \cos(bb_2)^2$$

$$\begin{aligned}
& -4. aa_F^2 \sin(om t)^2 \sin(bb_2) JB \cos(bb_2) \\
& + 2. m_b R e \cos(om t)^2 om^2 \sin(bb_2) \\
& + m_b R^2 \sin(om t)^2 om^2 \cos(bb_2) \sin(bb_2) \\
& + 2. m_b R e \sin(om t)^2 om^2 \sin(bb_2) \\
& - 2. m_b g_R \sin(bb_2) \cos(om t) \cos(aa) \\
& - 2. m_b g_R \cos(bb_2) \sin(aa) + m_b R^2 aa_FF \sin(bb_2)^2 \cos(om t)^3 \\
& + m_b R^2 aa_FF \sin(bb_2)^2 \cos(om t) \sin(om t)^2 \\
& + 2. m_b aa_FF \cos(om t) R \cos(bb_2) e + R m_b l aa_FF \cos(bb_2) \\
& + m_b R \sin(bb_2) l aa_F^2 \cos(om t) \\
& + 2. m_b R \sin(bb_2) e \cos(om t)^2 aa_F^2 \\
& + m_b R^2 \sin(om t)^2 \sin(bb_2) \cos(bb_2) bb_F_2^2 \\
& + m_b R^2 \cos(om t) aa_FF \cos(bb_2)^2 \\
& + m_b R^2 \cos(om t)^2 \sin(bb_2) \cos(bb_2) bb_F_2^2 \\
& + m_b R^2 \cos(om t)^2 om^2 \cos(bb_2) \sin(bb_2) \\
& - 1. m_b R^2 \sin(om t) om aa_F \cos(bb_2)^2
\end{aligned}$$

$$\begin{aligned}
& + 4. JB aa_F \sin(om t) \sin(bb_2)^2 om + 4. kb bb_2 \\
& - 1. m_b R^2 aa_F^2 \cos(om t)^4 \sin(bb_2) \cos(bb_2) \\
& + 4. JB om^2 \cos(bb_2) \sin(bb_2)) \cos(\Omega t)^2 \Big) \Big/ (4. JB \\
& + R^2 m_b \cos(om t)^2 \sin(bb_2)^2 + R^2 m_b \sin(om t)^2 \sin(bb_2)^2 \\
& + R^2 m_b \cos(bb_2)^2)) \cos(\Omega t) - \left(1. \cos(\beta_1(t))^2 \right. \\
& \left. - 4. JB aa_FF \cos(om t) + m_b R^2 \sin(om t) om \cos(bb_1)^2 \cos(om t)^2 aa_F \right. \\
& \left. - 2. m_b R^2 aa_F^2 \sin(om t)^2 \sin(bb_1) \cos(bb_1) \cos(om t)^2 \right. \\
& \left. + m_b R^2 \sin(om t)^3 om \cos(bb_1)^2 aa_F \right. \\
& \left. + 2. m_b R e \sin(om t)^3 om aa_F \cos(bb_1) \right. \\
& \left. - 1. m_b R^2 \cos(bb_1)^2 aa_FF \cos(om t) + R m_b l aa_FF \cos(bb_1) \right. \\
& \left. - 1. m_b R^2 \cos(om t)^3 \sin(bb_1)^2 aa_FF \right. \\
& \left. - 2. m_b aa_FF \cos(om t) R \cos(bb_1) e \right. \\
& \left. + 2. m_b R e \sin(om t) om \cos(bb_1) \cos(om t)^2 aa_F \right. \\
& \left. + m_b R^2 \sin(bb_1) aa_F^2 \cos(om t)^2 \cos(bb_1) \right. \\
& \left. - 4. JB aa_F \sin(om t) \sin(bb_1)^2 om \right)
\end{aligned}$$

$$\begin{aligned}
& -1. m_b R \sin(bb_I) l aa_F^2 \cos(om t) \\
& + 2. m_b R \sin(bb_I) e \cos(om t)^2 aa_F^2 \\
& + m_b R^2 \sin(om t)^2 om^2 \cos(bb_I) \sin(bb_I) \\
& + 2. m_b R e \sin(om t)^2 om^2 \sin(bb_I) \\
& - 1. m_b R^2 \sin(bb_I)^2 \sin(om t)^2 aa_FF \cos(om t) \\
& + 4. JB \cos(bb_I)^2 aa_F \sin(om t) om \\
& + m_b R^2 \cos(om t)^2 om^2 \cos(bb_I) \sin(bb_I) \\
& + 2. m_b R e \cos(om t)^2 om^2 \sin(bb_I) \\
& + 2. m_b g_R \sin(bb_I) \cos(om t) \cos(aa) \\
& - 2. m_b g_R \cos(bb_I) \sin(aa) + 4. kb bb_I \\
& + 2. m_b aa_F \sin(om t) om R \cos(bb_I) e \\
& + m_b R^2 \cos(om t)^2 \sin(bb_I) \cos(bb_I) bb_F_I^2 \\
& + 4. JB om^2 \cos(bb_I) \sin(bb_I) + 4. JB aa_F \sin(om t) om \\
& - 4. aa_F^2 \sin(om t)^2 \sin(bb_I) JB \cos(bb_I) \\
& - 1. m_b R^2 aa_F^2 \sin(om t)^4 \sin(bb_I) \cos(bb_I)
\end{aligned}$$

$$\begin{aligned}
& + m_b R^2 \cos(bb_I)^2 aa_F \sin(om t) om \\
& - 1. m_b R^2 \cos(bb_I) \sin(bb_I) bb_F I^2 \\
& + m_b R^2 \sin(bb_I) \sin(om t)^2 \cos(bb_I) bb_F I^2 \\
& - 1. m_b R^2 \cos(om t)^4 \sin(bb_I) aa_F^2 \cos(bb_I) \cos(\Omega t) \Big) / (4. JB \\
& + R^2 m_b \sin(om t)^2 \sin(bb_I)^2 + R^2 m_b \cos(bb_I)^2 \\
& + R^2 m_b \cos(om t)^2 \sin(bb_I)^2) + \left((-2. bb_F I^2 + (2. aa_F bb_F I \right. \\
& \left. + (2. bb_F I^2 - 2. aa_F bb_F I \cos(\Omega t)) \cos(\Omega t)) \cos(\Omega t) \right) \\
& \cos(\Omega t) \cos(\beta_1(t)) - \left(1. \cos(\Omega t)^3 (-4. JB aa_FF \cos(om t) \right. \\
& \left. + m_b R^2 \sin(om t) om \cos(bb_I)^2 \cos(om t)^2 aa_F \right. \\
& \left. - 2. m_b R^2 aa_F^2 \sin(om t)^2 \sin(bb_I) \cos(bb_I) \cos(om t)^2 \right. \\
& \left. + m_b R^2 \sin(om t)^3 om \cos(bb_I)^2 aa_F \right. \\
& \left. + 2. m_b R e \sin(om t)^3 om aa_F \cos(bb_I) \right. \\
& \left. - 1. m_b R^2 \cos(bb_I)^2 aa_FF \cos(om t) + R m_b l aa_FF \cos(bb_I) \right. \\
& \left. - 1. m_b R^2 \cos(om t)^3 \sin(bb_I)^2 aa_FF \right. \\
& \left. - 2. m_b aa_FF \cos(om t) R \cos(bb_I) e \right)
\end{aligned}$$

$$+ 2. m_b R e \sin(om t) om \cos(bb_I) \cos(om t)^2 aa_F$$

$$+ m_b R^2 \sin(bb_I) aa_F^2 \cos(om t)^2 \cos(bb_I)$$

$$- 4. JB aa_F \sin(om t) \sin(bb_I)^2 om$$

$$- 1. m_b R \sin(bb_I) l aa_F^2 \cos(om t)$$

$$+ 2. m_b R \sin(bb_I) e \cos(om t)^2 aa_F^2$$

$$+ m_b R^2 \sin(om t)^2 om^2 \cos(bb_I) \sin(bb_I)$$

$$+ 2. m_b R e \sin(om t)^2 om^2 \sin(bb_I)$$

$$- 1. m_b R^2 \sin(bb_I)^2 \sin(om t)^2 aa_FF \cos(om t)$$

$$+ 4. JB \cos(bb_I)^2 aa_F \sin(om t) om$$

$$+ m_b R^2 \cos(om t)^2 om^2 \cos(bb_I) \sin(bb_I)$$

$$+ 2. m_b R e \cos(om t)^2 om^2 \sin(bb_I)$$

$$+ 2. m_b g_R \sin(bb_I) \cos(om t) \cos(aa)$$

$$- 2. m_b g_R \cos(bb_I) \sin(aa) + 4. kb bb_I$$

$$+ 2. m_b aa_F \sin(om t) om R \cos(bb_I) e$$

$$+ m_b R^2 \cos(om t)^2 \sin(bb_I) \cos(bb_I) bb_F_I^2$$

$$\begin{aligned}
& + 4. JB \text{om}^2 \cos(bb_I) \sin(bb_I) + 4. JB aa_F \sin(om t) \text{om} \\
& - 4. aa_F^2 \sin(om t)^2 \sin(bb_I) JB \cos(bb_I) \\
& - 1. m_b R^2 aa_F^2 \sin(om t)^4 \sin(bb_I) \cos(bb_I) \\
& + m_b R^2 \cos(bb_I)^2 aa_F \sin(om t) \text{om} \\
& - 1. m_b R^2 \cos(bb_I) \sin(bb_I) bb_F_I^2 \\
& + m_b R^2 \sin(bb_I) \sin(om t)^2 \cos(bb_I) bb_F_I^2 \\
& - 1. m_b R^2 \cos(om t)^4 \sin(bb_I) aa_F^2 \cos(bb_I)) \sin(\beta_1(t)) \Big) \Big/ (4. JB \\
& + R^2 m_b \sin(om t)^2 \sin(bb_I)^2 + R^2 m_b \cos(bb_I)^2 \\
& + R^2 m_b \cos(om t)^2 \sin(bb_I)^2)) \sin(\beta_1(t)) \\
& + \left(\left(1. \sin(\beta_2(t))^2 \cos(\Omega t) (4. JB aa_FF \cos(om t) \right. \right. \\
& \left. \left. - 4. JB aa_F \sin(om t) \text{om} - 2. m_b aa_F \sin(om t) \text{om} R \cos(bb_2) e \right. \right. \\
& \left. \left. - 1. m_b R^2 \cos(bb_2) \sin(bb_2) bb_F_2^2 \right. \right. \\
& \left. \left. + m_b R^2 \sin(bb_2) aa_F^2 \cos(om t)^2 \cos(bb_2) \right. \right. \\
& \left. \left. - 1. m_b R^2 aa_F^2 \sin(om t)^4 \sin(bb_2) \cos(bb_2) \right. \right. \\
& \left. \left. - 2. m_b R^2 aa_F^2 \sin(om t)^2 \sin(bb_2) \cos(om t)^2 \cos(bb_2) \right. \right)
\end{aligned}$$

$$\begin{aligned}
& -1. m_b R^2 \sin(\omega t)^3 \omega m \cos(bb_2)^2 aa_F \\
& -1. m_b R^2 \sin(\omega t) \omega m \cos(bb_2)^2 aa_F \cos(\omega t)^2 \\
& -2. m_b R e \sin(\omega t)^3 \omega m aa_F \cos(bb_2) \\
& -2. m_b R e \sin(\omega t) \omega m aa_F \cos(\omega t)^2 \cos(bb_2) \\
& -4. J B \sin(\omega t) \omega m aa_F \cos(bb_2)^2 \\
& -4. aa_F^2 \sin(\omega t)^2 \sin(bb_2) J B \cos(bb_2) \\
& +2. m_b R e \cos(\omega t)^2 \omega m^2 \sin(bb_2) \\
& +m_b R^2 \sin(\omega t)^2 \omega m^2 \cos(bb_2) \sin(bb_2) \\
& +2. m_b R e \sin(\omega t)^2 \omega m^2 \sin(bb_2) \\
& -2. m_b g_R \sin(bb_2) \cos(\omega t) \cos(aa) \\
& -2. m_b g_R \cos(bb_2) \sin(aa) + m_b R^2 aa_FF \sin(bb_2)^2 \cos(\omega t)^3 \\
& +m_b R^2 aa_FF \sin(bb_2)^2 \cos(\omega t) \sin(\omega t)^2 \\
& +2. m_b aa_FF \cos(\omega t) R \cos(bb_2) e + R m_b l aa_FF \cos(bb_2) \\
& +m_b R \sin(bb_2) l aa_F^2 \cos(\omega t) \\
& +2. m_b R \sin(bb_2) e \cos(\omega t)^2 aa_F^2 \\
& +m_b R^2 \sin(\omega t)^2 \sin(bb_2) \cos(bb_2) bb_F_2^2
\end{aligned}$$

$$\begin{aligned}
& + m_b R^2 \cos(\omega t) aa_FF \cos(bb_2)^2 \\
& + m_b R^2 \cos(\omega t)^2 \sin(bb_2) \cos(bb_2) bb_F_2^2 \\
& + m_b R^2 \cos(\omega t)^2 \omega^2 \cos(bb_2) \sin(bb_2) \\
& - 1. m_b R^2 \sin(\omega t) \omega aa_F \cos(bb_2)^2 \\
& + 4. JB aa_F \sin(\omega t) \sin(bb_2)^2 \omega + 4. kb bb_2 \\
& - 1. m_b R^2 aa_F^2 \cos(\omega t)^4 \sin(bb_2) \cos(bb_2) \\
& + 4. JB \omega^2 \cos(bb_2) \sin(bb_2))) / (4. JB + R^2 m_b \cos(\omega t)^2 \sin(bb_2)^2 \\
& + R^2 m_b \sin(\omega t)^2 \sin(bb_2)^2 + R^2 m_b \cos(bb_2)^2) + \left((2. bb_F_I^2 \right. \\
& \left. - 4. aa_F bb_F_I \cos(\Omega t)) \cos(\Omega t) \cos(\beta_1(t)) - (1. \cos(\Omega t) (\right. \\
& \left. - 4. JB aa_FF \cos(\omega t) + m_b R^2 \sin(\omega t) \omega \cos(bb_1)^2 \cos(\omega t)^2 aa_F \right. \\
& \left. - 2. m_b R^2 aa_F^2 \sin(\omega t)^2 \sin(bb_1) \cos(bb_1) \cos(\omega t)^2 \right. \\
& \left. + m_b R^2 \sin(\omega t)^3 \omega \cos(bb_1)^2 aa_F \right. \\
& \left. + 2. m_b R e \sin(\omega t)^3 \omega aa_F \cos(bb_1) \right. \\
& \left. - 1. m_b R^2 \cos(bb_1)^2 aa_FF \cos(\omega t) + R m_b l aa_FF \cos(bb_1) \right. \\
& \left. - 1. m_b R^2 \cos(\omega t)^3 \sin(bb_1)^2 aa_FF \right. \\
& \left. - 2. m_b aa_FF \cos(\omega t) R \cos(bb_1) e \right)
\end{aligned}$$

$$\begin{aligned}
& + 2 \cdot m_b R e \sin(om t) om \cos(bb_1) \cos(om t)^2 aa_F \\
& + m_b R^2 \sin(bb_1) aa_F^2 \cos(om t)^2 \cos(bb_1) \\
& - 4 \cdot JB aa_F \sin(om t) \sin(bb_1)^2 om \\
& - 1 \cdot m_b R \sin(bb_1) l aa_F^2 \cos(om t) \\
& + 2 \cdot m_b R \sin(bb_1) e \cos(om t)^2 aa_F^2 \\
& + m_b R^2 \sin(om t)^2 om^2 \cos(bb_1) \sin(bb_1) \\
& + 2 \cdot m_b R e \sin(om t)^2 om^2 \sin(bb_1) \\
& - 1 \cdot m_b R^2 \sin(bb_1)^2 \sin(om t)^2 aa_F F \cos(om t) \\
& + 4 \cdot JB \cos(bb_1)^2 aa_F \sin(om t) om \\
& + m_b R^2 \cos(om t)^2 om^2 \cos(bb_1) \sin(bb_1) \\
& + 2 \cdot m_b R e \cos(om t)^2 om^2 \sin(bb_1) \\
& + 2 \cdot m_b g_R \sin(bb_1) \cos(om t) \cos(aa) \\
& - 2 \cdot m_b g_R \cos(bb_1) \sin(aa) + 4 \cdot kb bb_1 \\
& + 2 \cdot m_b aa_F \sin(om t) om R \cos(bb_1) e \\
& + m_b R^2 \cos(om t)^2 \sin(bb_1) \cos(bb_1) bb_F I^2 \\
& + 4 \cdot JB om^2 \cos(bb_1) \sin(bb_1) + 4 \cdot JB aa_F \sin(om t) om
\end{aligned}$$

$$\begin{aligned}
& -4 \cdot aa_F^2 \sin(om t)^2 \sin(bb_I) JB \cos(bb_I) \\
& - 1 \cdot m_b R^2 aa_F^2 \sin(om t)^4 \sin(bb_I) \cos(bb_I) \\
& + m_b R^2 \cos(bb_I)^2 aa_F \sin(om t) om \\
& - 1 \cdot m_b R^2 \cos(bb_I) \sin(bb_I) bb_F_I^2 \\
& + m_b R^2 \sin(bb_I) \sin(om t)^2 \cos(bb_I) bb_F_I^2 \\
& - 1 \cdot m_b R^2 \cos(om t)^4 \sin(bb_I) aa_F^2 \cos(bb_I) \sin(\beta_1(t)) \Big) \Big) \Big/ (4 \cdot JB \\
& + R^2 m_b \sin(om t)^2 \sin(bb_I)^2 + R^2 m_b \cos(bb_I)^2 \\
& + R^2 m_b \cos(om t)^2 \sin(bb_I)^2) \sin(\beta_1(t)) \\
& - 2 \cdot \sin(\Omega t)^2 \sin(\beta_1(t)) aa_F \cos(\beta_1(t)) bb_F_I \sin(\Omega t)^2 \\
& + \Big(\Big(2 \cdot aa_F \cos(\beta_2(t)) \sin(\beta_2(t)) \\
& - 2 \cdot aa_F \sin(\beta_2(t)) \cos(\Omega t)^2 \cos(\beta_2(t)) \Big) \cos(\Omega t)^2 + \Big(\\
& - 4 \cdot aa_F \sin(\beta_2(t)) \cos(\Omega t)^2 \cos(\beta_2(t)) \\
& - 2 \cdot \sin(\Omega t)^2 \sin(\beta_2(t)) aa_F \cos(\beta_2(t)) \Big) \sin(\Omega t)^2 \\
& + \Big(\Big(2 \cdot \cos(\beta_2(t)) \sin(\beta_2(t)) \\
& - 2 \cdot \cos(\Omega t)^2 \sin(\beta_2(t)) \cos(\beta_2(t)) \Big) \cos(\Omega t) \\
& - 2 \cdot \cos(\Omega t) \cos(\beta_2(t)) \sin(\Omega t)^2 \sin(\beta_2(t)) \Big) bb_F_2 \Big) bb_F_2 \Big) m_b
\end{aligned}$$

$$\begin{aligned}
& + \left(\left(\left(2. \cos(\beta_2(t))^2 aa_F \cos(\Omega t) + (-1. bb_F_I + (2. aa_F \right. \right. \right. \right. \\
& \quad \left. \left. \left. \left. + bb_F_I \cos(\Omega t) \right) \cos(\Omega t) \right) \cos(\beta_1(t))^2 \right. \right. \\
& \quad \left. \left. - 2. \sin(\beta_1(t))^2 bb_F_I \cos(\Omega t)^2 + \left(-2. \sin(\beta_1(t))^2 bb_F_I \right. \right. \right. \\
& \quad \left. \left. \left. + \cos(\beta_1(t))^2 bb_F_I \right) \sin(\Omega t)^2 \right) \sin(\Omega t) + \left(\cos(\beta_2(t))^2 \right. \right. \\
& \quad \left. \left. + (2. \sin(\beta_2(t))^2 - 1. \cos(\beta_2(t))^2) \cos(\Omega t)^2 + (2. \sin(\beta_2(t))^2 \right. \right. \\
& \quad \left. \left. - 1. \cos(\beta_2(t))^2) \sin(\Omega t)^2 \right) \sin(\Omega t) bb_F_2 \right) m_b \\
& \quad + \left(\cos(\Omega t)^3 \cos(\beta_1(t)) \sin(\beta_1(t)) - 1. \cos(\Omega t)^3 \cos(\beta_2(t)) \sin(\beta_2(t)) \right. \\
& \quad \left. + (-1. \cos(\Omega t) \sin(\beta_2(t)) \cos(\beta_2(t)) \right. \\
& \quad \left. + \cos(\Omega t) \sin(\beta_1(t)) \cos(\beta_1(t)) \right) \sin(\Omega t)^2 m_b \Omega \right) R \Big) R \\
& + \left(\left(\left(\left(- \left(2. \cos(\beta_1(t)) \left(-4. JB aa_FF \cos(om t) \right. \right. \right. \right. \right. \right. \right. \right. \\
& \quad \left. \left. \left. \left. \left. \left. \left. \left. + m_b R^2 \sin(om t) om \cos(bb_I)^2 \cos(om t)^2 aa_F \right. \right. \right. \right. \right. \right. \right. \right. \\
& \quad \left. \left. \left. \left. \left. \left. \left. \left. - 2. m_b R^2 aa_F^2 \sin(om t)^2 \sin(bb_I) \cos(bb_I) \cos(om t)^2 \right. \right. \right. \right. \right. \right. \right. \right. \\
& \quad \left. \left. \left. \left. \left. \left. \left. \left. + m_b R^2 \sin(om t)^3 om \cos(bb_I)^2 aa_F \right. \right. \right. \right. \right. \right. \right. \right. \\
& \quad \left. \left. \left. \left. \left. \left. \left. \left. + 2. m_b R e \sin(om t)^3 om aa_F \cos(bb_I) \right. \right. \right. \right. \right. \right. \right. \right. \\
& \quad \left. \left. \left. \left. \left. \left. \left. \left. - 1. m_b R^2 \cos(bb_I)^2 aa_FF \cos(om t) + R m_b l aa_FF \cos(bb_I) \right. \right. \right. \right. \right. \right. \right. \right. \\
& \quad \left. \left. \left. \left. \left. \left. \left. \left. - 1. m_b R^2 \cos(om t)^3 \sin(bb_I)^2 aa_FF \right. \right. \right. \right. \right. \right. \right. \right.
\end{aligned}$$

$$\begin{aligned}
& -2. m_b aa_FF \cos(om t) R \cos(bb_1) e \\
& + 2. m_b R e \sin(om t) om \cos(bb_1) \cos(om t)^2 aa_F \\
& + m_b R^2 \sin(bb_1) aa_F^2 \cos(om t)^2 \cos(bb_1) \\
& - 4. JB aa_F \sin(om t) \sin(bb_1)^2 om \\
& - 1. m_b R \sin(bb_1) l aa_F^2 \cos(om t) \\
& + 2. m_b R \sin(bb_1) e \cos(om t)^2 aa_F^2 \\
& + m_b R^2 \sin(om t)^2 om^2 \cos(bb_1) \sin(bb_1) \\
& + 2. m_b R e \sin(om t)^2 om^2 \sin(bb_1) \\
& - 1. m_b R^2 \sin(bb_1)^2 \sin(om t)^2 aa_FF \cos(om t) \\
& + 4. JB \cos(bb_1)^2 aa_F \sin(om t) om \\
& + m_b R^2 \cos(om t)^2 om^2 \cos(bb_1) \sin(bb_1) \\
& + 2. m_b R e \cos(om t)^2 om^2 \sin(bb_1) \\
& + 2. m_b g_R \sin(bb_1) \cos(om t) \cos(aa) \\
& - 2. m_b g_R \cos(bb_1) \sin(aa) + 4. kb bb_I \\
& + 2. m_b aa_F \sin(om t) om R \cos(bb_1) e \\
& + m_b R^2 \cos(om t)^2 \sin(bb_1) \cos(bb_1) bb_F_I^2
\end{aligned}$$

$$\begin{aligned}
& + 4 \cdot JB \cdot om^2 \cos(bb_1) \sin(bb_1) + 4 \cdot JB \cdot aa_F \sin(om t) \cdot om \\
& - 4 \cdot aa_F^2 \sin(om t)^2 \sin(bb_1) \cdot JB \cos(bb_1) \\
& - 1 \cdot m_b \cdot R^2 \cdot aa_F^2 \sin(om t)^4 \sin(bb_1) \cos(bb_1) \\
& + m_b \cdot R^2 \cos(bb_1)^2 \cdot aa_F \sin(om t) \cdot om \\
& - 1 \cdot m_b \cdot R^2 \cos(bb_1) \sin(bb_1) \cdot bb_F_I^2 \\
& + m_b \cdot R^2 \sin(bb_1) \sin(om t)^2 \cos(bb_1) \cdot bb_F_I^2 \\
& - 1 \cdot m_b \cdot R^2 \cos(om t)^4 \sin(bb_1) \cdot aa_F^2 \cos(bb_1) \cdot \cos(\Omega t) \Big) \Big/ (4 \cdot JB \\
& + R^2 \cdot m_b \sin(om t)^2 \sin(bb_1)^2 + R^2 \cdot m_b \cos(bb_1)^2 \\
& + R^2 \cdot m_b \cos(om t)^2 \sin(bb_1)^2) \\
& + \left(2 \cdot \cos(\beta_2(t)) \left(4 \cdot JB \cdot aa_FF \cos(om t) - 4 \cdot JB \cdot aa_F \sin(om t) \cdot om - 2 \cdot m_b \cdot aa_F \sin(om t) \cdot om \right. \right. \\
& + m_b \cdot R^2 \sin(bb_2) \cdot aa_F^2 \cos(om t)^2 \cos(bb_2) \\
& - 1 \cdot m_b \cdot R^2 \cdot aa_F^2 \sin(om t)^4 \sin(bb_2) \cos(bb_2) \\
& - 2 \cdot m_b \cdot R^2 \cdot aa_F^2 \sin(om t)^2 \sin(bb_2) \cos(om t)^2 \cos(bb_2) \\
& - 1 \cdot m_b \cdot R^2 \sin(om t)^3 \cdot om \cos(bb_2)^2 \cdot aa_F \\
& - 1 \cdot m_b \cdot R^2 \sin(om t) \cdot om \cos(bb_2)^2 \cdot aa_F \cos(om t)^2 \\
& - 2 \cdot m_b \cdot R \cdot e \sin(om t)^3 \cdot om \cdot aa_F \cos(bb_2) \\
& - 2 \cdot m_b \cdot R \cdot e \sin(om t) \cdot om \cdot aa_F \cos(om t)^2 \cos(bb_2) \\
& - 4 \cdot JB \sin(om t) \cdot om \cdot aa_F \cos(bb_2)^2 \\
& - 4 \cdot aa_F^2 \sin(om t)^2 \sin(bb_2) \cdot JB \cos(bb_2) \\
& + 2 \cdot m_b \cdot R \cdot e \cos(om t)^2 \cdot om^2 \sin(bb_2)
\end{aligned}$$

$$\begin{aligned}
& + m_b R^2 \sin(\omega t)^2 \omega^2 \cos(bb_2) \sin(bb_2) \\
& + 2. m_b R e \sin(\omega t)^2 \omega^2 \sin(bb_2) \\
& - 2. m_b g_R \sin(bb_2) \cos(\omega t) \cos(aa) \\
& - 2. m_b g_R \cos(bb_2) \sin(aa) + m_b R^2 a_{FF} \sin(bb_2)^2 \cos(\omega t)^3 \\
& + m_b R^2 a_{FF} \sin(bb_2)^2 \cos(\omega t) \sin(\omega t)^2 \\
& + 2. m_b a_{FF} \cos(\omega t) R \cos(bb_2) e + R m_b l a_{FF} \cos(bb_2) \\
& + m_b R \sin(bb_2) l a_{F}^2 \cos(\omega t) \\
& + 2. m_b R \sin(bb_2) e \cos(\omega t)^2 a_{F}^2 \\
& + m_b R^2 \sin(\omega t)^2 \sin(bb_2) \cos(bb_2) b_{F2}^2 \\
& + m_b R^2 \cos(\omega t) a_{FF} \cos(bb_2)^2 \\
& + m_b R^2 \cos(\omega t)^2 \sin(bb_2) \cos(bb_2) b_{F2}^2 \\
& + m_b R^2 \cos(\omega t)^2 \omega^2 \cos(bb_2) \sin(bb_2) \\
& - 1. m_b R^2 \sin(\omega t) \omega a_{F} \cos(bb_2)^2 \\
& + 4. J_B a_{F} \sin(\omega t) \sin(bb_2)^2 \omega + 4. k_b b_{2} \\
& - 1. m_b R^2 a_{F}^2 \cos(\omega t)^4 \sin(bb_2) \cos(bb_2) \\
& + 4. J_B \omega^2 \cos(bb_2) \sin(bb_2) \cos(\Omega t) \Big) / (4. J_B) \\
& + R^2 m_b \cos(\omega t)^2 \sin(bb_2)^2 + R^2 m_b \sin(\omega t)^2 \sin(bb_2)^2 \\
& + R^2 m_b \cos(bb_2)^2) + (-2. b_{F1}^2 \\
& + 4. a_{F} b_{F1} \cos(\Omega t) \cos(\Omega t) \sin(\beta_1(t)) \\
& + (4. \sin(\beta_2(t)) a_{F} \cos(\Omega t)^2 \\
& + 2. \sin(\beta_2(t)) \cos(\Omega t) b_{F2}) b_{F2} m_b \\
& + ((8. a_{F} \cos(\Omega t) \cos(\beta_2(t)) + (-2. b_{F1} + (8. a_{F} \\
& + 2. b_{F1} \cos(\Omega t) \cos(\Omega t) \cos(\beta_1(t)) \\
& + 2. \sin(\Omega t)^2 \cos(\beta_1(t)) b_{F1}) \sin(\Omega t) + (-2. \cos(\Omega t)^2 \cos(\beta_2(t)) \\
& + 2. \cos(\beta_2(t)) - 2. \cos(\beta_2(t)) \sin(\Omega t)^2) \sin(\Omega t) b_{F2}) m_b + \\
& - 2. \cos(\Omega t)^3 \sin(\beta_2(t)) + 2. \cos(\Omega t)^3 \sin(\beta_1(t)))
\end{aligned}$$

$$\begin{aligned}
& + \left(2. \cos(\Omega t) \sin(\beta_1(t)) - 2. \sin(\beta_2(t)) \cos(\Omega t) \right) \sin(\Omega t)^2 \Big) m_b \Omega \Big) \\
& \Omega \Big) R + 16. m_b \sin(\Omega t) \Omega aa_F \cos(\Omega t) e \Big) e \Big) \Bigg) \Bigg/ \left(16. JT \right. \\
& + \left(32. \cos(\Omega t)^2 + \left(16. \sin(\beta_2(t))^2 + 16. \sin(\beta_1(t))^2 \right) \sin(\Omega t)^2 \right) JB \\
& + \left(8. m_b + m_t \right) l^2 + \left(\left(-8. \cos(\Omega t) \cos(\beta_1(t)) \right. \right. \\
& + 8. \cos(\Omega t) \cos(\beta_2(t)) \Big) m_b l + \left(\left(4. \cos(\beta_2(t))^2 \right. \right. \\
& + 4. \cos(\Omega t)^2 \sin(\beta_2(t))^2 \Big) \cos(\Omega t)^2 + 4. \cos(\beta_1(t))^2 \cos(\Omega t)^2 \\
& + 4. \cos(\Omega t)^4 \sin(\beta_1(t))^2 + \left(8. \cos(\Omega t)^2 \sin(\beta_2(t))^2 \right. \\
& + 8. \sin(\beta_1(t))^2 \cos(\Omega t)^2 + \left(4. \sin(\beta_2(t))^2 + 4. \sin(\beta_1(t))^2 \right) \sin(\Omega t)^2 \Big) \\
& \sin(\Omega t)^2 \Big) m_b R \Big) R + \left(\left(16. \cos(\Omega t)^2 \cos(\beta_1(t)) \right. \right. \\
& + 16. \cos(\Omega t)^2 \cos(\beta_2(t)) \Big) m_b R + 32. m_b \cos(\Omega t)^2 e \Big) e \Big) \Big)
\end{aligned}$$

```
> T3_eq_rho[full] := subs(\{beta[1](t)=bb_1, beta[2](t)=bb_2,
    rho(t)=aa, Omega=om\},T2_eq_rho[full]);
```

$$\begin{aligned}
T3_eq_rho_{full} := & \left(4. \left(-4. ka aa + \left(\left((4. (4. JB aa_FF \cos(om t) - 4. JB aa_F \sin(om t)) om \right. \right. \right. \right. \right. \right. \\
& - 2. m_b aa_F \sin(om t) om R \cos(bb_2) e \\
& - 1. m_b R^2 \cos(bb_2) \sin(bb_2) bb_F_2^2 \\
& + m_b R^2 \sin(bb_2) aa_F^2 \cos(om t)^2 \cos(bb_2) \\
& - 1. m_b R^2 aa_F^2 \sin(om t)^4 \sin(bb_2) \cos(bb_2) \\
& - 2. m_b R^2 aa_F^2 \sin(om t)^2 \sin(bb_2) \cos(om t)^2 \cos(bb_2) \\
& - 1. m_b R^2 \sin(om t)^3 om \cos(bb_2)^2 aa_F \\
& - 1. m_b R^2 \sin(om t) om \cos(bb_2)^2 aa_F \cos(om t)^2 \\
& - 2. m_b R e \sin(om t)^3 om aa_F \cos(bb_2) \\
& - 2. m_b R e \sin(om t) om aa_F \cos(om t)^2 \cos(bb_2)
\end{aligned}$$

$$\begin{aligned}
& -4. JB \sin(\omega m t) \omega m a a_F \cos(bb_2)^2 \\
& -4. a a_F^2 \sin(\omega m t)^2 \sin(bb_2) J B \cos(bb_2) \\
& +2. m_b R e \cos(\omega m t)^2 \omega m^2 \sin(bb_2) \\
& +m_b R^2 \sin(\omega m t)^2 \omega m^2 \cos(bb_2) \sin(bb_2) \\
& +2. m_b R e \sin(\omega m t)^2 \omega m^2 \sin(bb_2) \\
& -2. m_b g_R \sin(bb_2) \cos(\omega m t) \cos(aa) \\
& -2. m_b g_R \cos(bb_2) \sin(aa) +m_b R^2 a a_F F \sin(bb_2)^2 \cos(\omega m t)^3 \\
& +m_b R^2 a a_F F \sin(bb_2)^2 \cos(\omega m t) \sin(\omega m t)^2 \\
& +2. m_b a a_F F \cos(\omega m t) R \cos(bb_2) e +R m_b l a a_F F \cos(bb_2) \\
& +m_b R \sin(bb_2) l a a_F^2 \cos(\omega m t) \\
& +2. m_b R \sin(bb_2) e \cos(\omega m t)^2 a a_F^2 \\
& +m_b R^2 \sin(\omega m t)^2 \sin(bb_2) \cos(bb_2) b b_F_2^2 \\
& +m_b R^2 \cos(\omega m t) a a_F F \cos(bb_2)^2 \\
& +m_b R^2 \cos(\omega m t)^2 \sin(bb_2) \cos(bb_2) b b_F_2^2 \\
& +m_b R^2 \cos(\omega m t)^2 \omega m^2 \cos(bb_2) \sin(bb_2) \\
& -1. m_b R^2 \sin(\omega m t) \omega m a a_F \cos(bb_2)^2 \\
& +4. J B a a_F \sin(\omega m t) \sin(bb_2)^2 \omega m +4. k b b_2 \\
& -1. m_b R^2 a a_F^2 \cos(\omega m t)^4 \sin(bb_2) \cos(bb_2)
\end{aligned}$$

$$\begin{aligned}
& + 4. JB \text{om}^2 \cos(bb_2) \sin(bb_2)) \Big) / (4. JB + R^2 m_b \cos(om t)^2 \sin(bb_2)^2 \\
& + R^2 m_b \sin(om t)^2 \sin(bb_2)^2 + R^2 m_b \cos(bb_2)^2) - (4. (\\
& - 4. JB aa_FF \cos(om t) + m_b R^2 \sin(om t) om \cos(bb_1)^2 \cos(om t)^2 aa_F \\
& - 2. m_b R^2 aa_F^2 \sin(om t)^2 \sin(bb_1) \cos(bb_1) \cos(om t)^2 \\
& + m_b R^2 \sin(om t)^3 om \cos(bb_1)^2 aa_F \\
& + 2. m_b R e \sin(om t)^3 om aa_F \cos(bb_1) \\
& - 1. m_b R^2 \cos(bb_1)^2 aa_FF \cos(om t) + R m_b l aa_FF \cos(bb_1) \\
& - 1. m_b R^2 \cos(om t)^3 \sin(bb_1)^2 aa_FF \\
& - 2. m_b aa_FF \cos(om t) R \cos(bb_1) e \\
& + 2. m_b R e \sin(om t) om \cos(bb_1) \cos(om t)^2 aa_F \\
& + m_b R^2 \sin(bb_1) aa_F^2 \cos(om t)^2 \cos(bb_1) \\
& - 4. JB aa_F \sin(om t) \sin(bb_1)^2 om \\
& - 1. m_b R \sin(bb_1) l aa_F^2 \cos(om t) \\
& + 2. m_b R \sin(bb_1) e \cos(om t)^2 aa_F^2 \\
& + m_b R^2 \sin(om t)^2 om^2 \cos(bb_1) \sin(bb_1) \\
& + 2. m_b R e \sin(om t)^2 om^2 \sin(bb_1) \\
& - 1. m_b R^2 \sin(bb_1)^2 \sin(om t)^2 aa_FF \cos(om t) \\
& + 4. JB \cos(bb_1)^2 aa_F \sin(om t) om
\end{aligned}$$

$$\begin{aligned}
& + m_b R^2 \cos(om t)^2 om^2 \cos(bb_1) \sin(bb_1) \\
& + 2. m_b R e \cos(om t)^2 om^2 \sin(bb_1) \\
& + 2. m_b g_- R \sin(bb_1) \cos(om t) \cos(aa) \\
& - 2. m_b g_- R \cos(bb_1) \sin(aa) + 4. kb bb_1 \\
& + 2. m_b aa_F \sin(om t) om R \cos(bb_1) e \\
& + m_b R^2 \cos(om t)^2 \sin(bb_1) \cos(bb_1) bb_F l^2 \\
& + 4. JB om^2 \cos(bb_1) \sin(bb_1) + 4. JB aa_F \sin(om t) om \\
& - 4. aa_F^2 \sin(om t)^2 \sin(bb_1) JB \cos(bb_1) \\
& - 1. m_b R^2 aa_F^2 \sin(om t)^4 \sin(bb_1) \cos(bb_1) \\
& + m_b R^2 \cos(bb_1)^2 aa_F \sin(om t) om \\
& - 1. m_b R^2 \cos(bb_1) \sin(bb_1) bb_F l^2 \\
& + m_b R^2 \sin(bb_1) \sin(om t)^2 \cos(bb_1) bb_F l^2 \\
& - 1. m_b R^2 \cos(om t)^4 \sin(bb_1) aa_F^2 \cos(bb_1))) / (4. JB \\
& + R^2 m_b \sin(om t)^2 \sin(bb_1)^2 + R^2 m_b \cos(bb_1)^2 \\
& + R^2 m_b \cos(om t)^2 \sin(bb_1)^2)) \cos(om t) \\
& - 8. \sin(om t)^2 \sin(bb_1) aa_F \cos(bb_1) bb_F l \\
& - 8. \sin(om t)^2 \sin(bb_2) aa_F \cos(bb_2) bb_F l) JB + (4. m_b g_- \sin(aa) \\
& + m_t g_- \sin(aa)) l + ((-4. bb_F l + (16.
\end{aligned}$$

$$\begin{aligned}
& -8 \cdot \sin(bb_2)^2) aa_F \cos(om t) + 4 \cdot \cos(bb_1)^2 bb_F_1 + (-4 \cdot bb_F_1 \\
& - 8 \cdot aa_F \cos(om t) \sin(bb_1)^2) \sin(om t) + (-4 \cdot \cos(bb_2)^2 + 4 \\
& + 4 \cdot \sin(bb_2)^2) \sin(om t) bb_F_2) JB + (\\
& -4 \cdot \cos(om t) \sin(bb_2) \cos(bb_2) + 4 \cdot \cos(om t) \sin(bb_1) \cos(bb_1)) \\
& JB om + \left((2 \cdot \sin(bb_2) \cos(aa) + 2 \cdot \cos(bb_2) \cos(om t) \sin(aa) \right. \\
& \left. + 2 \cdot \sin(bb_1) \cos(aa) - 2 \cdot \cos(bb_1) \cos(om t) \sin(aa)) g_m_b \right. \\
& \left. + \left((1 \cdot \cos(bb_1) (-4 \cdot JB aa_FF \cos(om t) \right. \right. \\
& \left. \left. + m_b R^2 \sin(om t) om \cos(bb_1)^2 \cos(om t)^2 aa_F \right. \right. \\
& \left. \left. - 2 \cdot m_b R^2 aa_F^2 \sin(om t)^2 \sin(bb_1) \cos(bb_1) \cos(om t)^2 \right. \right. \\
& \left. \left. + m_b R^2 \sin(om t)^3 om \cos(bb_1)^2 aa_F \right. \right. \\
& \left. \left. + 2 \cdot m_b R e \sin(om t)^3 om aa_F \cos(bb_1) \right. \right. \\
& \left. \left. - 1 \cdot m_b R^2 \cos(bb_1)^2 aa_FF \cos(om t) + R m_b l aa_FF \cos(bb_1) \right. \right. \\
& \left. \left. - 1 \cdot m_b R^2 \cos(om t)^3 \sin(bb_1)^2 aa_FF \right. \right. \\
& \left. \left. - 2 \cdot m_b aa_FF \cos(om t) R \cos(bb_1) e \right. \right. \\
& \left. \left. + 2 \cdot m_b R e \sin(om t) om \cos(bb_1) \cos(om t)^2 aa_F \right. \right. \\
& \left. \left. + m_b R^2 \sin(bb_1) aa_F^2 \cos(om t)^2 \cos(bb_1) \right. \right. \\
& \left. \left. - 4 \cdot JB aa_F \sin(om t) \sin(bb_1)^2 om \right. \right. \\
& \left. \left. - 1 \cdot m_b R \sin(bb_1) l aa_F^2 \cos(om t) \right. \right)
\end{aligned}$$

$$\begin{aligned}
& + 2 \cdot m_b R \sin(bb_1) e \cos(omt)^2 aa_F^2 \\
& + m_b R^2 \sin(omt)^2 om^2 \cos(bb_1) \sin(bb_1) \\
& + 2 \cdot m_b R e \sin(omt)^2 om^2 \sin(bb_1) \\
& - 1 \cdot m_b R^2 \sin(bb_1)^2 \sin(omt)^2 aa_F F \cos(omt) \\
& + 4 \cdot JB \cos(bb_1)^2 aa_F \sin(omt) om \\
& + m_b R^2 \cos(omt)^2 om^2 \cos(bb_1) \sin(bb_1) \\
& + 2 \cdot m_b R e \cos(omt)^2 om^2 \sin(bb_1) \\
& + 2 \cdot m_b g_R \sin(bb_1) \cos(omt) \cos(aa) \\
& - 2 \cdot m_b g_R \cos(bb_1) \sin(aa) + 4 \cdot kb bb_1 \\
& + 2 \cdot m_b aa_F \sin(omt) om R \cos(bb_1) e \\
& + m_b R^2 \cos(omt)^2 \sin(bb_1) \cos(bb_1) bb_F I^2 \\
& + 4 \cdot JB om^2 \cos(bb_1) \sin(bb_1) + 4 \cdot JB aa_F \sin(omt) om \\
& - 4 \cdot aa_F^2 \sin(omt)^2 \sin(bb_1) JB \cos(bb_1) \\
& - 1 \cdot m_b R^2 aa_F^2 \sin(omt)^4 \sin(bb_1) \cos(bb_1) \\
& + m_b R^2 \cos(bb_1)^2 aa_F \sin(omt) om \\
& - 1 \cdot m_b R^2 \cos(bb_1) \sin(bb_1) bb_F I^2 \\
& + m_b R^2 \sin(bb_1) \sin(omt)^2 \cos(bb_1) bb_F I^2 \\
& - 1 \cdot m_b R^2 \cos(omt)^4 \sin(bb_1) aa_F^2 \cos(bb_1))) / (4 \cdot JB
\end{aligned}$$

$$\begin{aligned}
& + R^2 m_b \sin(\omega_m t)^2 \sin(bb_1)^2 + R^2 m_b \cos(bb_1)^2 \\
& + R^2 m_b \cos(\omega_m t)^2 \sin(bb_1)^2 \\
& + (1. \cos(bb_2) (4. JB aa_{FF} \cos(\omega_m t) - 4. JB aa_F \sin(\omega_m t) \omega_m - 2. m_b aa_F \sin(\omega_m t) \omega_m \\
& + m_b R^2 \sin(bb_2) aa_{F^2} \cos(\omega_m t)^2 \cos(bb_2) \\
& - 1. m_b R^2 aa_{F^2} \sin(\omega_m t)^4 \sin(bb_2) \cos(bb_2) \\
& - 2. m_b R^2 aa_{F^2} \sin(\omega_m t)^2 \sin(bb_2) \cos(\omega_m t)^2 \cos(bb_2) \\
& - 1. m_b R^2 \sin(\omega_m t)^3 \omega_m \cos(bb_2)^2 aa_F \\
& - 1. m_b R^2 \sin(\omega_m t) \omega_m \cos(bb_2)^2 aa_F \cos(\omega_m t)^2 \\
& - 2. m_b R e \sin(\omega_m t)^3 \omega_m aa_F \cos(bb_2) \\
& - 2. m_b R e \sin(\omega_m t) \omega_m aa_F \cos(\omega_m t)^2 \cos(bb_2) \\
& - 4. JB \sin(\omega_m t) \omega_m aa_F \cos(bb_2)^2 \\
& - 4. aa_{F^2} \sin(\omega_m t)^2 \sin(bb_2) JB \cos(bb_2) \\
& + 2. m_b R e \cos(\omega_m t)^2 \omega_m^2 \sin(bb_2) \\
& + m_b R^2 \sin(\omega_m t)^2 \omega_m^2 \cos(bb_2) \sin(bb_2) \\
& + 2. m_b R e \sin(\omega_m t)^2 \omega_m^2 \sin(bb_2) \\
& - 2. m_b g_R \sin(bb_2) \cos(\omega_m t) \cos(aa) \\
& - 2. m_b g_R \cos(bb_2) \sin(aa) + m_b R^2 aa_{FF} \sin(bb_2)^2 \cos(\omega_m t)^3 \\
& + m_b R^2 aa_{FF} \sin(bb_2)^2 \cos(\omega_m t) \sin(\omega_m t)^2
\end{aligned}$$

$$\begin{aligned}
& + 2 \cdot m_b aa_{FF} \cos(\omega_m t) R \cos(bb_2) e + R m_b l aa_{FF} \cos(bb_2) \\
& + m_b R \sin(bb_2) l aa_F^2 \cos(\omega_m t) \\
& + 2 \cdot m_b R \sin(bb_2) e \cos(\omega_m t)^2 aa_F^2 \\
& + m_b R^2 \sin(\omega_m t)^2 \sin(bb_2) \cos(bb_2) bb_F^2 \\
& + m_b R^2 \cos(\omega_m t) aa_{FF} \cos(bb_2)^2 \\
& + m_b R^2 \cos(\omega_m t)^2 \sin(bb_2) \cos(bb_2) bb_F^2 \\
& + m_b R^2 \cos(\omega_m t)^2 \omega_m^2 \cos(bb_2) \sin(bb_2) \\
& - 1 \cdot m_b R^2 \sin(\omega_m t) \omega_m aa_F \cos(bb_2)^2 \\
& + 4 \cdot JB aa_F \sin(\omega_m t) \sin(bb_2)^2 \omega_m + 4 \cdot kb bb_2 \\
& - 1 \cdot m_b R^2 aa_F^2 \cos(\omega_m t)^4 \sin(bb_2) \cos(bb_2) \\
& + 4 \cdot JB \omega_m^2 \cos(bb_2) \sin(bb_2)) / (4 \cdot JB + R^2 m_b \cos(\omega_m t)^2 \sin(bb_2)^2 \\
& + R^2 m_b \sin(\omega_m t)^2 \sin(bb_2)^2 + R^2 m_b \cos(bb_2)^2) + (\\
& - 2 \cdot aa_F bb_F l \cos(\omega_m t) + bb_F l^2) \sin(bb_l) \\
& + (2 \cdot \sin(bb_2) aa_F \cos(\omega_m t) + \sin(bb_2) bb_F 2) bb_F 2) m_b l + (\\
& - 2 \cdot \cos(bb_l) aa_F + 2 \cdot \cos(bb_2) aa_F) \sin(\omega_m t) m_b l \omega_m \\
& + \left(\left(\left((1 \cdot \cos(bb_2)^2 (4 \cdot JB aa_{FF} \cos(\omega_m t) - 4 \cdot JB aa_F \sin(\omega_m t) \omega_m \right. \right. \right. \right. \\
& - 2 \cdot m_b aa_F \sin(\omega_m t) \omega_m R \cos(bb_2) e \\
& - 1 \cdot m_b R^2 \cos(bb_2) \sin(bb_2) bb_F^2
\end{aligned}$$

$$\begin{aligned}
& + m_b R^2 \sin(bb_2) aa_F^2 \cos(om t)^2 \cos(bb_2) \\
& - 1. m_b R^2 aa_F^2 \sin(om t)^4 \sin(bb_2) \cos(bb_2) \\
& - 2. m_b R^2 aa_F^2 \sin(om t)^2 \sin(bb_2) \cos(om t)^2 \cos(bb_2) \\
& - 1. m_b R^2 \sin(om t)^3 om \cos(bb_2)^2 aa_F \\
& - 1. m_b R^2 \sin(om t) om \cos(bb_2)^2 aa_F \cos(om t)^2 \\
& - 2. m_b R e \sin(om t)^3 om aa_F \cos(bb_2) \\
& - 2. m_b R e \sin(om t) om aa_F \cos(om t)^2 \cos(bb_2) \\
& - 4. JB \sin(om t) om aa_F \cos(bb_2)^2 \\
& - 4. aa_F^2 \sin(om t)^2 \sin(bb_2) JB \cos(bb_2) \\
& + 2. m_b R e \cos(om t)^2 om^2 \sin(bb_2) \\
& + m_b R^2 \sin(om t)^2 om^2 \cos(bb_2) \sin(bb_2) \\
& + 2. m_b R e \sin(om t)^2 om^2 \sin(bb_2) \\
& - 2. m_b g_R \sin(bb_2) \cos(om t) \cos(aa) \\
& - 2. m_b g_R \cos(bb_2) \sin(aa) + m_b R^2 aa_FF \sin(bb_2)^2 \cos(om t)^3 \\
& + m_b R^2 aa_FF \sin(bb_2)^2 \cos(om t) \sin(om t)^2 \\
& + 2. m_b aa_FF \cos(om t) R \cos(bb_2) e + R m_b l aa_FF \cos(bb_2) \\
& + m_b R \sin(bb_2) l aa_F^2 \cos(om t) \\
& + 2. m_b R \sin(bb_2) e \cos(om t)^2 aa_F^2
\end{aligned}$$

$$\begin{aligned}
& + m_b R^2 \sin(\omega_m t)^2 \sin(bb_2) \cos(bb_2) bb_F 2^2 \\
& + m_b R^2 \cos(\omega_m t) aa_FF \cos(bb_2)^2 \\
& + m_b R^2 \cos(\omega_m t)^2 \sin(bb_2) \cos(bb_2) bb_F 2^2 \\
& + m_b R^2 \cos(\omega_m t)^2 \omega_m^2 \cos(bb_2) \sin(bb_2) \\
& - 1. m_b R^2 \sin(\omega_m t) \omega_m aa_F \cos(bb_2)^2 \\
& + 4. JB aa_F \sin(\omega_m t) \sin(bb_2)^2 \omega_m + 4. kb bb_2 \\
& - 1. m_b R^2 aa_F^2 \cos(\omega_m t)^4 \sin(bb_2) \cos(bb_2) \\
& + 4. JB \omega_m^2 \cos(bb_2) \sin(bb_2))) / (4. JB + R^2 m_b \cos(\omega_m t)^2 \sin(bb_2)^2 \\
& + R^2 m_b \sin(\omega_m t)^2 \sin(bb_2)^2 + R^2 m_b \cos(bb_2)^2) \\
& + (1. \sin(bb_2)^2 (4. JB aa_FF \cos(\omega_m t) - 4. JB aa_F \sin(\omega_m t) \omega_m - 2. m_b aa_F \sin(\omega_m t) \omega_m \\
& - 1. m_b R^2 aa_F^2 \sin(\omega_m t)^4 \sin(bb_2) \cos(bb_2) \\
& - 2. m_b R^2 aa_F^2 \sin(\omega_m t)^2 \sin(bb_2) \cos(\omega_m t)^2 \cos(bb_2) \\
& - 1. m_b R^2 \sin(\omega_m t)^3 \omega_m \cos(bb_2)^2 aa_F \\
& - 1. m_b R^2 \sin(\omega_m t) \omega_m \cos(bb_2)^2 aa_F \cos(\omega_m t)^2 \\
& - 2. m_b R e \sin(\omega_m t)^3 \omega_m aa_F \cos(bb_2) \\
& - 2. m_b R e \sin(\omega_m t) \omega_m aa_F \cos(\omega_m t)^2 \cos(bb_2) \\
& - 4. JB \sin(\omega_m t) \omega_m aa_F \cos(bb_2)^2 \\
& - 4. aa_F^2 \sin(\omega_m t)^2 \sin(bb_2) JB \cos(bb_2)
\end{aligned}$$

$$\begin{aligned}
& + 2 \cdot m_b R e \cos(om t)^2 om^2 \sin(bb_2) \\
& + m_b R^2 \sin(om t)^2 om^2 \cos(bb_2) \sin(bb_2) \\
& + 2 \cdot m_b R e \sin(om t)^2 om^2 \sin(bb_2) \\
& - 2 \cdot m_b g_- R \sin(bb_2) \cos(om t) \cos(aa) \\
& - 2 \cdot m_b g_- R \cos(bb_2) \sin(aa) + m_b R^2 aa_{FF} \sin(bb_2)^2 \cos(om t)^3 \\
& + m_b R^2 aa_{FF} \sin(bb_2)^2 \cos(om t) \sin(om t)^2 \\
& + 2 \cdot m_b aa_{FF} \cos(om t) R \cos(bb_2) e + R m_b l aa_{FF} \cos(bb_2) \\
& + m_b R \sin(bb_2) l aa_F^2 \cos(om t) \\
& + 2 \cdot m_b R \sin(bb_2) e \cos(om t)^2 aa_F^2 \\
& + m_b R^2 \sin(om t)^2 \sin(bb_2) \cos(bb_2) bb_F^2 \\
& + m_b R^2 \cos(om t) aa_{FF} \cos(bb_2)^2 \\
& + m_b R^2 \cos(om t)^2 \sin(bb_2) \cos(bb_2) bb_F^2 \\
& + m_b R^2 \cos(om t)^2 om^2 \cos(bb_2) \sin(bb_2) \\
& - 1 \cdot m_b R^2 \sin(om t) om aa_F \cos(bb_2)^2 \\
& + 4 \cdot JB aa_F \sin(om t) \sin(bb_2)^2 om + 4 \cdot kb bb_2 \\
& - 1 \cdot m_b R^2 aa_F^2 \cos(om t)^4 \sin(bb_2) \cos(bb_2) \\
& + 4 \cdot JB om^2 \cos(bb_2) \sin(bb_2) \cos(om t)^2 \Big) / (4 \cdot JB \\
& + R^2 m_b \cos(om t)^2 \sin(bb_2)^2 + R^2 m_b \sin(om t)^2 \sin(bb_2)^2
\end{aligned}$$

$$\begin{aligned}
& + R^2 m_b \cos(bb_2)^2 \big) \cos(om t) - (1. \cos(bb_1)^2 (\\
& - 4. JB aa_{FF} \cos(om t) + m_b R^2 \sin(om t) om \cos(bb_1)^2 \cos(om t)^2 aa_F \\
& - 2. m_b R^2 aa_F^2 \sin(om t)^2 \sin(bb_1) \cos(bb_1) \cos(om t)^2 \\
& + m_b R^2 \sin(om t)^3 om \cos(bb_1)^2 aa_F \\
& + 2. m_b R e \sin(om t)^3 om aa_F \cos(bb_1) \\
& - 1. m_b R^2 \cos(bb_1)^2 aa_{FF} \cos(om t) + R m_b l aa_{FF} \cos(bb_1) \\
& - 1. m_b R^2 \cos(om t)^3 \sin(bb_1)^2 aa_{FF} \\
& - 2. m_b aa_{FF} \cos(om t) R \cos(bb_1) e \\
& + 2. m_b R e \sin(om t) om \cos(bb_1) \cos(om t)^2 aa_F \\
& + m_b R^2 \sin(bb_1) aa_F^2 \cos(om t)^2 \cos(bb_1) \\
& - 4. JB aa_F \sin(om t) \sin(bb_1)^2 om \\
& - 1. m_b R \sin(bb_1) l aa_F^2 \cos(om t) \\
& + 2. m_b R \sin(bb_1) e \cos(om t)^2 aa_F^2 \\
& + m_b R^2 \sin(om t)^2 om^2 \cos(bb_1) \sin(bb_1) \\
& + 2. m_b R e \sin(om t)^2 om^2 \sin(bb_1) \\
& - 1. m_b R^2 \sin(bb_1)^2 \sin(om t)^2 aa_{FF} \cos(om t) \\
& + 4. JB \cos(bb_1)^2 aa_F \sin(om t) om \\
& + m_b R^2 \cos(om t)^2 om^2 \cos(bb_1) \sin(bb_1)
\end{aligned}$$

$$\begin{aligned}
& + 2 \cdot m_b R e \cos(om t)^2 om^2 \sin(bb_1) \\
& + 2 \cdot m_b g_- R \sin(bb_1) \cos(om t) \cos(aa) \\
& - 2 \cdot m_b g_- R \cos(bb_1) \sin(aa) + 4 \cdot kb bb_1 \\
& + 2 \cdot m_b aa_F \sin(om t) om R \cos(bb_1) e \\
& + m_b R^2 \cos(om t)^2 \sin(bb_1) \cos(bb_1) bb_F I^2 \\
& + 4 \cdot JB om^2 \cos(bb_1) \sin(bb_1) + 4 \cdot JB aa_F \sin(om t) om \\
& - 4 \cdot aa_F^2 \sin(om t)^2 \sin(bb_1) JB \cos(bb_1) \\
& - 1 \cdot m_b R^2 aa_F^2 \sin(om t)^4 \sin(bb_1) \cos(bb_1) \\
& + m_b R^2 \cos(bb_1)^2 aa_F \sin(om t) om \\
& - 1 \cdot m_b R^2 \cos(bb_1) \sin(bb_1) bb_F I^2 \\
& + m_b R^2 \sin(bb_1) \sin(om t)^2 \cos(bb_1) bb_F I^2 \\
& - 1 \cdot m_b R^2 \cos(om t)^4 \sin(bb_1) aa_F^2 \cos(bb_1) \cos(om t) \Big/ (4 \cdot JB \\
& + R^2 m_b \sin(om t)^2 \sin(bb_1)^2 + R^2 m_b \cos(bb_1)^2 \\
& + R^2 m_b \cos(om t)^2 \sin(bb_1)^2) + \left((-2 \cdot bb_F I^2 + (2 \cdot aa_F bb_F I \right. \\
& \left. + (2 \cdot bb_F I^2 - 2 \cdot aa_F bb_F I \cos(om t)) \cos(om t)) \cos(om t) \right) \\
& \cos(om t) \cos(bb_1) - (1 \cdot \cos(om t)^3 (-4 \cdot JB aa_F F \cos(om t) \\
& + m_b R^2 \sin(om t) om \cos(bb_1)^2 \cos(om t)^2 aa_F \\
& - 2 \cdot m_b R^2 aa_F^2 \sin(om t)^2 \sin(bb_1) \cos(bb_1) \cos(om t)^2
\end{aligned}$$

$$\begin{aligned}
& + m_b R^2 \sin(\omega t)^3 \omega m \cos(bb_I)^2 aa_F \\
& + 2. m_b R e \sin(\omega t)^3 \omega m aa_F \cos(bb_I) \\
& - 1. m_b R^2 \cos(bb_I)^2 aa_F F \cos(\omega t) + R m_b l aa_F F \cos(bb_I) \\
& - 1. m_b R^2 \cos(\omega t)^3 \sin(bb_I)^2 aa_F F \\
& - 2. m_b aa_F F \cos(\omega t) R \cos(bb_I) e \\
& + 2. m_b R e \sin(\omega t) \omega m \cos(bb_I) \cos(\omega t)^2 aa_F \\
& + m_b R^2 \sin(bb_I) aa_F^2 \cos(\omega t)^2 \cos(bb_I) \\
& - 4. J B aa_F \sin(\omega t) \sin(bb_I)^2 \omega m \\
& - 1. m_b R \sin(bb_I) l aa_F^2 \cos(\omega t) \\
& + 2. m_b R \sin(bb_I) e \cos(\omega t)^2 aa_F^2 \\
& + m_b R^2 \sin(\omega t)^2 \omega m^2 \cos(bb_I) \sin(bb_I) \\
& + 2. m_b R e \sin(\omega t)^2 \omega m^2 \sin(bb_I) \\
& - 1. m_b R^2 \sin(bb_I)^2 \sin(\omega t)^2 aa_F F \cos(\omega t) \\
& + 4. J B \cos(bb_I)^2 aa_F \sin(\omega t) \omega m \\
& + m_b R^2 \cos(\omega t)^2 \omega m^2 \cos(bb_I) \sin(bb_I) \\
& + 2. m_b R e \cos(\omega t)^2 \omega m^2 \sin(bb_I) \\
& + 2. m_b g_R \sin(bb_I) \cos(\omega t) \cos(aa) \\
& - 2. m_b g_R \cos(bb_I) \sin(aa) + 4. k b bb_I
\end{aligned}$$

$$\begin{aligned}
& + 2 \cdot m_b \cdot aa_F \sin(om t) \cdot om R \cos(bb_1) \cdot e \\
& + m_b R^2 \cos(om t)^2 \sin(bb_1) \cos(bb_1) \cdot bb_F \cdot I^2 \\
& + 4 \cdot JB \cdot om^2 \cos(bb_1) \sin(bb_1) + 4 \cdot JB \cdot aa_F \sin(om t) \cdot om \\
& - 4 \cdot aa_F^2 \sin(om t)^2 \sin(bb_1) \cdot JB \cos(bb_1) \\
& - 1 \cdot m_b R^2 \cdot aa_F^2 \sin(om t)^4 \sin(bb_1) \cos(bb_1) \\
& + m_b R^2 \cos(bb_1)^2 \cdot aa_F \sin(om t) \cdot om \\
& - 1 \cdot m_b R^2 \cos(bb_1) \sin(bb_1) \cdot bb_F \cdot I^2 \\
& + m_b R^2 \sin(bb_1) \sin(om t)^2 \cos(bb_1) \cdot bb_F \cdot I^2 \\
& - 1 \cdot m_b R^2 \cos(om t)^4 \sin(bb_1) \cdot aa_F^2 \cos(bb_1) \cdot \sin(bb_1) \Big/ (4 \cdot JB \\
& + R^2 m_b \sin(om t)^2 \sin(bb_1)^2 + R^2 m_b \cos(bb_1)^2 \\
& + R^2 m_b \cos(om t)^2 \sin(bb_1)^2) \cdot \sin(bb_1) \\
& + \left((1 \cdot \sin(bb_2)^2 \cos(om t) \cdot (4 \cdot JB \cdot aa_F F \cos(om t) \right. \\
& - 4 \cdot JB \cdot aa_F \sin(om t) \cdot om - 2 \cdot m_b \cdot aa_F \sin(om t) \cdot om R \cos(bb_2) \cdot e \\
& - 1 \cdot m_b R^2 \cos(bb_2) \sin(bb_2) \cdot bb_F \cdot I^2 \\
& + m_b R^2 \sin(bb_2) \cdot aa_F^2 \cos(om t)^2 \cos(bb_2) \\
& - 1 \cdot m_b R^2 \cdot aa_F^2 \sin(om t)^4 \sin(bb_2) \cos(bb_2) \\
& - 2 \cdot m_b R^2 \cdot aa_F^2 \sin(om t)^2 \sin(bb_2) \cos(om t)^2 \cos(bb_2) \\
& - 1 \cdot m_b R^2 \sin(om t)^3 \cdot om \cos(bb_2)^2 \cdot aa_F
\end{aligned}$$

$$\begin{aligned}
& -1. m_b R^2 \sin(om t) om \cos(bb_2)^2 aa_F \cos(om t)^2 \\
& -2. m_b R e \sin(om t)^3 om aa_F \cos(bb_2) \\
& -2. m_b R e \sin(om t) om aa_F \cos(om t)^2 \cos(bb_2) \\
& -4. JB \sin(om t) om aa_F \cos(bb_2)^2 \\
& -4. aa_F^2 \sin(om t)^2 \sin(bb_2) JB \cos(bb_2) \\
& +2. m_b R e \cos(om t)^2 om^2 \sin(bb_2) \\
& +m_b R^2 \sin(om t)^2 om^2 \cos(bb_2) \sin(bb_2) \\
& +2. m_b R e \sin(om t)^2 om^2 \sin(bb_2) \\
& -2. m_b g_R \sin(bb_2) \cos(om t) \cos(aa) \\
& -2. m_b g_R \cos(bb_2) \sin(aa) + m_b R^2 aa_FF \sin(bb_2)^2 \cos(om t)^3 \\
& +m_b R^2 aa_FF \sin(bb_2)^2 \cos(om t) \sin(om t)^2 \\
& +2. m_b aa_FF \cos(om t) R \cos(bb_2) e + R m_b l aa_FF \cos(bb_2) \\
& +m_b R \sin(bb_2) l aa_F^2 \cos(om t) \\
& +2. m_b R \sin(bb_2) e \cos(om t)^2 aa_F^2 \\
& +m_b R^2 \sin(om t)^2 \sin(bb_2) \cos(bb_2) bb_F_2^2 \\
& +m_b R^2 \cos(om t) aa_FF \cos(bb_2)^2 \\
& +m_b R^2 \cos(om t)^2 \sin(bb_2) \cos(bb_2) bb_F_2^2 \\
& +m_b R^2 \cos(om t)^2 om^2 \cos(bb_2) \sin(bb_2)
\end{aligned}$$

$$\begin{aligned}
& -1. m_b R^2 \sin(\omega_m t) \omega_m a_a F \cos(bb_2)^2 \\
& + 4. J B a_a F \sin(\omega_m t) \sin(bb_2)^2 \omega_m + 4. k_b b_b_2 \\
& - 1. m_b R^2 a_a F^2 \cos(\omega_m t)^4 \sin(bb_2) \cos(bb_2) \\
& + 4. J B \omega_m^2 \cos(bb_2) \sin(bb_2)) / (4. J B + R^2 m_b \cos(\omega_m t)^2 \sin(bb_2)^2 \\
& + R^2 m_b \sin(\omega_m t)^2 \sin(bb_2)^2 + R^2 m_b \cos(bb_2)^2) + \left((2. b_b F_l I^2 \right. \\
& \left. - 4. a_a F b_b F_l \cos(\omega_m t) \right) \cos(\omega_m t) \cos(bb_1) - (1. \cos(\omega_m t) (\\
& - 4. J B a_a F F \cos(\omega_m t) + m_b R^2 \sin(\omega_m t) \omega_m \cos(bb_1)^2 \cos(\omega_m t)^2 a_a F \\
& - 2. m_b R^2 a_a F^2 \sin(\omega_m t)^2 \sin(bb_1) \cos(bb_1) \cos(\omega_m t)^2 \\
& + m_b R^2 \sin(\omega_m t)^3 \omega_m \cos(bb_1)^2 a_a F \\
& + 2. m_b R e \sin(\omega_m t)^3 \omega_m a_a F \cos(bb_1) \\
& - 1. m_b R^2 \cos(bb_1)^2 a_a F F \cos(\omega_m t) + R m_b l a_a F F \cos(bb_1) \\
& - 1. m_b R^2 \cos(\omega_m t)^3 \sin(bb_1)^2 a_a F F \\
& - 2. m_b a_a F F \cos(\omega_m t) R \cos(bb_1) e \\
& + 2. m_b R e \sin(\omega_m t) \omega_m \cos(bb_1) \cos(\omega_m t)^2 a_a F \\
& + m_b R^2 \sin(bb_1) a_a F^2 \cos(\omega_m t)^2 \cos(bb_1) \\
& - 4. J B a_a F \sin(\omega_m t) \sin(bb_1)^2 \omega_m \\
& - 1. m_b R \sin(bb_1) l a_a F^2 \cos(\omega_m t) \\
& + 2. m_b R \sin(bb_1) e \cos(\omega_m t)^2 a_a F^2
\end{aligned}$$

$$\begin{aligned}
& + m_b R^2 \sin(om t)^2 om^2 \cos(bb_1) \sin(bb_1) \\
& + 2. m_b R e \sin(om t)^2 om^2 \sin(bb_1) \\
& - 1. m_b R^2 \sin(bb_1)^2 \sin(om t)^2 aa_FF \cos(om t) \\
& + 4. JB \cos(bb_1)^2 aa_F \sin(om t) om \\
& + m_b R^2 \cos(om t)^2 om^2 \cos(bb_1) \sin(bb_1) \\
& + 2. m_b R e \cos(om t)^2 om^2 \sin(bb_1) \\
& + 2. m_b g_R \sin(bb_1) \cos(om t) \cos(aa) \\
& - 2. m_b g_R \cos(bb_1) \sin(aa) + 4. kb bb_1 \\
& + 2. m_b aa_F \sin(om t) om R \cos(bb_1) e \\
& + m_b R^2 \cos(om t)^2 \sin(bb_1) \cos(bb_1) bb_F_I^2 \\
& + 4. JB om^2 \cos(bb_1) \sin(bb_1) + 4. JB aa_F \sin(om t) om \\
& - 4. aa_F^2 \sin(om t)^2 \sin(bb_1) JB \cos(bb_1) \\
& - 1. m_b R^2 aa_F^2 \sin(om t)^4 \sin(bb_1) \cos(bb_1) \\
& + m_b R^2 \cos(bb_1)^2 aa_F \sin(om t) om \\
& - 1. m_b R^2 \cos(bb_1) \sin(bb_1) bb_F_I^2 \\
& + m_b R^2 \sin(bb_1) \sin(om t)^2 \cos(bb_1) bb_F_I^2 \\
& - 1. m_b R^2 \cos(om t)^4 \sin(bb_1) aa_F^2 \cos(bb_1) \sin(bb_1) \Big) / (4. JB \\
& + R^2 m_b \sin(om t)^2 \sin(bb_1)^2 + R^2 m_b \cos(bb_1)^2
\end{aligned}$$

$$\begin{aligned}
& + R^2 m_b \cos(\omega_m t)^2 \sin(bb_1)^2)) \sin(bb_1) \\
& - 2. \sin(\omega_m t)^2 \sin(bb_1) aa_F \cos(bb_1) bb_F_1 \) \sin(\omega_m t)^2 \\
& + ((2. aa_F \cos(bb_2) \sin(bb_2) \\
& - 2. aa_F \sin(bb_2) \cos(\omega_m t)^2 \cos(bb_2)) \cos(\omega_m t)^2 + (\\
& - 4. aa_F \sin(bb_2) \cos(\omega_m t)^2 \cos(bb_2) \\
& - 2. \sin(\omega_m t)^2 \sin(bb_2) aa_F \cos(bb_2)) \sin(\omega_m t)^2 \\
& + ((2. \cos(bb_2) \sin(bb_2) \\
& - 2. \cos(\omega_m t)^2 \sin(bb_2) \cos(bb_2)) \cos(\omega_m t) \\
& - 2. \cos(\omega_m t) \cos(bb_2) \sin(\omega_m t)^2 \sin(bb_2)) bb_F_2 \) bb_F_2 \) m_b \\
& + (((2. \cos(bb_2)^2 aa_F \cos(\omega_m t) + (-1. bb_F_1 + (2. aa_F \\
& + bb_F_1 \cos(\omega_m t)) \cos(\omega_m t)) \cos(bb_1)^2 \\
& - 2. \sin(bb_1)^2 bb_F_1 \cos(\omega_m t)^2 + (-2. \sin(bb_1)^2 bb_F_1 \\
& + \cos(bb_1)^2 bb_F_1) \sin(\omega_m t)^2) \sin(\omega_m t) + (\cos(bb_2)^2 \\
& + (2. \sin(bb_2)^2 - 1. \cos(bb_2)^2) \cos(\omega_m t)^2 + (2. \sin(bb_2)^2 \\
& - 1. \cos(bb_2)^2) \sin(\omega_m t)^2) \sin(\omega_m t) bb_F_2 \) m_b \\
& + (\cos(\omega_m t)^3 \cos(bb_1) \sin(bb_1) - 1. \cos(\omega_m t)^3 \cos(bb_2) \sin(bb_2) \\
& + (-1. \cos(\omega_m t) \sin(bb_2) \cos(bb_2) \\
& + \cos(\omega_m t) \sin(bb_1) \cos(bb_1)) \sin(\omega_m t)^2) m_b \omega_m) \omega_m) R \) R
\end{aligned}$$

$$\begin{aligned}
& + \left(\left(\left(- (2. \cos(bb_1) (-4. JB aa_FF \cos(om t) \right. \right. \right. \right. \\
& \quad \left. \left. \left. \left. + m_b R^2 \sin(om t) om \cos(bb_1)^2 \cos(om t)^2 aa_F \right. \right. \right. \right. \\
& \quad \left. \left. \left. \left. - 2. m_b R^2 aa_F^2 \sin(om t)^2 \sin(bb_1) \cos(bb_1) \cos(om t)^2 \right. \right. \right. \right. \\
& \quad \left. \left. \left. \left. + m_b R^2 \sin(om t)^3 om \cos(bb_1)^2 aa_F \right. \right. \right. \right. \\
& \quad \left. \left. \left. \left. + 2. m_b R e \sin(om t)^3 om aa_F \cos(bb_1) \right. \right. \right. \right. \\
& \quad \left. \left. \left. \left. - 1. m_b R^2 \cos(bb_1)^2 aa_FF \cos(om t) + R m_b l aa_FF \cos(bb_1) \right. \right. \right. \right. \\
& \quad \left. \left. \left. \left. - 1. m_b R^2 \cos(om t)^3 \sin(bb_1)^2 aa_FF \right. \right. \right. \right. \\
& \quad \left. \left. \left. \left. - 2. m_b aa_FF \cos(om t) R \cos(bb_1) e \right. \right. \right. \right. \\
& \quad \left. \left. \left. \left. + 2. m_b R e \sin(om t) om \cos(bb_1) \cos(om t)^2 aa_F \right. \right. \right. \right. \\
& \quad \left. \left. \left. \left. + m_b R^2 \sin(bb_1) aa_F^2 \cos(om t)^2 \cos(bb_1) \right. \right. \right. \right. \\
& \quad \left. \left. \left. \left. - 4. JB aa_F \sin(om t) \sin(bb_1)^2 om \right. \right. \right. \right. \\
& \quad \left. \left. \left. \left. - 1. m_b R \sin(bb_1) l aa_F^2 \cos(om t) \right. \right. \right. \right. \\
& \quad \left. \left. \left. \left. + 2. m_b R \sin(bb_1) e \cos(om t)^2 aa_F^2 \right. \right. \right. \right. \\
& \quad \left. \left. \left. \left. + m_b R^2 \sin(om t)^2 om^2 \cos(bb_1) \sin(bb_1) \right. \right. \right. \right. \\
& \quad \left. \left. \left. \left. + 2. m_b R e \sin(om t)^2 om^2 \sin(bb_1) \right. \right. \right. \right. \\
& \quad \left. \left. \left. \left. - 1. m_b R^2 \sin(bb_1)^2 \sin(om t)^2 aa_FF \cos(om t) \right. \right. \right. \right. \\
& \quad \left. \left. \left. \left. + 4. JB \cos(bb_1)^2 aa_F \sin(om t) om \right. \right. \right. \right. \\
& \quad \left. \left. \left. \left. + m_b R^2 \cos(om t)^2 om^2 \cos(bb_1) \sin(bb_1) \right. \right. \right. \right.
\end{aligned}$$

$$\begin{aligned}
& + 2 \cdot m_b R e \cos(om t)^2 om^2 \sin(bb_1) \\
& + 2 \cdot m_b g_- R \sin(bb_1) \cos(om t) \cos(aa) \\
& - 2 \cdot m_b g_- R \cos(bb_1) \sin(aa) + 4 \cdot kb bb_1 \\
& + 2 \cdot m_b aa_F \sin(om t) om R \cos(bb_1) e \\
& + m_b R^2 \cos(om t)^2 \sin(bb_1) \cos(bb_1) bb_F I^2 \\
& + 4 \cdot JB om^2 \cos(bb_1) \sin(bb_1) + 4 \cdot JB aa_F \sin(om t) om \\
& - 4 \cdot aa_F^2 \sin(om t)^2 \sin(bb_1) JB \cos(bb_1) \\
& - 1 \cdot m_b R^2 aa_F^2 \sin(om t)^4 \sin(bb_1) \cos(bb_1) \\
& + m_b R^2 \cos(bb_1)^2 aa_F \sin(om t) om \\
& - 1 \cdot m_b R^2 \cos(bb_1) \sin(bb_1) bb_F I^2 \\
& + m_b R^2 \sin(bb_1) \sin(om t)^2 \cos(bb_1) bb_F I^2 \\
& - 1 \cdot m_b R^2 \cos(om t)^4 \sin(bb_1) aa_F^2 \cos(bb_1) \cos(om t) \Big) / (4 \cdot JB \\
& + R^2 m_b \sin(om t)^2 \sin(bb_1)^2 + R^2 m_b \cos(bb_1)^2 \\
& + R^2 m_b \cos(om t)^2 \sin(bb_1)^2) \\
& + (2 \cdot \cos(bb_2) (4 \cdot JB aa_FF \cos(om t) - 4 \cdot JB aa_F \sin(om t) om - 2 \cdot m_b aa_F \sin(om t) om \\
& + m_b R^2 \sin(bb_2) aa_F^2 \cos(om t)^2 \cos(bb_2) \\
& - 1 \cdot m_b R^2 aa_F^2 \sin(om t)^4 \sin(bb_2) \cos(bb_2) \\
& - 2 \cdot m_b R^2 aa_F^2 \sin(om t)^2 \sin(bb_2) \cos(om t)^2 \cos(bb_2) \\
& - 1 \cdot m_b R^2 \sin(om t)^3 om \cos(bb_2)^2 aa_F \\
& - 1 \cdot m_b R^2 \sin(om t) om \cos(bb_2)^2 aa_F \cos(om t)^2 \\
& - 2 \cdot m_b R e \sin(om t)^3 om aa_F \cos(bb_2) \\
& - 2 \cdot m_b R e \sin(om t) om aa_F \cos(om t)^2 \cos(bb_2)
\end{aligned}$$

$$\begin{aligned}
& -4. JB \sin(om t) om aa_F \cos(bb_2)^2 \\
& -4. aa_F^2 \sin(om t)^2 \sin(bb_2) JB \cos(bb_2) \\
& +2. m_b R e \cos(om t)^2 om^2 \sin(bb_2) \\
& +m_b R^2 \sin(om t)^2 om^2 \cos(bb_2) \sin(bb_2) \\
& +2. m_b R e \sin(om t)^2 om^2 \sin(bb_2) \\
& -2. m_b g_R \sin(bb_2) \cos(om t) \cos(aa) \\
& -2. m_b g_R \cos(bb_2) \sin(aa) + m_b R^2 aa_FF \sin(bb_2)^2 \cos(om t)^3 \\
& +m_b R^2 aa_FF \sin(bb_2)^2 \cos(om t) \sin(om t)^2 \\
& +2. m_b aa_FF \cos(om t) R \cos(bb_2) e + R m_b l aa_FF \cos(bb_2) \\
& +m_b R \sin(bb_2) l aa_F^2 \cos(om t) \\
& +2. m_b R \sin(bb_2) e \cos(om t)^2 aa_F^2 \\
& +m_b R^2 \sin(om t)^2 \sin(bb_2) \cos(bb_2) bb_F_2^2 \\
& +m_b R^2 \cos(om t) aa_FF \cos(bb_2)^2 \\
& +m_b R^2 \cos(om t)^2 \sin(bb_2) \cos(bb_2) bb_F_2^2 \\
& +m_b R^2 \cos(om t)^2 om^2 \cos(bb_2) \sin(bb_2) \\
& -1. m_b R^2 \sin(om t) om aa_F \cos(bb_2)^2 \\
& +4. JB aa_F \sin(om t) \sin(bb_2)^2 om + 4. kb bb_2 \\
& -1. m_b R^2 aa_F^2 \cos(om t)^4 \sin(bb_2) \cos(bb_2) \\
& +4. JB om^2 \cos(bb_2) \sin(bb_2)) \cos(om t) \Big/ (4. JB \\
& +R^2 m_b \cos(om t)^2 \sin(bb_2)^2 + R^2 m_b \sin(om t)^2 \sin(bb_2)^2 \\
& +R^2 m_b \cos(bb_2)^2) + (-2. bb_F_I^2 \\
& +4. aa_F bb_F_I \cos(om t)) \cos(om t) \sin(bb_1) \\
& +(4. \sin(bb_2) aa_F \cos(om t)^2 \\
& +2. \sin(bb_2) \cos(om t) bb_F_2) bb_F_2 m_b \\
& +((8. aa_F \cos(om t) \cos(bb_2) + (-2. bb_F_I + (8. aa_F \\
& +2. bb_F_I \cos(om t)) \cos(om t)) \cos(bb_1) \\
& +2. \sin(om t)^2 \cos(bb_1) bb_F_I) \sin(om t) + (-2. \cos(om t)^2 \cos(bb_2) \\
& +2. \cos(bb_2) - 2. \cos(bb_2) \sin(om t)^2) \sin(om t) bb_F_2) m_b + \\
& -2. \cos(om t)^3 \sin(bb_2) + 2. \cos(om t)^3 \sin(bb_1) \\
& +(2. \cos(om t) \sin(bb_1) - 2. \sin(bb_2) \cos(om t)) \sin(om t)^2) m_b om \\
& om) R + 16. m_b \sin(om t) om aa_F \cos(om t) e) e) \Big) \Big/ (16. JT \\
& +(32. \cos(om t)^2 + (16. \sin(bb_2)^2 + 16. \sin(bb_1)^2) \sin(om t)^2) JB \\
& +(8. m_b + m_t) l^2 + ((-8. \cos(om t) \cos(bb_1) \\
& +8. \cos(om t) \cos(bb_2)) m_b l + ((4. \cos(bb_2)^2 \\
& +4. \cos(om t)^2 \sin(bb_2)^2) \cos(om t)^2 + 4. \cos(bb_1)^2 \cos(om t)^2
\end{aligned}$$

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+ 4. cos(om t)4 sin(bb_1)2 + ( 8. cos(om t)2 sin(bb_2)2
+ 8. sin(bb_1)2 cos(om t)2 + ( 4. sin(bb_2)2 + 4. sin(bb_1)2 ) sin(om t)2)
sin(om t)2 ) m_b R + ( ( 16. cos(om t)2 cos(bb_1)
+ 16. cos(om t)2 cos(bb_2) ) m_b R + 32. m_b cos(om t)2 e ) e)
> `starting length` = length(%), `converting to horner` =
length(convert(%,<horner>)), factoring=length(factor(%));
starting length = 32476, converting to horner = 55613, factoring = 173263 (14.3.3.5)
> T3_eq_rho[full] := collect(T3_eq_rho[full], aa_FF);
T3_eq_rhofull := 
$$4 \cdot \left( \begin{array}{l} (4 \cdot (m_b R^2 \cos(\text{om t}) \cos(\text{bb}_2)^2 \\ + m_b R^2 \sin(\text{bb}_2)^2 \cos(\text{om t})^3 + 2 \cdot m_b \cos(\text{om t}) R \cos(\text{bb}_2) e \\ + R m_b l \cos(\text{bb}_2) + 4 \cdot JB \cos(\text{om t}) \\ + m_b R^2 \sin(\text{bb}_2)^2 \cos(\text{om t}) \sin(\text{om t})^2)) / (4 \cdot JB \\ + R^2 m_b \cos(\text{om t})^2 \sin(\text{bb}_2)^2 + R^2 m_b \sin(\text{om t})^2 \sin(\text{bb}_2)^2 \\ + R^2 m_b \cos(\text{bb}_2)^2) - (4 \cdot (-4 \cdot JB \cos(\text{om t}) \\ - 1 \cdot m_b R^2 \sin(\text{bb}_1)^2 \sin(\text{om t})^2 \cos(\text{om t}) \\ - 1 \cdot m_b R^2 \cos(\text{bb}_1)^2 \cos(\text{om t}) - 1 \cdot m_b R^2 \cos(\text{om t})^3 \sin(\text{bb}_1)^2 \\ - 2 \cdot m_b \cos(\text{om t}) R \cos(\text{bb}_1) e + R m_b l \cos(\text{bb}_1))) / (4 \cdot JB \\ + R^2 m_b \sin(\text{om t})^2 \sin(\text{bb}_1)^2 + R^2 m_b \cos(\text{bb}_1)^2 \\ + R^2 m_b \cos(\text{om t})^2 \sin(\text{bb}_1)^2) ) \cos(\text{om t}) JB \\ + \left( \begin{array}{l} (1 \cdot \cos(\text{bb}_2) (m_b R^2 \cos(\text{om t}) \cos(\text{bb}_2)^2 \\ + m_b R^2 \sin(\text{bb}_2)^2 \cos(\text{om t})^3 + 2 \cdot m_b \cos(\text{om t}) R \cos(\text{bb}_2) e \\ + R m_b l \cos(\text{bb}_2) + 4 \cdot JB \cos(\text{om t}) \\ + R m_b l \cos(\text{bb}_2) + 4 \cdot JB \cos(\text{om t}) \\ + R m_b l \cos(\text{bb}_2) + 4 \cdot JB \cos(\text{om t})) \end{array} \right) \end{array} \right)$$

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$$\begin{aligned}
& + m_b R^2 \sin(bb_2)^2 \cos(om t) \sin(om t)^2)) / (4. JB \\
& + R^2 m_b \cos(om t)^2 \sin(bb_2)^2 + R^2 m_b \sin(om t)^2 \sin(bb_2)^2 \\
& + R^2 m_b \cos(bb_2)^2) + (1. \cos(bb_1) (-4. JB \cos(om t) \\
& - 1. m_b R^2 \sin(bb_1)^2 \sin(om t)^2 \cos(om t) \\
& - 1. m_b R^2 \cos(bb_1)^2 \cos(om t) - 1. m_b R^2 \cos(om t)^3 \sin(bb_1)^2 \\
& - 2. m_b \cos(om t) R \cos(bb_1) e + R m_b l \cos(bb_1))) / (4. JB \\
& + R^2 m_b \sin(om t)^2 \sin(bb_1)^2 + R^2 m_b \cos(bb_1)^2 \\
& + R^2 m_b \cos(om t)^2 \sin(bb_1)^2) m_b l \\
& + \left((1. \cos(bb_2)^2 (m_b R^2 \cos(om t) \cos(bb_2)^2 \right. \\
& \left. + m_b R^2 \sin(bb_2)^2 \cos(om t)^3 + 2. m_b \cos(om t) R \cos(bb_2) e \right. \\
& \left. + R m_b l \cos(bb_2) + 4. JB \cos(om t) \right. \\
& \left. + m_b R^2 \sin(bb_2)^2 \cos(om t) \sin(om t)^2)) / (4. JB \right. \\
& \left. + R^2 m_b \cos(om t)^2 \sin(bb_2)^2 + R^2 m_b \sin(om t)^2 \sin(bb_2)^2 \right. \\
& \left. + R^2 m_b \cos(bb_2)^2) + (1. \sin(bb_2)^2 (m_b R^2 \cos(om t) \cos(bb_2)^2 \right. \\
& \left. + m_b R^2 \sin(bb_2)^2 \cos(om t)^3 + 2. m_b \cos(om t) R \cos(bb_2) e \right. \\
& \left. + R m_b l \cos(bb_2) + 4. JB \cos(om t) \right. \\
& \left. + m_b R^2 \sin(bb_2)^2 \cos(om t) \sin(om t)^2) \cos(om t)^2) / (4. JB \right. \\
& \left. + R^2 m_b \cos(om t)^2 \sin(bb_2)^2 + R^2 m_b \sin(om t)^2 \sin(bb_2)^2 \right)
\end{aligned}$$

$$\begin{aligned}
& + R^2 m_b \cos(bb_2)^2 \big) \cos(om t) - (1. \cos(bb_1)^2 (-4. JB \cos(om t) \\
& - 1. m_b R^2 \sin(bb_1)^2 \sin(om t)^2 \cos(om t) \\
& - 1. m_b R^2 \cos(bb_1)^2 \cos(om t) - 1. m_b R^2 \cos(om t)^3 \sin(bb_1)^2 \\
& - 2. m_b \cos(om t) R \cos(bb_1) e + R m_b l \cos(bb_1) \big) \cos(om t) \big) / (4. JB \\
& + R^2 m_b \sin(om t)^2 \sin(bb_1)^2 + R^2 m_b \cos(bb_1)^2 \\
& + R^2 m_b \cos(om t)^2 \sin(bb_1)^2) - (1. \cos(om t)^3 (-4. JB \cos(om t) \\
& - 1. m_b R^2 \sin(bb_1)^2 \sin(om t)^2 \cos(om t) \\
& - 1. m_b R^2 \cos(bb_1)^2 \cos(om t) - 1. m_b R^2 \cos(om t)^3 \sin(bb_1)^2 \\
& - 2. m_b \cos(om t) R \cos(bb_1) e + R m_b l \cos(bb_1) \big) \sin(bb_1)^2 \big) / \\
& (4. JB + R^2 m_b \sin(om t)^2 \sin(bb_1)^2 + R^2 m_b \cos(bb_1)^2 \\
& + R^2 m_b \cos(om t)^2 \sin(bb_1)^2) \\
& + \left((1. \sin(bb_2)^2 \cos(om t) (m_b R^2 \cos(om t) \cos(bb_2)^2 \right. \\
& \left. + m_b R^2 \sin(bb_2)^2 \cos(om t)^3 + 2. m_b \cos(om t) R \cos(bb_2) e \right. \\
& \left. + R m_b l \cos(bb_2) + 4. JB \cos(om t) \right. \\
& \left. + m_b R^2 \sin(bb_2)^2 \cos(om t) \sin(om t)^2 \right) \big) / (4. JB \\
& + R^2 m_b \cos(om t)^2 \sin(bb_2)^2 + R^2 m_b \sin(om t)^2 \sin(bb_2)^2 \\
& + R^2 m_b \cos(bb_2)^2) - (1. \cos(om t) (-4. JB \cos(om t) \\
& - 1. m_b R^2 \sin(bb_1)^2 \sin(om t)^2 \cos(om t)
\end{aligned}$$

$$\begin{aligned}
& -1. m_b R^2 \cos(bb_1)^2 \cos(om t) - 1. m_b R^2 \cos(om t)^3 \sin(bb_1)^2 \\
& - 2. m_b \cos(om t) R \cos(bb_1) e + R m_b l \cos(bb_1) \sin(bb_1)^2 \Big) / \\
& (4. JB + R^2 m_b \sin(om t)^2 \sin(bb_1)^2 + R^2 m_b \cos(bb_1)^2 \\
& + R^2 m_b \cos(om t)^2 \sin(bb_1)^2) \sin(om t)^2) m_b R) R \\
& + \left((2. \cos(bb_2) (m_b R^2 \cos(om t) \cos(bb_2)^2 \right. \\
& \left. + m_b R^2 \sin(bb_2)^2 \cos(om t)^3 + 2. m_b \cos(om t) R \cos(bb_2) e \right. \\
& \left. + R m_b l \cos(bb_2) + 4. JB \cos(om t) \right. \\
& \left. + m_b R^2 \sin(bb_2)^2 \cos(om t) \sin(om t)^2) \cos(om t) \right) / (4. JB \\
& + R^2 m_b \cos(om t)^2 \sin(bb_2)^2 + R^2 m_b \sin(om t)^2 \sin(bb_2)^2 \\
& + R^2 m_b \cos(bb_2)^2) - (2. \cos(bb_1) (-4. JB \cos(om t) \\
& - 1. m_b R^2 \sin(bb_1)^2 \sin(om t)^2 \cos(om t) \\
& - 1. m_b R^2 \cos(bb_1)^2 \cos(om t) - 1. m_b R^2 \cos(om t)^3 \sin(bb_1)^2 \\
& - 2. m_b \cos(om t) R \cos(bb_1) e + R m_b l \cos(bb_1) \cos(om t)) / (4. JB \\
& + R^2 m_b \sin(om t)^2 \sin(bb_1)^2 + R^2 m_b \cos(bb_1)^2 \\
& + R^2 m_b \cos(om t)^2 \sin(bb_1)^2) m_b R e) aa_FF) \Big) / (16. JT \\
& + (32. \cos(om t)^2 + (16. \sin(bb_2)^2 + 16. \sin(bb_1)^2) \sin(om t)^2) JB \\
& + (8. m_b + m_t) l^2 + ((-8. \cos(om t) \cos(bb_1) \\
& + 8. \cos(om t) \cos(bb_2)) m_b l + ((4. \cos(bb_2)^2 \\
& + 4. \cos(om t)^2 \sin(bb_2)^2) \cos(om t)^2 + 4. \cos(bb_1)^2 \cos(om t)^2 \\
& + 4. \cos(om t)^4 \sin(bb_1)^2 + (8. \cos(om t)^2 \sin(bb_2)^2 \\
& + 8. \sin(bb_1)^2 \cos(om t)^2 + (4. \sin(bb_2)^2 + 4. \sin(bb_1)^2) \sin(om t)^2) \\
& \sin(om t)^2) m_b R) R + ((16. \cos(om t)^2 \cos(bb_1) \\
& + 16. \cos(om t)^2 \cos(bb_2)) m_b R + 32. m_b \cos(om t)^2 e) e) + \left(4. \left(\right. \right. \\
& \left. \left. - 4. ka aa + \left(\left(4. (-4. JB aa_F \sin(om t) om \right. \right. \right. \right. \right. \\
\end{aligned}$$

$$\begin{aligned}
& -2 \cdot m_b aa_F \sin(om t) om R \cos(bb_2) e \\
& -1 \cdot m_b R^2 \cos(bb_2) \sin(bb_2) bb_F 2^2 \\
& + m_b R^2 \sin(bb_2) aa_F^2 \cos(om t)^2 \cos(bb_2) \\
& -1 \cdot m_b R^2 aa_F^2 \sin(om t)^4 \sin(bb_2) \cos(bb_2) \\
& -2 \cdot m_b R^2 aa_F^2 \sin(om t)^2 \sin(bb_2) \cos(om t)^2 \cos(bb_2) \\
& -1 \cdot m_b R^2 \sin(om t)^3 om \cos(bb_2)^2 aa_F \\
& -1 \cdot m_b R^2 \sin(om t) om \cos(bb_2)^2 aa_F \cos(om t)^2 \\
& -2 \cdot m_b R e \sin(om t)^3 om aa_F \cos(bb_2) \\
& -2 \cdot m_b R e \sin(om t) om aa_F \cos(om t)^2 \cos(bb_2) \\
& -4 \cdot JB \sin(om t) om aa_F \cos(bb_2)^2 \\
& -4 \cdot aa_F^2 \sin(om t)^2 \sin(bb_2) JB \cos(bb_2) \\
& + 2 \cdot m_b R e \cos(om t)^2 om^2 \sin(bb_2) \\
& + m_b R^2 \sin(om t)^2 om^2 \cos(bb_2) \sin(bb_2) \\
& + 2 \cdot m_b R e \sin(om t)^2 om^2 \sin(bb_2) \\
& -2 \cdot m_b g_- R \sin(bb_2) \cos(om t) \cos(aa) \\
& -2 \cdot m_b g_- R \cos(bb_2) \sin(aa) + m_b R \sin(bb_2) l aa_F^2 \cos(om t) \\
& + 2 \cdot m_b R \sin(bb_2) e \cos(om t)^2 aa_F^2 \\
& + m_b R^2 \sin(om t)^2 \sin(bb_2) \cos(bb_2) bb_F 2^2
\end{aligned}$$

$$\begin{aligned}
& + m_b R^2 \cos(\text{om } t)^2 \sin(bb_2) \cos(bb_2) bb_F_2^2 \\
& + m_b R^2 \cos(\text{om } t)^2 \text{om}^2 \cos(bb_2) \sin(bb_2) \\
& - 1. m_b R^2 \sin(\text{om } t) \text{om} aa_F \cos(bb_2)^2 \\
& + 4. JB aa_F \sin(\text{om } t) \sin(bb_2)^2 \text{om} + 4. kb bb_2 \\
& - 1. m_b R^2 aa_F^2 \cos(\text{om } t)^4 \sin(bb_2) \cos(bb_2) \\
& + 4. JB \text{om}^2 \cos(bb_2) \sin(bb_2))) / (4. JB + R^2 m_b \cos(\text{om } t)^2 \sin(bb_2)^2 \\
& + R^2 m_b \sin(\text{om } t)^2 \sin(bb_2)^2 + R^2 m_b \cos(bb_2)^2) \\
& - (4. (m_b R^2 \sin(\text{om } t) \text{om} \cos(bb_1)^2 \cos(\text{om } t)^2 aa_F - 2. m_b R^2 aa_F^2 \sin(\text{om } t)^2 \sin(bb_1) \\
& + 2. m_b R e \sin(\text{om } t) \text{om} \cos(bb_1) \cos(\text{om } t)^2 aa_F \\
& + m_b R^2 \sin(bb_1) aa_F^2 \cos(\text{om } t)^2 \cos(bb_1) \\
& - 4. JB aa_F \sin(\text{om } t) \sin(bb_1)^2 \text{om} \\
& - 1. m_b R \sin(bb_1) l aa_F^2 \cos(\text{om } t) \\
& + 2. m_b R \sin(bb_1) e \cos(\text{om } t)^2 aa_F^2 \\
& + m_b R^2 \sin(\text{om } t)^2 \text{om}^2 \cos(bb_1) \sin(bb_1) \\
& + 2. m_b R e \sin(\text{om } t)^2 \text{om}^2 \sin(bb_1) + 4. JB \cos(bb_1)^2 aa_F \sin(\text{om } t) \text{om} \\
& + m_b R^2 \cos(\text{om } t)^2 \text{om}^2 \cos(bb_1) \sin(bb_1) \\
& + 2. m_b R e \cos(\text{om } t)^2 \text{om}^2 \sin(bb_1) \\
& + 2. m_b g_R \sin(bb_1) \cos(\text{om } t) \cos(aa)
\end{aligned}$$

$$\begin{aligned}
& -2 \cdot m_b g_R \cos(bb_1) \sin(aa) + 4 \cdot kb bb_1 \\
& + 2 \cdot m_b aa_F \sin(om t) om R \cos(bb_1) e \\
& + m_b R^2 \cos(om t)^2 \sin(bb_1) \cos(bb_1) bb_F I^2 \\
& + 4 \cdot JB om^2 \cos(bb_1) \sin(bb_1) + 4 \cdot JB aa_F \sin(om t) om \\
& - 4 \cdot aa_F^2 \sin(om t)^2 \sin(bb_1) JB \cos(bb_1) \\
& - 1 \cdot m_b R^2 aa_F^2 \sin(om t)^4 \sin(bb_1) \cos(bb_1) \\
& + m_b R^2 \cos(bb_1)^2 aa_F \sin(om t) om \\
& - 1 \cdot m_b R^2 \cos(bb_1) \sin(bb_1) bb_F I^2 \\
& + m_b R^2 \sin(bb_1) \sin(om t)^2 \cos(bb_1) bb_F I^2 \\
& - 1 \cdot m_b R^2 \cos(om t)^4 \sin(bb_1) aa_F^2 \cos(bb_1))) / (4 \cdot JB \\
& + R^2 m_b \sin(om t)^2 \sin(bb_1)^2 + R^2 m_b \cos(bb_1)^2 \\
& + R^2 m_b \cos(om t)^2 \sin(bb_1)^2) \cos(om t) \\
& - 8 \cdot \sin(om t)^2 \sin(bb_1) aa_F \cos(bb_1) bb_F I \\
& - 8 \cdot \sin(om t)^2 \sin(bb_2) aa_F \cos(bb_2) bb_F 2) JB + (4 \cdot m_b g_ \sin(aa) \\
& + m_t g_ \sin(aa)) l + ((-4 \cdot bb_F I + (16 \\
& - 8 \cdot \sin(bb_2)^2) aa_F \cos(om t) + 4 \cdot \cos(bb_1)^2 bb_F I + (-4 \cdot bb_F I \\
& - 8 \cdot aa_F \cos(om t)) \sin(bb_1)^2) \sin(om t) + (-4 \cdot \cos(bb_2)^2 + 4 \\
& + 4 \cdot \sin(bb_2)^2) \sin(om t) bb_F 2) JB + (
\end{aligned}$$

$$\begin{aligned}
& -4 \cdot \cos(om t) \sin(bb_2) \cos(bb_2) + 4 \cdot \cos(om t) \sin(bb_1) \cos(bb_1)) \\
& JB om) om + \left((2 \cdot \sin(bb_2) \cos(aa) + 2 \cdot \cos(bb_2) \cos(om t) \sin(aa) \right. \\
& + 2 \cdot \sin(bb_1) \cos(aa) - 2 \cdot \cos(bb_1) \cos(om t) \sin(aa)) g_m_b \\
& + \left((1 \cdot \cos(bb_1) (m_b R^2 \sin(om t) om \cos(bb_1)^2 \cos(om t)^2 aa_F \right. \\
& - 2 \cdot m_b R^2 aa_F^2 \sin(om t)^2 \sin(bb_1) \cos(bb_1) \cos(om t)^2 \\
& + m_b R^2 \sin(om t)^3 om \cos(bb_1)^2 aa_F \\
& + 2 \cdot m_b R e \sin(om t)^3 om aa_F \cos(bb_1) \\
& + 2 \cdot m_b R e \sin(om t) om \cos(bb_1) \cos(om t)^2 aa_F \\
& + m_b R^2 \sin(bb_1) aa_F^2 \cos(om t)^2 \cos(bb_1) \\
& - 4 \cdot JB aa_F \sin(om t) \sin(bb_1)^2 om \\
& - 1 \cdot m_b R \sin(bb_1) l aa_F^2 \cos(om t) \\
& + 2 \cdot m_b R \sin(bb_1) e \cos(om t)^2 aa_F^2 \\
& + m_b R^2 \sin(om t)^2 om^2 \cos(bb_1) \sin(bb_1) \\
& + 2 \cdot m_b R e \sin(om t)^2 om^2 \sin(bb_1) + 4 \cdot JB \cos(bb_1)^2 aa_F \sin(om t) om \\
& + m_b R^2 \cos(om t)^2 om^2 \cos(bb_1) \sin(bb_1) \\
& + 2 \cdot m_b R e \cos(om t)^2 om^2 \sin(bb_1) \\
& + 2 \cdot m_b g_R \sin(bb_1) \cos(om t) \cos(aa) \\
& - 2 \cdot m_b g_R \cos(bb_1) \sin(aa) + 4 \cdot kb bb_1
\end{aligned}$$

$$\begin{aligned}
& + 2 \cdot m_b \cdot aa_F \sin(om t) \cdot om R \cos(bb_1) \cdot e \\
& + m_b R^2 \cos(om t)^2 \sin(bb_1) \cos(bb_1) \cdot bb_F \cdot I^2 \\
& + 4 \cdot JB \cdot om^2 \cos(bb_1) \sin(bb_1) + 4 \cdot JB \cdot aa_F \sin(om t) \cdot om \\
& - 4 \cdot aa_F^2 \sin(om t)^2 \sin(bb_1) \cdot JB \cos(bb_1) \\
& - 1 \cdot m_b R^2 \cdot aa_F^2 \sin(om t)^4 \sin(bb_1) \cos(bb_1) \\
& + m_b R^2 \cos(bb_1)^2 \cdot aa_F \sin(om t) \cdot om \\
& - 1 \cdot m_b R^2 \cos(bb_1) \sin(bb_1) \cdot bb_F \cdot I^2 \\
& + m_b R^2 \sin(bb_1) \sin(om t)^2 \cos(bb_1) \cdot bb_F \cdot I^2 \\
& - 1 \cdot m_b R^2 \cos(om t)^4 \sin(bb_1) \cdot aa_F^2 \cos(bb_1))) / (4 \cdot JB \\
& + R^2 \cdot m_b \sin(om t)^2 \sin(bb_1)^2 + R^2 \cdot m_b \cos(bb_1)^2 \\
& + R^2 \cdot m_b \cos(om t)^2 \sin(bb_1)^2) + (2 \cdot \sin(bb_2) \cdot aa_F \cos(om t) \\
& + \sin(bb_2) \cdot bb_F \cdot 2 \cdot bb_F \cdot 2 + (1 \cdot \cos(bb_2) \cdot (\\
& - 4 \cdot JB \cdot aa_F \sin(om t) \cdot om - 2 \cdot m_b \cdot aa_F \sin(om t) \cdot om R \cos(bb_2) \cdot e \\
& - 1 \cdot m_b R^2 \cos(bb_2) \sin(bb_2) \cdot bb_F \cdot 2^2 \\
& + m_b R^2 \sin(bb_2) \cdot aa_F^2 \cos(om t)^2 \cos(bb_2) \\
& - 1 \cdot m_b R^2 \cdot aa_F^2 \sin(om t)^4 \sin(bb_2) \cos(bb_2) \\
& - 2 \cdot m_b R^2 \cdot aa_F^2 \sin(om t)^2 \sin(bb_2) \cos(om t)^2 \cos(bb_2) \\
& - 1 \cdot m_b R^2 \sin(om t)^3 \cdot om \cos(bb_2)^2 \cdot aa_F
\end{aligned}$$

$$\begin{aligned}
& -1. m_b R^2 \sin(om t) om \cos(bb_2)^2 aa_F \cos(om t)^2 \\
& -2. m_b R e \sin(om t)^3 om aa_F \cos(bb_2) \\
& -2. m_b R e \sin(om t) om aa_F \cos(om t)^2 \cos(bb_2) \\
& -4. JB \sin(om t) om aa_F \cos(bb_2)^2 \\
& -4. aa_F^2 \sin(om t)^2 \sin(bb_2) JB \cos(bb_2) \\
& +2. m_b R e \cos(om t)^2 om^2 \sin(bb_2) \\
& +m_b R^2 \sin(om t)^2 om^2 \cos(bb_2) \sin(bb_2) \\
& +2. m_b R e \sin(om t)^2 om^2 \sin(bb_2) \\
& -2. m_b g_R \sin(bb_2) \cos(om t) \cos(aa) \\
& -2. m_b g_R \cos(bb_2) \sin(aa) + m_b R \sin(bb_2) l aa_F^2 \cos(om t) \\
& +2. m_b R \sin(bb_2) e \cos(om t)^2 aa_F^2 \\
& +m_b R^2 \sin(om t)^2 \sin(bb_2) \cos(bb_2) bb_F_2^2 \\
& +m_b R^2 \cos(om t)^2 \sin(bb_2) \cos(bb_2) bb_F_2^2 \\
& +m_b R^2 \cos(om t)^2 om^2 \cos(bb_2) \sin(bb_2) \\
& -1. m_b R^2 \sin(om t) om aa_F \cos(bb_2)^2 \\
& +4. JB aa_F \sin(om t) \sin(bb_2)^2 om + 4. kb bb_2 \\
& -1. m_b R^2 aa_F^2 \cos(om t)^4 \sin(bb_2) \cos(bb_2) \\
& +4. JB om^2 \cos(bb_2) \sin(bb_2))) / (4. JB + R^2 m_b \cos(om t)^2 \sin(bb_2)^2)
\end{aligned}$$

$$\begin{aligned}
& + R^2 m_b \sin(\omega t)^2 \sin(bb_2)^2 + R^2 m_b \cos(bb_2)^2) + \\
& - 2. aa_F bb_F l \cos(\omega t) + bb_F l^2) \sin(bb_l) \Big) m_b l + \\
& - 2. \cos(bb_l) aa_F + 2. \cos(bb_2) aa_F \sin(\omega t) m_b l \omega \\
& + \left(\left(\left(\left(1. \cos(bb_2)^2 (-4. JB aa_F \sin(\omega t) \omega \right. \right. \right. \right. \right. \right. \\
& - 2. m_b aa_F \sin(\omega t) \omega R \cos(bb_2) e \\
& - 1. m_b R^2 \cos(bb_2) \sin(bb_2) bb_F l^2 \\
& + m_b R^2 \sin(bb_2) aa_F^2 \cos(\omega t)^2 \cos(bb_2) \\
& - 1. m_b R^2 aa_F^2 \sin(\omega t)^4 \sin(bb_2) \cos(bb_2) \\
& - 2. m_b R^2 aa_F^2 \sin(\omega t)^2 \sin(bb_2) \cos(\omega t)^2 \cos(bb_2) \\
& - 1. m_b R^2 \sin(\omega t)^3 \omega \cos(bb_2)^2 aa_F \\
& - 1. m_b R^2 \sin(\omega t) \omega \cos(bb_2)^2 aa_F \cos(\omega t)^2 \\
& - 2. m_b R e \sin(\omega t)^3 \omega aa_F \cos(bb_2) \\
& - 2. m_b R e \sin(\omega t) \omega aa_F \cos(\omega t)^2 \cos(bb_2) \\
& - 4. JB \sin(\omega t) \omega aa_F \cos(bb_2)^2 \\
& - 4. aa_F^2 \sin(\omega t)^2 \sin(bb_2) JB \cos(bb_2) \\
& + 2. m_b R e \cos(\omega t)^2 \omega^2 \sin(bb_2) \\
& + m_b R^2 \sin(\omega t)^2 \omega^2 \cos(bb_2) \sin(bb_2) \\
& + 2. m_b R e \sin(\omega t)^2 \omega^2 \sin(bb_2)
\end{aligned}$$

$$\begin{aligned}
& -2 \cdot m_b g_R \sin(bb_2) \cos(om t) \cos(aa) \\
& -2 \cdot m_b g_R \cos(bb_2) \sin(aa) + m_b R \sin(bb_2) l aa_F^2 \cos(om t) \\
& + 2 \cdot m_b R \sin(bb_2) e \cos(om t)^2 aa_F^2 \\
& + m_b R^2 \sin(om t)^2 \sin(bb_2) \cos(bb_2) bb_F^2 \\
& + m_b R^2 \cos(om t)^2 \sin(bb_2) \cos(bb_2) bb_F^2 \\
& + m_b R^2 \cos(om t)^2 om^2 \cos(bb_2) \sin(bb_2) \\
& - 1 \cdot m_b R^2 \sin(om t) om aa_F \cos(bb_2)^2 \\
& + 4 \cdot JB aa_F \sin(om t) \sin(bb_2)^2 om + 4 \cdot kb bb_2 \\
& - 1 \cdot m_b R^2 aa_F^2 \cos(om t)^4 \sin(bb_2) \cos(bb_2) \\
& + 4 \cdot JB om^2 \cos(bb_2) \sin(bb_2))) / (4 \cdot JB + R^2 m_b \cos(om t)^2 \sin(bb_2)^2 \\
& + R^2 m_b \sin(om t)^2 \sin(bb_2)^2 + R^2 m_b \cos(bb_2)^2) \\
& + (1 \cdot \sin(bb_2)^2 (-4 \cdot JB aa_F \sin(om t) om - 2 \cdot m_b aa_F \sin(om t) om R \cos(bb_2) e - 1 \cdot m_b aa_F \cos(om t)^2 \sin(bb_2)^2)) / (4 \cdot JB + R^2 m_b \cos(om t)^2 \sin(bb_2)^2 \\
& - 1 \cdot m_b R^2 aa_F^2 \sin(om t)^4 \sin(bb_2) \cos(bb_2) \\
& - 2 \cdot m_b R^2 aa_F^2 \sin(om t)^2 \sin(bb_2) \cos(om t)^2 \cos(bb_2) \\
& - 1 \cdot m_b R^2 \sin(om t)^3 om \cos(bb_2)^2 aa_F \\
& - 1 \cdot m_b R^2 \sin(om t) om \cos(bb_2)^2 aa_F \cos(om t)^2 \\
& - 2 \cdot m_b R e \sin(om t)^3 om aa_F \cos(bb_2) \\
& - 2 \cdot m_b R e \sin(om t) om aa_F \cos(om t)^2 \cos(bb_2)
\end{aligned}$$

$$\begin{aligned}
& -4. JB \sin(om t) om aa_F \cos(bb_2)^2 \\
& -4. aa_F^2 \sin(om t)^2 \sin(bb_2) JB \cos(bb_2) \\
& +2. m_b R e \cos(om t)^2 om^2 \sin(bb_2) \\
& +m_b R^2 \sin(om t)^2 om^2 \cos(bb_2) \sin(bb_2) \\
& +2. m_b R e \sin(om t)^2 om^2 \sin(bb_2) \\
& -2. m_b g_R \sin(bb_2) \cos(om t) \cos(aa) \\
& -2. m_b g_R \cos(bb_2) \sin(aa) +m_b R \sin(bb_2) l aa_F^2 \cos(om t) \\
& +2. m_b R \sin(bb_2) e \cos(om t)^2 aa_F^2 \\
& +m_b R^2 \sin(om t)^2 \sin(bb_2) \cos(bb_2) bb_F_2^2 \\
& +m_b R^2 \cos(om t)^2 \sin(bb_2) \cos(bb_2) bb_F_2^2 \\
& +m_b R^2 \cos(om t)^2 om^2 \cos(bb_2) \sin(bb_2) \\
& -1. m_b R^2 \sin(om t) om aa_F \cos(bb_2)^2 \\
& +4. JB aa_F \sin(om t) \sin(bb_2)^2 om +4. kb bb_2 \\
& -1. m_b R^2 aa_F^2 \cos(om t)^4 \sin(bb_2) \cos(bb_2) \\
& +4. JB om^2 \cos(bb_2) \sin(bb_2)) \cos(om t)^2) / (4. JB \\
& +R^2 m_b \cos(om t)^2 \sin(bb_2)^2 +R^2 m_b \sin(om t)^2 \sin(bb_2)^2 \\
& +R^2 m_b \cos(bb_2)^2)) \cos(om t) \\
& - (1. \cos(bb_1)^2 (m_b R^2 \sin(om t) om \cos(bb_1)^2 \cos(om t)^2 aa_F -2. m_b R^2 aa_F^2 \sin(om t)
\end{aligned}$$

$$\begin{aligned}
& + 2 \cdot m_b R e \sin(om t)^3 om aa_F \cos(bb_1) \\
& + 2 \cdot m_b R e \sin(om t) om \cos(bb_1) \cos(om t)^2 aa_F \\
& + m_b R^2 \sin(bb_1) aa_F^2 \cos(om t)^2 \cos(bb_1) \\
& - 4 \cdot JB aa_F \sin(om t) \sin(bb_1)^2 om \\
& - 1 \cdot m_b R \sin(bb_1) l aa_F^2 \cos(om t) \\
& + 2 \cdot m_b R \sin(bb_1) e \cos(om t)^2 aa_F^2 \\
& + m_b R^2 \sin(om t)^2 om^2 \cos(bb_1) \sin(bb_1) \\
& + 2 \cdot m_b R e \sin(om t)^2 om^2 \sin(bb_1) + 4 \cdot JB \cos(bb_1)^2 aa_F \sin(om t) om \\
& + m_b R^2 \cos(om t)^2 om^2 \cos(bb_1) \sin(bb_1) \\
& + 2 \cdot m_b R e \cos(om t)^2 om^2 \sin(bb_1) \\
& + 2 \cdot m_b g_R \sin(bb_1) \cos(om t) \cos(aa) \\
& - 2 \cdot m_b g_R \cos(bb_1) \sin(aa) + 4 \cdot kb bb_1 \\
& + 2 \cdot m_b aa_F \sin(om t) om R \cos(bb_1) e \\
& + m_b R^2 \cos(om t)^2 \sin(bb_1) \cos(bb_1) bb_F l^2 \\
& + 4 \cdot JB om^2 \cos(bb_1) \sin(bb_1) + 4 \cdot JB aa_F \sin(om t) om \\
& - 4 \cdot aa_F^2 \sin(om t)^2 \sin(bb_1) JB \cos(bb_1) \\
& - 1 \cdot m_b R^2 aa_F^2 \sin(om t)^4 \sin(bb_1) \cos(bb_1) \\
& + m_b R^2 \cos(bb_1)^2 aa_F \sin(om t) om
\end{aligned}$$

$$\begin{aligned}
& -1. m_b R^2 \cos(bb_1) \sin(bb_1) bb_F I^2 \\
& + m_b R^2 \sin(bb_1) \sin(om t)^2 \cos(bb_1) bb_F I^2 \\
& - 1. m_b R^2 \cos(om t)^4 \sin(bb_1) aa_F^2 \cos(bb_1) \cos(om t) \Big) / (4. JB \\
& + R^2 m_b \sin(om t)^2 \sin(bb_1)^2 + R^2 m_b \cos(bb_1)^2 \\
& + R^2 m_b \cos(om t)^2 \sin(bb_1)^2) + \left((-2. bb_F I^2 + (2. aa_F bb_F I \right. \\
& \left. + (2. bb_F I^2 - 2. aa_F bb_F I \cos(om t)) \cos(om t)) \cos(om t) \right) \\
& \cos(om t) \cos(bb_1) \\
& - (1. \cos(om t)^3 (m_b R^2 \sin(om t) om \cos(bb_1)^2 \cos(om t)^2 aa_F - 2. m_b R^2 aa_F^2 \sin(om t)^2 \\
& + m_b R^2 \sin(om t)^3 om \cos(bb_1)^2 aa_F \\
& + 2. m_b R e \sin(om t)^3 om aa_F \cos(bb_1) \\
& + 2. m_b R e \sin(om t) om \cos(bb_1) \cos(om t)^2 aa_F \\
& + m_b R^2 \sin(bb_1) aa_F^2 \cos(om t)^2 \cos(bb_1) \\
& - 4. JB aa_F \sin(om t) \sin(bb_1)^2 om \\
& - 1. m_b R \sin(bb_1) l aa_F^2 \cos(om t) \\
& + 2. m_b R \sin(bb_1) e \cos(om t)^2 aa_F^2 \\
& + m_b R^2 \sin(om t)^2 om^2 \cos(bb_1) \sin(bb_1) \\
& + 2. m_b R e \sin(om t)^2 om^2 \sin(bb_1) + 4. JB \cos(bb_1)^2 aa_F \sin(om t) om \\
& + m_b R^2 \cos(om t)^2 om^2 \cos(bb_1) \sin(bb_1)
\end{aligned}$$

$$\begin{aligned}
& + 2 \cdot m_b R e \cos(om t)^2 om^2 \sin(bb_1) \\
& + 2 \cdot m_b g_- R \sin(bb_1) \cos(om t) \cos(aa) \\
& - 2 \cdot m_b g_- R \cos(bb_1) \sin(aa) + 4 \cdot kb bb_1 \\
& + 2 \cdot m_b aa_F \sin(om t) om R \cos(bb_1) e \\
& + m_b R^2 \cos(om t)^2 \sin(bb_1) \cos(bb_1) bb_F I^2 \\
& + 4 \cdot JB om^2 \cos(bb_1) \sin(bb_1) + 4 \cdot JB aa_F \sin(om t) om \\
& - 4 \cdot aa_F^2 \sin(om t)^2 \sin(bb_1) JB \cos(bb_1) \\
& - 1 \cdot m_b R^2 aa_F^2 \sin(om t)^4 \sin(bb_1) \cos(bb_1) \\
& + m_b R^2 \cos(bb_1)^2 aa_F \sin(om t) om \\
& - 1 \cdot m_b R^2 \cos(bb_1) \sin(bb_1) bb_F I^2 \\
& + m_b R^2 \sin(bb_1) \sin(om t)^2 \cos(bb_1) bb_F I^2 \\
& - 1 \cdot m_b R^2 \cos(om t)^4 \sin(bb_1) aa_F^2 \cos(bb_1) \sin(bb_1) \Big/ (4 \cdot JB \\
& + R^2 m_b \sin(om t)^2 \sin(bb_1)^2 + R^2 m_b \cos(bb_1)^2 \\
& + R^2 m_b \cos(om t)^2 \sin(bb_1)^2) \sin(bb_1) \\
& + \left((1 \cdot \sin(bb_2)^2 \cos(om t) (-4 \cdot JB aa_F \sin(om t) om \right. \\
& \left. - 2 \cdot m_b aa_F \sin(om t) om R \cos(bb_2) e \right. \\
& \left. - 1 \cdot m_b R^2 \cos(bb_2) \sin(bb_2) bb_F I^2 \right. \\
& \left. + m_b R^2 \sin(bb_2) aa_F^2 \cos(om t)^2 \cos(bb_2) \right)
\end{aligned}$$

$$\begin{aligned}
& -1. m_b R^2 aa_F^2 \sin(om t)^4 \sin(bb_2) \cos(bb_2) \\
& -2. m_b R^2 aa_F^2 \sin(om t)^2 \sin(bb_2) \cos(om t)^2 \cos(bb_2) \\
& -1. m_b R^2 \sin(om t)^3 om \cos(bb_2)^2 aa_F \\
& -1. m_b R^2 \sin(om t) om \cos(bb_2)^2 aa_F \cos(om t)^2 \\
& -2. m_b R e \sin(om t)^3 om aa_F \cos(bb_2) \\
& -2. m_b R e \sin(om t) om aa_F \cos(om t)^2 \cos(bb_2) \\
& -4. JB \sin(om t) om aa_F \cos(bb_2)^2 \\
& -4. aa_F^2 \sin(om t)^2 \sin(bb_2) JB \cos(bb_2) \\
& +2. m_b R e \cos(om t)^2 om^2 \sin(bb_2) \\
& +m_b R^2 \sin(om t)^2 om^2 \cos(bb_2) \sin(bb_2) \\
& +2. m_b R e \sin(om t)^2 om^2 \sin(bb_2) \\
& -2. m_b g_- R \sin(bb_2) \cos(om t) \cos(aa) \\
& -2. m_b g_- R \cos(bb_2) \sin(aa) + m_b R \sin(bb_2) l aa_F^2 \cos(om t) \\
& +2. m_b R \sin(bb_2) e \cos(om t)^2 aa_F^2 \\
& +m_b R^2 \sin(om t)^2 \sin(bb_2) \cos(bb_2) bb_F^2 \\
& +m_b R^2 \cos(om t)^2 \sin(bb_2) \cos(bb_2) bb_F^2 \\
& +m_b R^2 \cos(om t)^2 om^2 \cos(bb_2) \sin(bb_2) \\
& -1. m_b R^2 \sin(om t) om aa_F \cos(bb_2)^2
\end{aligned}$$

$$\begin{aligned}
& + 4. JB aa_F \sin(om t) \sin(bb_2)^2 om + 4. kb bb_2 \\
& - 1. m_b R^2 aa_F^2 \cos(om t)^4 \sin(bb_2) \cos(bb_2) \\
& + 4. JB om^2 \cos(bb_2) \sin(bb_2))) / (4. JB + R^2 m_b \cos(om t)^2 \sin(bb_2)^2 \\
& + R^2 m_b \sin(om t)^2 \sin(bb_2)^2 + R^2 m_b \cos(bb_2)^2) + \left((2. bb_F_I^2 \right. \\
& \left. - 4. aa_F bb_F_I \cos(om t) \right) \cos(om t) \cos(bb_1) \\
& - (1. \cos(om t) (m_b R^2 \sin(om t) om \cos(bb_1)^2 \cos(om t)^2 aa_F - 2. m_b R^2 aa_F^2 \sin(om t)^2 \\
& + m_b R^2 \sin(om t)^3 om \cos(bb_1)^2 aa_F \\
& + 2. m_b R e \sin(om t)^3 om aa_F \cos(bb_1) \\
& + 2. m_b R e \sin(om t) om \cos(bb_1) \cos(om t)^2 aa_F \\
& + m_b R^2 \sin(bb_1) aa_F^2 \cos(om t)^2 \cos(bb_1) \\
& - 4. JB aa_F \sin(om t) \sin(bb_1)^2 om \\
& - 1. m_b R \sin(bb_1) l aa_F^2 \cos(om t) \\
& + 2. m_b R \sin(bb_1) e \cos(om t)^2 aa_F^2 \\
& + m_b R^2 \sin(om t)^2 om^2 \cos(bb_1) \sin(bb_1) \\
& + 2. m_b R e \sin(om t)^2 om^2 \sin(bb_1) + 4. JB \cos(bb_1)^2 aa_F \sin(om t) om \\
& + m_b R^2 \cos(om t)^2 om^2 \cos(bb_1) \sin(bb_1) \\
& + 2. m_b R e \cos(om t)^2 om^2 \sin(bb_1) \\
& + 2. m_b g_R \sin(bb_1) \cos(om t) \cos(aa)
\end{aligned}$$

$$\begin{aligned}
& -2 \cdot m_b g_R \cos(bb_1) \sin(aa) + 4 \cdot kb bb_1 \\
& + 2 \cdot m_b aa_F \sin(om t) om R \cos(bb_1) e \\
& + m_b R^2 \cos(om t)^2 \sin(bb_1) \cos(bb_1) bb_F I^2 \\
& + 4 \cdot JB om^2 \cos(bb_1) \sin(bb_1) + 4 \cdot JB aa_F \sin(om t) om \\
& - 4 \cdot aa_F^2 \sin(om t)^2 \sin(bb_1) JB \cos(bb_1) \\
& - 1 \cdot m_b R^2 aa_F^2 \sin(om t)^4 \sin(bb_1) \cos(bb_1) \\
& + m_b R^2 \cos(bb_1)^2 aa_F \sin(om t) om \\
& - 1 \cdot m_b R^2 \cos(bb_1) \sin(bb_1) bb_F I^2 \\
& + m_b R^2 \sin(bb_1) \sin(om t)^2 \cos(bb_1) bb_F I^2 \\
& - 1 \cdot m_b R^2 \cos(om t)^4 \sin(bb_1) aa_F^2 \cos(bb_1) \sin(bb_1) \Big/ (4 \cdot JB \\
& + R^2 m_b \sin(om t)^2 \sin(bb_1)^2 + R^2 m_b \cos(bb_1)^2 \\
& + R^2 m_b \cos(om t)^2 \sin(bb_1)^2) \sin(bb_1) \\
& - 2 \cdot \sin(om t)^2 \sin(bb_1) aa_F \cos(bb_1) bb_F I \sin(om t)^2 \\
& + ((2 \cdot aa_F \cos(bb_2) \sin(bb_2) \\
& - 2 \cdot aa_F \sin(bb_2) \cos(om t)^2 \cos(bb_2)) \cos(om t)^2 + \\
& - 4 \cdot aa_F \sin(bb_2) \cos(om t)^2 \cos(bb_2) \\
& - 2 \cdot \sin(om t)^2 \sin(bb_2) aa_F \cos(bb_2)) \sin(om t)^2 \\
& + ((2 \cdot \cos(bb_2) \sin(bb_2)
\end{aligned}$$

$$\begin{aligned}
& -2 \cdot \cos(\omega_m t)^2 \sin(bb_2) \cos(bb_2) \big) \cos(\omega_m t) \\
& -2 \cdot \cos(\omega_m t) \cos(bb_2) \sin(\omega_m t)^2 \sin(bb_2) \big) bb_F_2 \big) bb_F_2 \big) m_b \\
& + \left(\left(\left(2 \cdot \cos(bb_2)^2 aa_F \cos(\omega_m t) + (-1 \cdot bb_F_1 + (2 \cdot aa_F \right. \right. \right. \right. \\
& \left. \left. \left. \left. + bb_F_1 \cos(\omega_m t) \right) \cos(\omega_m t) \right) \cos(bb_1)^2 \right. \right. \\
& \left. \left. - 2 \cdot \sin(bb_1)^2 bb_F_1 \cos(\omega_m t)^2 + (-2 \cdot \sin(bb_1)^2 bb_F_1 \right. \right. \\
& \left. \left. + \cos(bb_1)^2 bb_F_1 \right) \sin(\omega_m t)^2 \right) \sin(\omega_m t) + (\cos(bb_2)^2 \right. \right. \\
& \left. \left. + (2 \cdot \sin(bb_2)^2 - 1 \cdot \cos(bb_2)^2) \cos(\omega_m t)^2 + (2 \cdot \sin(bb_2)^2 \right. \right. \\
& \left. \left. - 1 \cdot \cos(bb_2)^2) \sin(\omega_m t)^2 \right) \sin(\omega_m t) bb_F_2 \big) m_b \right. \\
& + (\cos(\omega_m t)^3 \cos(bb_1) \sin(bb_1) - 1 \cdot \cos(\omega_m t)^3 \cos(bb_2) \sin(bb_2) \\
& + (-1 \cdot \cos(\omega_m t) \sin(bb_2) \cos(bb_2) \\
& + \cos(\omega_m t) \sin(bb_1) \cos(bb_1)) \sin(\omega_m t)^2 \big) m_b \omega_m \big) \omega_m \big) R \big) R \\
& + \left(\left(\left(\left(- (2 \cdot \cos(bb_1) (m_b R^2 \sin(\omega_m t) \omega_m \cos(bb_1)^2 \cos(\omega_m t)^2 aa_F \right. \right. \right. \right. \right. \\
& \left. \left. \left. \left. \left. \left. - 2 \cdot m_b R^2 aa_F^2 \sin(\omega_m t)^2 \sin(bb_1) \cos(bb_1) \cos(\omega_m t)^2 \right. \right. \right. \right. \right. \\
& \left. \left. \left. \left. \left. \left. + m_b R^2 \sin(\omega_m t)^3 \omega_m \cos(bb_1)^2 aa_F \right. \right. \right. \right. \right. \\
& \left. \left. \left. \left. \left. \left. + 2 \cdot m_b R e \sin(\omega_m t)^3 \omega_m aa_F \cos(bb_1) \right. \right. \right. \right. \right. \\
& \left. \left. \left. \left. \left. \left. + 2 \cdot m_b R e \sin(\omega_m t) \omega_m \cos(bb_1) \cos(\omega_m t)^2 aa_F \right. \right. \right. \right. \right. \\
& \left. \left. \left. \left. \left. \left. + m_b R^2 \sin(bb_1) aa_F^2 \cos(\omega_m t)^2 \cos(bb_1) \right. \right. \right. \right. \right. \\
& \left. \left. \left. \left. \left. \left. - 4 \cdot JB aa_F \sin(\omega_m t) \sin(bb_1)^2 \omega_m \right. \right. \right. \right. \right.
\end{aligned}$$

$$\begin{aligned}
& -1. m_b R \sin(bb_I) l aa_F^2 \cos(om t) \\
& + 2. m_b R \sin(bb_I) e \cos(om t)^2 aa_F^2 \\
& + m_b R^2 \sin(om t)^2 om^2 \cos(bb_I) \sin(bb_I) \\
& + 2. m_b R e \sin(om t)^2 om^2 \sin(bb_I) + 4. JB \cos(bb_I)^2 aa_F \sin(om t) om \\
& + m_b R^2 \cos(om t)^2 om^2 \cos(bb_I) \sin(bb_I) \\
& + 2. m_b R e \cos(om t)^2 om^2 \sin(bb_I) \\
& + 2. m_b g_R \sin(bb_I) \cos(om t) \cos(aa) \\
& - 2. m_b g_R \cos(bb_I) \sin(aa) + 4. kb bb_I \\
& + 2. m_b aa_F \sin(om t) om R \cos(bb_I) e \\
& + m_b R^2 \cos(om t)^2 \sin(bb_I) \cos(bb_I) bb_F_I^2 \\
& + 4. JB om^2 \cos(bb_I) \sin(bb_I) + 4. JB aa_F \sin(om t) om \\
& - 4. aa_F^2 \sin(om t)^2 \sin(bb_I) JB \cos(bb_I) \\
& - 1. m_b R^2 aa_F^2 \sin(om t)^4 \sin(bb_I) \cos(bb_I) \\
& + m_b R^2 \cos(bb_I)^2 aa_F \sin(om t) om \\
& - 1. m_b R^2 \cos(bb_I) \sin(bb_I) bb_F_I^2 \\
& + m_b R^2 \sin(bb_I) \sin(om t)^2 \cos(bb_I) bb_F_I^2 \\
& - 1. m_b R^2 \cos(om t)^4 \sin(bb_I) aa_F^2 \cos(bb_I) \cos(om t) \Big) / (4. JB \\
& + R^2 m_b \sin(om t)^2 \sin(bb_I)^2 + R^2 m_b \cos(bb_I)^2
\end{aligned}$$

$$\begin{aligned}
& + R^2 m_b \cos(om t)^2 \sin(bb_1)^2) + (4. \sin(bb_2) aa_F \cos(om t)^2 \\
& + 2. \sin(bb_2) \cos(om t) bb_F_2) bb_F_2 + (2. \cos(bb_2) (\\
& - 4. JB aa_F \sin(om t) om - 2. m_b aa_F \sin(om t) om R \cos(bb_2) e \\
& - 1. m_b R^2 \cos(bb_2) \sin(bb_2) bb_F_2^2 \\
& + m_b R^2 \sin(bb_2) aa_F^2 \cos(om t)^2 \cos(bb_2) \\
& - 1. m_b R^2 aa_F^2 \sin(om t)^4 \sin(bb_2) \cos(bb_2) \\
& - 2. m_b R^2 aa_F^2 \sin(om t)^2 \sin(bb_2) \cos(om t)^2 \cos(bb_2) \\
& - 1. m_b R^2 \sin(om t)^3 om \cos(bb_2)^2 aa_F \\
& - 1. m_b R^2 \sin(om t) om \cos(bb_2)^2 aa_F \cos(om t)^2 \\
& - 2. m_b R e \sin(om t)^3 om aa_F \cos(bb_2) \\
& - 2. m_b R e \sin(om t) om aa_F \cos(om t)^2 \cos(bb_2) \\
& - 4. JB \sin(om t) om aa_F \cos(bb_2)^2 \\
& - 4. aa_F^2 \sin(om t)^2 \sin(bb_2) JB \cos(bb_2) \\
& + 2. m_b R e \cos(om t)^2 om^2 \sin(bb_2) \\
& + m_b R^2 \sin(om t)^2 om^2 \cos(bb_2) \sin(bb_2) \\
& + 2. m_b R e \sin(om t)^2 om^2 \sin(bb_2) \\
& - 2. m_b g_R \sin(bb_2) \cos(om t) \cos(aa) \\
& - 2. m_b g_R \cos(bb_2) \sin(aa) + m_b R \sin(bb_2) l aa_F^2 \cos(om t) \\
& + 2. m_b R \sin(bb_2) e \cos(om t)^2 aa_F^2 \\
& + m_b R^2 \sin(om t)^2 \sin(bb_2) \cos(bb_2) bb_F_2^2 \\
& + m_b R^2 \cos(om t)^2 \sin(bb_2) \cos(bb_2) bb_F_2^2 \\
& + m_b R^2 \cos(om t)^2 om^2 \cos(bb_2) \sin(bb_2) \\
& - 1. m_b R^2 \sin(om t) om aa_F \cos(bb_2)^2 \\
& + 4. JB aa_F \sin(om t) \sin(bb_2)^2 om + 4. kb bb_2 \\
& - 1. m_b R^2 aa_F^2 \cos(om t)^4 \sin(bb_2) \cos(bb_2) \\
& + 4. JB om^2 \cos(bb_2) \sin(bb_2)) \cos(om t)) / (4. JB \\
& + R^2 m_b \cos(om t)^2 \sin(bb_2)^2 + R^2 m_b \sin(om t)^2 \sin(bb_2)^2 \\
& + R^2 m_b \cos(bb_2)^2) + (-2. bb_F_l^2 \\
& + 4. aa_F bb_F_1 \cos(om t)) \cos(om t) \sin(bb_1)) m_b \\
& + (((8. aa_F \cos(om t) \cos(bb_2) + (-2. bb_F_1 + (8. aa_F \\
& + 2. bb_F_1 \cos(om t)) \cos(om t)) \cos(bb_1) \\
& + 2. \sin(om t)^2 \cos(bb_1) bb_F_1) \sin(om t) + (-2. \cos(om t)^2 \cos(bb_2) \\
& + 2. \cos(bb_2) - 2. \cos(bb_2) \sin(om t)^2) \sin(om t) bb_F_2) m_b + (\\
& - 2. \cos(om t)^3 \sin(bb_2) + 2. \cos(om t)^3 \sin(bb_1) \\
& + (2. \cos(om t) \sin(bb_1) - 2. \sin(bb_2) \cos(om t)) \sin(om t)^2) m_b om)
\end{aligned}$$

$$\begin{aligned}
& \left. \left(om \right) R + 16. m_b \sin(om t) om aa_F \cos(om t) e \right) e \right) \right) \quad (16. JT \\
& + (32. \cos(om t)^2 + (16. \sin(bb_2)^2 + 16. \sin(bb_1)^2) \sin(om t)^2) JB \\
& + (8. m_b + m_t) l^2 + ((-8. \cos(om t) \cos(bb_1) \\
& + 8. \cos(om t) \cos(bb_2)) m_b l + ((4. \cos(bb_2)^2 \\
& + 4. \cos(om t)^2 \sin(bb_2)^2) \cos(om t)^2 + 4. \cos(bb_1)^2 \cos(om t)^2 \\
& + 4. \cos(om t)^4 \sin(bb_1)^2 + (8. \cos(om t)^2 \sin(bb_2)^2 \\
& + 8. \sin(bb_1)^2 \cos(om t)^2 + (4. \sin(bb_2)^2 + 4. \sin(bb_1)^2) \sin(om t)^2 \\
& \sin(om t)^2) m_b R) R + ((16. \cos(om t)^2 \cos(bb_1) \\
& + 16. \cos(om t)^2 \cos(bb_2)) m_b R + 32. m_b \cos(om t)^2 e) e
\end{aligned}$$

```

> `starting length` = length(%), `converting to horner` =
length(convert(% ,horner)), factoring=length(factor(%));
starting length=35018, converting to horner=52263, factoring=173263   (14.3.3.7)

```

Solve again for aa_FF: since bb_FF_1 and bb_FF_2 are now substituted and are also functions
aa_FF - CAN NOT SIMPLIFY FURTHER

```

> T4_eq_rho[full] := solve(T3_eq_rho[full]=aa_FF, aa_FF);
T4_eq_rho[full] := (4. (-64. \cos(om t) kb bb\_1 JB^2 - 64. JB^3 om \sin(om t) bb\_F\_1  (14.3.3.8)

```

$$\begin{aligned}
& + 64. \cos(om t) kb bb_2 JB^2 + 64. JB^3 om \sin(om t) bb_F_2 \\
& - 2. m_b^3 R^5 l bb_F_1 \sin(bb_1) aa_F \cos(om t) \sin(om t)^2 \sin(bb_2)^2 \\
& \cos(bb_1)^2 \\
& - 2. m_b^3 R^5 l bb_F_1 \sin(bb_1)^3 aa_F \cos(om t) \cos(bb_2)^2 \sin(om t)^2 \\
& - 2. m_b^3 R^5 l bb_F_1 \sin(bb_1) aa_F \cos(om t) \cos(bb_2)^2 \cos(bb_1)^2 \\
& + 4. m_b^2 R^3 l bb_F_1^2 \sin(bb_1)^3 JB \cos(om t)^2 \\
& + 2. m_b^3 R^5 l bb_F_1^2 \sin(bb_1)^3 \cos(om t)^2 \sin(bb_2)^2 \sin(om t)^2 \\
& + m_b^3 R^5 l bb_F_1^2 \sin(bb_1)^3 \cos(om t)^4 \sin(bb_2)^2 \\
& + m_b^3 R^5 l bb_F_1^2 \sin(bb_1)^3 \sin(om t)^4 \sin(bb_2)^2 \\
& + m_b^3 R^5 l bb_F_1^2 \sin(bb_1)^3 \cos(bb_2)^2 \sin(om t)^2 \\
& + m_b^3 R^5 l bb_F_1^2 \sin(bb_1)^3 \cos(bb_2)^2 \cos(om t)^2 \\
& - 8. m_b^2 R^3 l bb_F_1 \sin(bb_1) aa_F \cos(om t)^3 \sin(bb_2)^2 JB \\
& - 8. m_b^2 R^3 l bb_F_1 \sin(bb_1) aa_F \cos(om t) \sin(om t)^2 \sin(bb_2)^2 JB \\
& + 4. m_b^2 R^3 l \sin(bb_2)^3 bb_F_2^2 \sin(om t)^2 JB \\
& + 4. m_b^2 R^4 \cos(om t) \cos(bb_1)^4 JB aa_F \sin(om t) om \\
& - 4. m_b^2 R^4 \cos(om t) \cos(bb_1)^2 kb bb_1 \cos(bb_2)^2 \\
& + 8. m_b^2 R^4 \cos(om t)^3 \cos(bb_1)^3 aa_F^2 \sin(om t)^2 \sin(bb_1) JB \\
& + 2. m_b^3 R^6 \cos(bb_2)^3 \sin(bb_2) bb_F_2 aa_F \cos(om t)^2 \cos(bb_1)^2 \\
& - 4. m_b^2 R^4 om \sin(om t)^5 bb_F_2 \cos(bb_2)^2 \sin(bb_2)^2 JB \\
& - 12. m_b^2 R^4 om \sin(om t)^3 \cos(bb_1)^2 bb_F_1 JB \sin(bb_1)^2
\end{aligned}$$

$$\begin{aligned}
& -2 \cdot m \cdot b^3 \cdot R^6 \sin(om t)^8 \sin(bb_1)^3 aa_F \cos(bb_1) bb_F \sin(bb_2)^2 \\
& -8 \cdot m \cdot b^2 \cdot R^4 \sin(om t)^4 \sin(bb_1) aa_F \cos(bb_1)^3 bb_F \sin(bb_2)^2 \\
& -2 \cdot m \cdot b^3 \cdot R^6 \cos(bb_2)^3 \sin(bb_2) bb_F \cos(bb_1)^4 aa_F \cos(bb_1)^2 \\
& +4 \cdot m \cdot b^2 \cdot R^4 \cos(om t) kb \cdot bb_2 \cos(bb_2)^2 \sin(om t)^2 \sin(bb_1)^2 \\
& +4 \cdot m \cdot b^2 \cdot R^4 \cos(om t) \sin(om t) om \cdot aa_F \cos(bb_2)^4 JB \\
& +12 \cdot m \cdot b^2 \cdot R^4 \cos(om t)^3 \sin(bb_1)^3 aa_F^2 \sin(om t)^4 \cos(bb_1) JB \\
& -6 \cdot m \cdot b^3 \cdot R^6 \cdot om \sin(om t)^3 \sin(bb_1)^4 bb_F \cos(om t)^4 \sin(bb_2)^2 \\
& +m \cdot b^3 \cdot R^6 \cos(om t) \sin(om t)^3 om \cdot aa_F \cos(bb_2)^4 \sin(bb_1)^2 \\
& -1 \cdot m \cdot b^3 \cdot R^6 \cos(om t) \sin(om t)^5 om \cos(bb_2)^4 aa_F \sin(bb_1)^2 \\
& -4 \cdot m \cdot b^2 \cdot R^4 \cdot om \sin(om t)^5 bb_F \cos(bb_2)^2 JB \sin(bb_1)^2 \\
& -8 \cdot m \cdot b^3 \cdot e^2 \cdot R^4 \sin(om t) om \cos(bb_1)^2 \cos(om t)^3 aa_F \cos(bb_2)^2 \\
& -8 \cdot m \cdot b^2 \cdot e \cdot JB \cos(bb_1)^3 aa_F \sin(om t) om \cdot R^3 \cos(om t)^3 \sin(bb_2)^2 \\
& +12 \cdot m \cdot b^3 \cdot e^2 \cdot aa_F \sin(om t) om \cdot R^4 \cos(bb_1)^2 \cos(om t)^3 \sin(bb_2)^2 \\
& +8 \cdot m \cdot b^2 \cdot e \cdot aa_F^2 \sin(om t)^2 \sin(bb_1) JB \cos(bb_1)^2 R^3 \cos(om t)^3 \\
& \sin(bb_2)^2 \\
& -4 \cdot m \cdot b^3 \cdot e \cdot R^5 \cos(om t)^3 \sin(bb_1) \cos(bb_1)^2 bb_F \sin(bb_2)^2 \sin(om t)^2 \\
& \sin(bb_2)^2 \\
& -8 \cdot m \cdot b^2 \cdot e \cdot JB \cdot om^2 \cos(bb_1)^2 \sin(bb_1) R^3 \cos(om t)^3 \sin(bb_2)^2 \\
& +16 \cdot m \cdot b^2 \cdot e \cdot R^3 \cdot aa_F^2 \sin(om t)^2 \sin(bb_1) \cos(bb_1)^2 \cos(om t)^3 JB \\
& -16 \cdot m \cdot b^2 \cdot e^2 \cdot R^2 \sin(om t) om \cos(bb_1)^2 \cos(om t)^3 aa_F JB \\
& -8 \cdot m \cdot b^2 \cdot e \cdot aa_F^2 \sin(om t)^2 \sin(bb_2) JB \cos(bb_2)^2 R^3 \cos(om t)^3 \\
& \sin(bb_1)^2 \\
& +4 \cdot m \cdot b^3 \cdot e \cdot R^5 \sin(om t)^2 \sin(bb_2) \cos(bb_2)^2 bb_F \cos(om t)^3 \\
& \sin(bb_1)^2 +4 \cdot m \cdot b^2 \cdot R^3 \cdot l \cdot JB \cdot om^2 \cos(bb_2)^2 \sin(bb_2) \cos(om t)^2 \sin(bb_1)^2 \\
& -4 \cdot m \cdot b^2 \cdot R^3 \cdot l \sin(om t) om \cos(bb_2)^3 aa_F \cos(om t)^2 JB \\
& -8 \cdot m \cdot b^2 \cdot R^2 \cdot l \sin(om t) om \cdot aa_F \cos(om t)^2 \cos(bb_2)^2 JB \\
& -8 \cdot m \cdot b^2 \cdot R^2 \cdot l \cos(bb_2) g_1 \sin(bb_2) \cos(om t) \cos(aa) JB \\
& +16 \cdot m \cdot b^2 \cdot R^2 \cdot l \cos(bb_2) \sin(bb_2) e \cos(om t)^2 aa_F^2 JB \\
& +2 \cdot m \cdot b^3 \cdot R^4 \cdot l \cos(bb_2) e \sin(om t)^4 om^2 \sin(bb_2) \sin(bb_1)^2 \\
& +2 \cdot m \cdot b^3 \cdot R^4 \cdot l \cos(bb_2) e \sin(om t)^2 om^2 \sin(bb_2) \cos(bb_1)^2 \\
& +4 \cdot m \cdot b^3 \cdot R^4 \cdot l \cos(bb_2) e \sin(om t)^2 om^2 \sin(bb_2) \cos(om t)^2 \sin(bb_1)^2 \\
& +3 \cdot m \cdot b^3 \cdot R^6 \cos(om t)^3 \sin(bb_1)^3 aa_F^2 \sin(om t)^4 \cos(bb_1) \cos(bb_2)^2 \\
& +m \cdot b^3 \cdot R^6 \cos(om t)^9 \sin(bb_1)^3 aa_F^2 \cos(bb_1) \sin(bb_2)^2 \\
& +m \cdot b^3 \cdot R^6 \cos(om t)^7 \sin(bb_1)^3 aa_F^2 \cos(bb_1) \cos(bb_2)^2 \\
& -3 \cdot m \cdot b^3 \cdot R^6 \cos(om t)^5 \sin(bb_1)^2 \sin(om t)^3 om \cos(bb_1)^2 aa_F \\
& \sin(bb_2)^2
\end{aligned}$$

$$\begin{aligned}
& -3 \cdot m_b^3 R^6 \cos(om t)^3 \sin(bb_1)^2 \sin(om t)^5 om \cos(bb_1)^2 aa_F \\
& \sin(bb_2)^2 \\
& -2 \cdot m_b^3 R^6 \cos(om t)^3 \sin(bb_1)^2 \sin(om t)^3 om \cos(bb_1)^2 aa_F \\
& \cos(bb_2)^2 \\
& -1 \cdot m_b^3 R^6 \cos(om t)^7 \sin(bb_1)^2 \sin(om t) om \cos(bb_1)^2 aa_F \\
& \sin(bb_2)^2 \\
& -1 \cdot m_b^3 R^6 \cos(om t)^5 \sin(bb_1)^2 \sin(om t) om \cos(bb_1)^2 aa_F \\
& \cos(bb_2)^2 \\
& +8 \cdot m_b^2 R^4 \cos(om t)^3 \sin(bb_1)^3 bb_F_1^2 \cos(bb_1) \sin(om t)^2 JB \\
& -24 \cdot m_b^2 R^4 \cos(om t)^4 \sin(bb_1)^3 bb_F_1 \cos(bb_1) aa_F \sin(om t)^2 JB \\
& -8 \cdot m_b^2 R^4 \cos(om t)^4 \sin(bb_1) bb_F_1 \cos(bb_1)^3 aa_F JB \\
& -16 \cdot m_b^2 R^3 \cos(om t)^3 \sin(bb_1)^2 e \sin(om t)^3 om aa_F \cos(bb_1) JB \\
& +4 \cdot JB m_b^2 R^3 \sin(bb_2) l aa_F^2 \cos(om t)^2 \cos(bb_1)^2 \\
& +4 \cdot JB m_b^2 R^3 \sin(bb_2) l aa_F^2 \cos(om t)^4 \sin(bb_1)^2 \\
& -4 \cdot JB m_b^2 R^4 \cos(om t)^3 \sin(bb_2) \cos(bb_2) bb_F_2^2 \cos(bb_1)^2 \\
& +4 \cdot JB m_b^2 R^4 \sin(bb_2) aa_F^2 \cos(om t)^3 \cos(bb_2) \sin(om t)^2 \sin(bb_1)^2 \\
& +4 \cdot JB m_b^2 R^4 \sin(bb_2) aa_F^2 \cos(om t)^5 \cos(bb_2) \sin(bb_1)^2 \\
& -8 \cdot m_b^2 R^2 l e \sin(om t)^3 om aa_F \cos(bb_2)^2 JB \\
& -16 \cdot m_b R^2 JB^2 \sin(om t) om aa_F \cos(bb_2)^2 \cos(om t)^3 \sin(bb_2)^2 \\
& -32 \cdot m_b R^2 \sin(om t)^4 \sin(bb_1) aa_F \cos(bb_1) bb_F_1 JB^2 \\
& +4 \cdot m_b^2 R^3 l \sin(bb_2) bb_F_2^2 JB \cos(bb_1)^2 \\
& -16 \cdot m_b R^2 \cos(om t)^3 \sin(bb_1)^2 kb bb_1 JB \\
& -16 \cdot m_b R^2 \cos(om t) JB^2 \sin(om t) om aa_F \cos(bb_2)^4 \\
& +16 \cdot m_b R l \cos(bb_1) kb bb_1 JB \\
& +m_b^3 R^5 l \cos(om t)^2 om^2 \cos(bb_2)^2 \sin(bb_2) \cos(bb_1)^2 \\
& -16 \cdot m_b R^2 \cos(om t) \cos(bb_1)^2 kb bb_1 JB \\
& -2 \cdot m_b^3 R^5 l aa_F^2 \sin(om t)^2 \sin(bb_1) \cos(bb_1)^2 \cos(om t)^2 \cos(bb_2)^2 \\
& +256 \cdot m_b e^2 \sin(om t) om aa_F \cos(om t) JB^2 \\
& +2 \cdot m_b^3 e om \sin(om t)^3 bb_F_2 \cos(bb_2) R^5 \sin(bb_2)^2 \cos(bb_1)^2 \\
& +4 \cdot m_b^2 R^3 \sin(om t)^2 \cos(om t)^2 \sin(bb_1)^3 l aa_F^2 JB \\
& -8 \cdot m_b^2 R^3 \sin(om t)^2 \cos(om t)^3 \sin(bb_1)^3 e aa_F^2 JB \\
& -8 \cdot m_b^2 R^3 \sin(om t)^2 \cos(om t)^2 \sin(bb_1)^3 g_1 \cos(aa) JB \\
& +4 \cdot m_b^2 R^4 \sin(om t)^6 \cos(om t) \sin(bb_1)^3 aa_F^2 \cos(bb_1) JB \\
& -8 \cdot m_b^2 R^3 \sin(om t)^5 \cos(om t) \sin(bb_1)^2 e om aa_F \cos(bb_1) JB \\
& -8 \cdot m_b^3 R^6 \cos(bb_2) \sin(bb_2)^3 bb_F_2 \cos(om t)^6 aa_F \sin(om t)^2 \\
& \sin(bb_1)^2
\end{aligned}$$

$$\begin{aligned}
& -6 \cdot m \cdot b^3 R^6 \cos(bb_2)^3 \sin(bb_2) bb_F_2 \cos(om t)^4 aa_F \sin(om t)^2 \\
& \quad \sin(bb_1)^2 \\
& -2 \cdot m \cdot b^3 R^6 \cos(bb_2)^3 \sin(bb_2) bb_F_2 \sin(om t)^4 aa_F \cos(bb_1)^2 \\
& -6 \cdot m \cdot b^3 R^6 \cos(bb_2)^3 \sin(bb_2) bb_F_2 \sin(om t)^4 aa_F \cos(om t)^2 \\
& \quad \sin(bb_1)^2 \\
& +2 \cdot m \cdot b^3 R^6 \cos(bb_2) \sin(bb_2)^3 bb_F_2 aa_F \cos(om t)^4 \cos(bb_1)^2 \\
& +2 \cdot m \cdot b^3 R^6 \cos(bb_2) \sin(bb_2)^3 bb_F_2 aa_F \cos(om t)^6 \sin(bb_1)^2 \\
& -64 \cdot ka \cdot aa \cdot JB^2 \\
& -4 \cdot m \cdot b^3 R^6 \sin(om t)^2 \cos(om t)^2 \sin(bb_1) bb_F_1 \cos(bb_1)^3 aa_F \\
& \cos(bb_2)^2 + m \cdot b^3 R^5 \sin(om t)^4 \cos(om t)^2 \sin(bb_1)^3 l aa_F^2 \sin(bb_2)^2 \\
& + m \cdot b^3 R^5 \sin(om t)^2 \cos(om t)^2 \sin(bb_1)^3 l aa_F^2 \cos(bb_2)^2 \\
& -2 \cdot m \cdot b^3 R^5 \sin(om t)^4 \cos(om t)^3 \sin(bb_1)^3 e aa_F^2 \sin(bb_2)^2 \\
& -2 \cdot m \cdot b^3 R^5 \sin(om t)^2 \cos(om t)^3 \sin(bb_1)^3 e aa_F^2 \cos(bb_2)^2 \\
& -2 \cdot m \cdot b^3 R^5 \sin(om t)^4 \cos(om t)^2 \sin(bb_1)^3 g \cos(aa) \sin(bb_2)^2 \\
& -2 \cdot m \cdot b^3 R^5 \sin(om t)^2 \cos(om t)^2 \sin(bb_1)^3 g \cos(aa) \cos(bb_2)^2 \\
& +4 \cdot m \cdot b^2 R^4 \sin(om t)^6 \cos(om t) \sin(bb_1)^3 aa_F^2 JB \cos(bb_1) \sin(bb_2)^2 \\
& +4 \cdot m \cdot b^2 R^4 \sin(om t)^4 \cos(om t) \sin(bb_1)^3 aa_F^2 JB \cos(bb_1) \\
& \cos(bb_2)^2 \\
& +m \cdot b^3 R^6 \sin(om t)^8 \cos(om t) \sin(bb_1)^3 aa_F^2 \cos(bb_1) \sin(bb_2)^2 \\
& +16 \cdot m \cdot b \cdot R \cdot l \cdot bb_F_1^2 \sin(bb_1) JB^2 \\
& -1 \cdot m \cdot b^3 R^5 l \sin(om t) om \cos(bb_2)^3 aa_F \cos(om t)^2 \cos(bb_1)^2 \\
& -1 \cdot m \cdot b^3 R^5 l \sin(om t) om \cos(bb_2)^3 aa_F \cos(om t)^4 \sin(bb_1)^2 \\
& -2 \cdot m \cdot b^3 R^4 l e \sin(om t)^5 om aa_F \cos(bb_2)^2 \sin(bb_1)^2 \\
& -4 \cdot m \cdot b^3 R^4 l e \sin(om t)^3 om aa_F \cos(bb_2)^2 \cos(om t)^2 \sin(bb_1)^2 \\
& -2 \cdot m \cdot b^3 R^4 l e \sin(om t) om aa_F \cos(om t)^4 \cos(bb_2)^2 \sin(bb_1)^2 \\
& -4 \cdot m \cdot b^2 R^3 l JB \sin(om t)^3 om aa_F \cos(bb_2)^3 \sin(bb_1)^2 \\
& -4 \cdot m \cdot b^2 R^3 l JB \sin(om t) om aa_F \cos(bb_2)^3 \cos(bb_1)^2 \\
& -4 \cdot m \cdot b^2 R^3 l JB \sin(om t) om aa_F \cos(bb_2)^3 \cos(om t)^2 \sin(bb_1)^2 \\
& -4 \cdot m \cdot b^2 R^3 l aa_F^2 \sin(om t)^4 \sin(bb_2) JB \cos(bb_2)^2 \sin(bb_1)^2 \\
& -4 \cdot m \cdot b^2 R^3 l aa_F^2 \sin(om t)^2 \sin(bb_2) JB \cos(bb_2)^2 \cos(bb_1)^2 \\
& +8 \cdot m \cdot b^2 R^3 l \sin(bb_2) bb_F_2 aa_F \cos(om t)^3 JB \sin(bb_1)^2 \\
& -2 \cdot m \cdot b^3 R^6 om \sin(om t)^5 \sin(bb_1)^4 bb_F_1 \cos(bb_2)^2 \\
& +m \cdot b^3 R^6 om \sin(om t)^7 \cos(bb_1)^2 bb_F_1 \sin(bb_2)^2 \sin(bb_1)^2 \\
& +m \cdot b^3 R^6 om \sin(om t)^5 \cos(bb_1)^4 bb_F_1 \sin(bb_2)^2 \\
& +m \cdot b^3 R^6 om \sin(om t)^5 \cos(bb_1)^2 bb_F_1 \cos(bb_2)^2 \sin(bb_1)^2 \\
& +m \cdot b^3 R^6 om \sin(om t)^3 \cos(bb_1)^4 bb_F_1 \cos(bb_2)^2
\end{aligned}$$

$$\begin{aligned}
& + 6 \cdot m \cdot b^3 R^6 \cdot om \sin(om t)^3 \cdot bb_F_2 \cos(bb_2)^2 \cos(om t)^2 \sin(bb_2)^2 \\
& \quad \sin(bb_1)^2 \\
& + 3 \cdot m \cdot b^3 R^6 \cdot om \sin(om t) \cdot bb_F_2 \cos(bb_2)^2 \cos(om t)^2 \sin(bb_2)^2 \\
& \quad \cos(bb_1)^2 \\
& + 3 \cdot m \cdot b^3 R^6 \cdot om \sin(om t) \cdot bb_F_2 \cos(bb_2)^2 \cos(om t)^4 \sin(bb_2)^2 \\
& \quad \sin(bb_1)^2 \\
& + 3 \cdot m \cdot b^3 R^6 \cdot om \sin(om t)^5 \cdot bb_F_2 \cos(bb_2)^2 \sin(bb_2)^2 \sin(bb_1)^2 \\
& + 3 \cdot m \cdot b^3 R^6 \cdot om \sin(om t)^3 \cdot bb_F_2 \cos(bb_2)^2 \sin(bb_2)^2 \cos(bb_1)^2 \\
& + m \cdot b^3 R^6 \cdot om \sin(om t)^3 \cdot bb_F_2 \cos(bb_2)^4 \sin(bb_1)^2 \\
& + m \cdot b^3 R^6 \cdot om \sin(om t) \cdot bb_F_2 \cos(bb_2)^4 \cos(bb_1)^2 \\
& + m \cdot b^3 R^6 \cdot om \sin(om t) \cdot bb_F_2 \cos(bb_2)^4 \cos(om t)^2 \sin(bb_1)^2 \\
& + 6 \cdot m \cdot b^3 R^6 \cdot om \sin(om t)^3 \cdot bb_F_2 \cos(om t)^4 \sin(bb_2)^4 \sin(bb_1)^2 \\
& + 2 \cdot m \cdot b^3 R^6 \cdot om \sin(om t) \cdot bb_F_2 \cos(om t)^4 \sin(bb_2)^4 \cos(bb_1)^2 \\
& + 2 \cdot m \cdot b^3 R^6 \cdot om \sin(om t) \cdot bb_F_2 \cos(om t)^6 \sin(bb_2)^4 \sin(bb_1)^2 \\
& + 6 \cdot m \cdot b^3 R^6 \cdot om \sin(om t)^5 \cdot bb_F_2 \cos(om t)^2 \sin(bb_2)^4 \sin(bb_1)^2 \\
& + 4 \cdot m \cdot b^3 R^6 \cdot om \sin(om t)^3 \cdot bb_F_2 \cos(om t)^2 \sin(bb_2)^4 \cos(bb_1)^2 \\
& - 3 \cdot m \cdot b^3 R^6 \cdot om \sin(om t)^3 \cdot bb_F_2 \cos(om t)^4 \cos(bb_2)^2 \sin(bb_2)^2 \\
& \quad \sin(bb_1)^2 \\
& - 1 \cdot m \cdot b^3 R^6 \cdot om \sin(om t) \cdot bb_F_2 \cos(om t)^4 \cos(bb_2)^2 \sin(bb_2)^2 \\
& \quad \cos(bb_1)^2 \\
& - 1 \cdot m \cdot b^3 R^6 \cdot om \sin(om t) \cdot bb_F_2 \cos(om t)^6 \cos(bb_2)^2 \sin(bb_2)^2 \\
& \quad \sin(bb_1)^2 \\
& - 3 \cdot m \cdot b^3 R^6 \cdot om \sin(om t)^5 \cdot bb_F_2 \cos(om t)^2 \cos(bb_2)^2 \sin(bb_2)^2 \\
& \quad \sin(bb_1)^2 \\
& - 2 \cdot m \cdot b^3 R^6 \cdot om \sin(om t)^3 \cdot bb_F_2 \cos(om t)^2 \cos(bb_2)^2 \sin(bb_2)^2 \\
& \quad \cos(bb_1)^2 \\
& - 2 \cdot m \cdot b^3 R^6 \cdot om \sin(om t)^3 \cdot bb_F_2 \cos(om t)^2 \cos(bb_2)^4 \sin(bb_1)^2 \\
& - 1 \cdot m \cdot b^3 R^6 \cdot om \sin(om t) \cdot bb_F_2 \cos(om t)^2 \cos(bb_2)^4 \cos(bb_1)^2 \\
& + 4 \cdot m \cdot b^3 R^5 l \sin(bb_2)^3 \cdot bb_F_2 aa_F \cos(om t)^3 \sin(om t)^2 \sin(bb_1)^2 \\
& + 2 \cdot m \cdot b^3 R^5 l \sin(bb_2)^3 \cdot bb_F_2 aa_F \cos(om t)^5 \sin(bb_1)^2 \\
& + 2 \cdot m \cdot b^3 R^5 l \sin(bb_2)^3 \cdot bb_F_2 aa_F \cos(om t) \sin(om t)^4 \sin(bb_1)^2 \\
& + 2 \cdot m \cdot b^3 R^5 l \sin(bb_2)^3 \cdot bb_F_2 aa_F \cos(om t) \sin(om t)^2 \cos(bb_1)^2 \\
& + 2 \cdot m \cdot b^3 R^5 l \sin(bb_2) \cdot bb_F_2 aa_F \cos(om t) \cos(bb_2)^2 \sin(om t)^2 \\
& \quad \sin(bb_1)^2 \\
& + 2 \cdot m \cdot b^3 R^5 l \sin(bb_2) \cdot bb_F_2 aa_F \cos(om t) \cos(bb_2)^2 \cos(bb_1)^2 \\
& + 2 \cdot m \cdot b^3 R^5 l \sin(bb_2) \cdot bb_F_2 aa_F \cos(om t)^3 \cos(bb_2)^2 \sin(bb_1)^2
\end{aligned}$$

$$\begin{aligned}
& + 8 \cdot m_b^2 R^3 l \sin(bb_2)^3 bb_F_2 aa_F \cos(om t) \sin(om t)^2 JB \\
& + 4 \cdot m_b^2 R^3 l \sin(bb_2) bb_F_2^2 JB \sin(om t)^2 \sin(bb_1)^2 \\
& + 4 \cdot m_b^2 R^3 l \sin(bb_2) bb_F_2^2 JB \cos(om t)^2 \sin(bb_1)^2 \\
& + 2 \cdot m_b^3 R^5 l \sin(bb_2)^3 bb_F_2^2 \cos(om t)^2 \sin(om t)^2 \sin(bb_1)^2 \\
& + m_b^3 R^5 l \sin(bb_2)^3 bb_F_2^2 \cos(om t)^2 \cos(bb_1)^2 \\
& + 16 \cdot JB m_b^2 aa_F \sin(om t) om R^3 \cos(bb_2) e \cos(om t)^3 \sin(bb_1)^2 \\
& - 8 \cdot JB \cos(om t) m_b^2 R^3 e \sin(om t)^5 om aa_F \cos(bb_1) \sin(bb_2)^2 \\
& - 8 \cdot JB \cos(om t) m_b^2 R^3 e \sin(om t)^3 om aa_F \cos(bb_1) \cos(bb_2)^2 \\
& + 16 \cdot JB \cos(om t) m_b^2 aa_F \sin(om t) om R^3 \cos(bb_1) e \cos(bb_2)^2 \\
& + 4 \cdot JB \cos(om t) m_b^2 R^4 aa_F^2 \sin(om t)^4 \sin(bb_1) \cos(bb_1) \cos(bb_2)^2 \\
& - 4 \cdot JB \cos(om t) m_b^2 R^4 \cos(bb_1) \sin(bb_1) bb_F_1^2 \sin(om t)^2 \\
& \sin(bb_2)^2 \\
& - 4 \cdot JB \cos(om t) m_b^2 R^4 \sin(om t)^5 om \cos(bb_1)^2 aa_F \sin(bb_2)^2 \\
& + 12 \cdot JB \cos(om t) m_b^2 R^4 \cos(bb_1)^2 aa_F \sin(om t)^3 om \sin(bb_2)^2 \\
& + 4 \cdot JB \cos(om t) m_b^2 R^4 \sin(bb_1) \sin(om t)^4 \cos(bb_1) bb_F_1^2 \\
& \sin(bb_2)^2 \\
& + 4 \cdot JB \cos(om t) m_b^2 R^4 \sin(bb_1) \sin(om t)^2 \cos(bb_1) bb_F_1^2 \\
& \cos(bb_2)^2 \\
& - 1 \cdot m_b^3 R^6 om \sin(om t) bb_F_2 \cos(om t)^4 \cos(bb_2)^4 \sin(bb_1)^2 \\
& + 2 \cdot m_b^3 R^6 om \sin(om t)^7 bb_F_2 \sin(bb_2)^4 \sin(bb_1)^2 \\
& + 2 \cdot m_b^3 R^6 om \sin(om t)^5 bb_F_2 \sin(bb_2)^4 \cos(bb_1)^2 \\
& - 1 \cdot m_b^3 R^6 om \sin(om t)^7 bb_F_2 \cos(bb_2)^2 \sin(bb_2)^2 \sin(bb_1)^2 \\
& - 1 \cdot m_b^3 R^6 om \sin(om t)^5 bb_F_2 \cos(bb_2)^2 \sin(bb_2)^2 \cos(bb_1)^2 \\
& - 1 \cdot m_b^3 R^6 om \sin(om t)^5 bb_F_2 \cos(bb_2)^4 \sin(bb_1)^2 \\
& - 1 \cdot m_b^3 R^6 om \sin(om t)^3 bb_F_2 \cos(bb_2)^4 \cos(bb_1)^2 \\
& - 8 \cdot m_b^2 R^4 om \sin(om t) \sin(bb_1)^4 bb_F_1 \cos(om t)^4 JB \\
& - 4 \cdot m_b^2 R^4 om \sin(om t) bb_F_2 \cos(om t)^2 \cos(bb_2)^2 JB \cos(bb_1)^2 \\
& - 4 \cdot m_b^2 R^4 om \sin(om t) bb_F_2 \cos(om t)^4 \cos(bb_2)^2 JB \sin(bb_1)^2 \\
& + 4 \cdot m_b^2 R^4 om \sin(om t) \cos(bb_1)^2 \cos(om t)^4 bb_F_1 \sin(bb_2)^2 JB \\
& + 8 \cdot m_b^2 R^4 om \sin(om t)^3 \cos(bb_1)^2 \cos(om t)^2 bb_F_1 \sin(bb_2)^2 JB \\
& + 4 \cdot m_b^2 R^4 om \sin(om t) \cos(bb_1)^2 \cos(om t)^2 bb_F_1 \cos(bb_2)^2 JB \\
& + m_b^3 R^6 \cos(om t) \cos(bb_1)^4 aa_F \sin(om t)^3 om \sin(bb_2)^2 \\
& + m_b^3 R^6 \cos(om t) \cos(bb_1)^3 \sin(bb_1) \sin(om t)^4 bb_F_1^2 \sin(bb_2)^2 \\
& + m_b^3 R^6 \cos(om t) \cos(bb_1)^3 \sin(bb_1) \sin(om t)^2 bb_F_1^2 \cos(bb_2)^2 \\
& - 1 \cdot m_b^3 R^6 \cos(om t)^5 \cos(bb_1)^4 \sin(om t) om aa_F \sin(bb_2)^2 \\
& - 1 \cdot m_b^3 R^6 \cos(om t)^5 \cos(bb_1)^3 \sin(bb_1) aa_F^2 \sin(bb_2)^2
\end{aligned}$$

$$\begin{aligned}
& -1. m_b^3 R^6 \cos(om t)^3 \cos(bb_1)^3 \sin(bb_1) aa_F^2 \sin(om t)^2 \sin(bb_2)^2 \\
& -1. m_b^3 R^6 \cos(om t)^3 \cos(bb_1)^3 \sin(bb_1) aa_F^2 \cos(bb_2)^2 \\
& -16. m_b^2 R^3 \cos(om t) \cos(bb_1)^3 e \sin(om t)^3 om aa_F JB \\
& -1. m_b^3 R^6 \cos(om t) \cos(bb_1)^4 \sin(om t)^3 om \cos(bb_2)^2 aa_F \\
& -1. m_b^3 R^6 \cos(om t)^3 \cos(bb_1)^4 \sin(om t) om \cos(bb_2)^2 aa_F \\
& -4. m_b^2 R^4 \cos(om t) \cos(bb_1)^4 JB \sin(om t) om aa_F \cos(bb_2)^2 \\
& +m_b^3 R^6 \cos(om t) \cos(bb_1)^4 \sin(om t) om aa_F \cos(bb_2)^2 \\
& +3. m_b^3 R^6 om \sin(om t)^3 \cos(bb_1)^2 \cos(om t)^4 bb_F_1 \sin(bb_2)^2 \\
& \sin(bb_1)^2 \\
& +m_b^3 R^6 om \sin(om t) \cos(bb_1)^2 \cos(om t)^6 bb_F_1 \sin(bb_2)^2 \\
& \sin(bb_1)^2 \\
& +3. m_b^3 R^6 om \sin(om t)^5 \cos(bb_1)^2 \cos(om t)^2 bb_F_1 \sin(bb_2)^2 \\
& \sin(bb_1)^2 \\
& +2. m_b^3 R^6 om \sin(om t)^3 \cos(bb_1)^4 \cos(om t)^2 bb_F_1 \sin(bb_2)^2 \\
& +2. m_b^3 R^6 om \sin(om t)^3 \cos(bb_1)^2 \cos(om t)^2 bb_F_1 \cos(bb_2)^2 \\
& \sin(bb_1)^2 +m_b^3 R^6 om \sin(om t) \cos(bb_1)^4 \cos(om t)^2 bb_F_1 \cos(bb_2)^2 \\
& +m_b^3 R^6 om \sin(om t) \cos(bb_1)^2 \cos(om t)^4 bb_F_1 \cos(bb_2)^2 \\
& \sin(bb_1)^2 \\
& -2. m_b^3 R^6 om \sin(om t) \sin(bb_1)^4 bb_F_1 \cos(om t)^6 \sin(bb_2)^2 \\
& -6. m_b^3 R^6 om \sin(om t)^5 \sin(bb_1)^4 bb_F_1 \cos(om t)^2 \sin(bb_2)^2 \\
& -4. m_b^3 R^6 om \sin(om t)^3 \sin(bb_1)^4 bb_F_1 \cos(om t)^2 \cos(bb_2)^2 \\
& -2. m_b^3 R^6 om \sin(om t) \sin(bb_1)^4 bb_F_1 \cos(om t)^4 \cos(bb_2)^2 \\
& -2. m_b^3 R^6 om \sin(om t)^7 \sin(bb_1)^4 bb_F_1 \sin(bb_2)^2 \\
& -6. m_b^3 R^6 aa_F^2 \sin(om t)^4 \sin(bb_2)^3 \cos(bb_2) \cos(om t)^5 \sin(bb_1)^2 \\
& +4. m_b^2 R^4 kb bb_2 \cos(bb_2)^2 \cos(om t)^3 \sin(bb_1)^2 \\
& +8. m_b^2 R^4 kb bb_2 \cos(om t)^3 \sin(bb_2)^2 \sin(om t)^2 \sin(bb_1)^2 \\
& +4. m_b^2 R^4 kb bb_2 \cos(om t)^3 \sin(bb_2)^2 \cos(bb_1)^2 \\
& +4. m_b^2 R^4 kb bb_2 \cos(om t)^5 \sin(bb_2)^2 \sin(bb_1)^2 \\
& +4. m_b^3 R^5 e \sin(om t)^2 om^2 \sin(bb_2) \cos(bb_2)^2 \cos(om t)^3 \sin(bb_1)^2 \\
& +m_b^3 R^6 \cos(bb_2)^3 \sin(bb_2) bb_F_2^2 \cos(om t)^3 \sin(bb_1)^2 \\
& -2. m_b^3 R^6 aa_F^2 \sin(om t)^2 \sin(bb_2) \cos(om t)^3 \cos(bb_2)^3 \cos(bb_1)^2 \\
& -3. m_b^3 R^6 aa_F^2 \sin(om t)^2 \sin(bb_2)^3 \cos(om t)^5 \cos(bb_2) \cos(bb_1)^2 \\
& -2. m_b^3 R^6 \sin(om t)^3 om \cos(bb_2)^4 aa_F \cos(om t)^3 \sin(bb_1)^2 \\
& -3. m_b^3 R^6 \sin(om t)^5 om \cos(bb_2)^2 aa_F \cos(om t)^3 \sin(bb_2)^2 \\
& \sin(bb_1)^2 \\
& -2. m_b^3 R^6 \sin(om t)^3 om \cos(bb_2)^2 aa_F \cos(om t)^3 \sin(bb_2)^2
\end{aligned}$$

$$\begin{aligned}
& \cos(bb_1)^2 + m_b^3 R^5 l \cos(om t)^4 \sin(bb_1) \cos(bb_1)^2 bb_F_I^2 \sin(bb_2)^2 \\
& + 16. m_b^2 e bb_F_I \sin(bb_1)^3 aa_F \cos(om t)^4 JB R^3 \\
& - 32. m_b e R \sin(om t) bb_F_I \cos(bb_1) JB^2 \\
& + 16. m_b R l \sin(bb_2) bb_F_I^2 JB^2 \\
& - 64. JB^3 \sin(om t) \sin(bb_1)^2 bb_F_I \\
& - 8. m_b^2 R^3 \cos(om t)^5 \sin(bb_1)^2 e \sin(om t) \sin(bb_1) aa_F JB \\
& + 4. m_b^2 R^3 \cos(om t)^4 \sin(bb_1)^3 l aa_F^2 JB \\
& - 8. m_b^2 R^3 \cos(om t)^5 \sin(bb_1)^3 e aa_F^2 JB \\
& - 8. m_b^2 R^3 \cos(om t)^4 \sin(bb_1)^3 g_cos(aa) JB \\
& + 4. m_b^2 R^4 \cos(om t)^7 \sin(bb_1)^3 aa_F^2 \cos(bb_1) JB \\
& - 8. m_b^2 R^4 \cos(om t)^3 \sin(bb_1)^2 \sin(om t)^3 om \cos(bb_1)^2 aa_F JB \\
& - 4. m_b^2 R^4 \cos(om t)^5 \sin(bb_1)^2 \sin(om t) om \cos(bb_1)^2 aa_F JB \\
& + 12. m_b^2 R^4 \cos(om t)^5 \sin(bb_1)^3 aa_F^2 \sin(om t)^2 \cos(bb_1) JB \\
& - 8. m_b^2 R^4 \cos(om t)^3 \sin(bb_1)^2 kb bb_I \sin(om t)^2 \sin(bb_2)^2 \\
& + 4. m_b^2 R^4 \cos(om t)^5 \sin(bb_1)^3 bb_F_I^2 \cos(bb_1) JB \\
& + 4. m_b^2 R^3 l \cos(bb_2) JB aa_F \sin(om t) \sin(om t)^2 \sin(bb_1)^2 \\
& + 4. m_b^2 R^3 l bb_F_I^2 \sin(bb_1) \cos(om t)^2 \sin(bb_2)^2 JB \\
& + 4. m_b^2 R^3 l bb_F_I^2 \sin(bb_1) \cos(bb_2)^2 JB \\
& - 32. m_b R l bb_F_I \sin(bb_1) aa_F \cos(om t) JB^2 \\
& - 8. m_b^2 R^3 l bb_F_I \sin(bb_1)^3 aa_F \cos(om t) JB \sin(om t)^2 \\
& - 8. m_b^2 R^3 l bb_F_I \sin(bb_1) aa_F \cos(om t) JB \cos(bb_1)^2 \\
& - 8. m_b^2 R^3 l bb_F_I \sin(bb_1)^3 aa_F \cos(om t)^3 JB \\
& - 4. m_b^3 R^5 l bb_F_I \sin(bb_1)^3 aa_F \cos(om t)^3 \sin(bb_2)^2 \sin(om t)^2 \\
& - 2. m_b^3 R^5 l bb_F_I \sin(bb_1) aa_F \cos(om t)^3 \sin(bb_2)^2 \cos(bb_1)^2 \\
& - 2. m_b^3 R^5 l bb_F_I \sin(bb_1)^3 aa_F \cos(om t)^5 \sin(bb_2)^2 \\
& - 2. m_b^3 R^5 l bb_F_I \sin(bb_1)^3 aa_F \cos(om t) \sin(om t)^4 \sin(bb_2)^2 \\
& + 4. m_b^2 R^3 l bb_F_I^2 \sin(bb_1)^3 JB \sin(om t)^2 \\
& + 12. JB \sin(om t)^3 bb_F_2 R^4 m_b^2 \sin(bb_2)^2 \cos(bb_1)^2 \\
& + 8. JB \sin(om t)^3 bb_F_2 R^4 m_b^2 \cos(bb_2)^2 \sin(bb_1)^2 \\
& + 8. JB \sin(om t) bb_F_2 R^4 m_b^2 \cos(bb_2)^2 \cos(bb_1)^2 \\
& + 8. JB \sin(om t)^3 bb_F_2 \sin(bb_2)^4 R^4 m_b^2 \cos(om t)^2 \sin(bb_1)^2 \\
& + 4. JB \sin(om t) bb_F_2 \sin(bb_2)^4 R^4 m_b^2 \cos(om t)^2 \cos(bb_1)^2 \\
& + 4. JB \sin(om t) bb_F_2 \sin(bb_2)^4 R^4 m_b^2 \cos(om t)^4 \sin(bb_1)^2 \\
& + 4. JB \sin(om t)^5 bb_F_2 \sin(bb_2)^4 R^4 m_b^2 \sin(bb_1)^2 \\
& + 4. JB \sin(om t)^3 bb_F_2 \sin(bb_2)^4 R^4 m_b^2 \cos(bb_1)^2 \\
& + 4. JB \sin(om t)^3 bb_F_2 \sin(bb_2)^2 R^4 m_b^2 \cos(bb_2)^2 \sin(bb_1)^2
\end{aligned}$$

$$\begin{aligned}
& + 4. JB \sin(\omega t) bb_F_2 \sin(bb_2)^2 R^4 m_b^2 \cos(bb_2)^2 \cos(bb_1)^2 \\
& + 4. JB \sin(\omega t) bb_F_2 \sin(bb_2)^2 R^4 m_b^2 \cos(bb_2)^2 \cos(\omega t)^2 \\
& \sin(bb_1)^2 - 16. m_b R l \cos(bb_1) JB^2 aa_F \sin(\omega t) \omega \\
& - 4. m_b^2 R^3 l \cos(bb_1) JB aa_F \sin(\omega t)^3 \omega \sin(bb_2)^2 \\
& + 4. m_b^3 R^4 l \cos(bb_2) \sin(bb_2) e \cos(\omega t)^4 aa_F^2 \sin(bb_1)^2 \\
& + 4. m_b^3 R^4 l \cos(bb_2) \sin(bb_2) e \cos(\omega t)^2 aa_F^2 \cos(bb_1)^2 \\
& + 8. m_b^2 R^2 l \cos(bb_2) e \sin(\omega t)^2 \omega^2 \sin(bb_2) JB \\
& - 2. m_b^3 R^4 l \cos(bb_2) g_ \sin(bb_2) \cos(\omega t)^3 \cos(aa) \sin(bb_1)^2 \\
& + m_b^3 R^5 l \sin(bb_2)^3 bb_F_2^2 \cos(\omega t)^4 \sin(bb_1)^2 \\
& + m_b^3 R^5 l \sin(bb_2)^3 bb_F_2^2 \sin(\omega t)^4 \sin(bb_1)^2 \\
& + m_b^3 R^5 l \sin(bb_2)^3 bb_F_2^2 \sin(\omega t)^2 \cos(bb_1)^2 \\
& - 4. m_b^3 R^5 aa_F \sin(\omega t)^3 l \omega \cos(bb_1) \cos(\omega t)^2 \sin(bb_2)^2 \\
& \sin(bb_1)^2 \\
& - 2. m_b^3 R^5 aa_F \sin(\omega t) l \omega \cos(bb_1) \cos(\omega t)^4 \sin(bb_2)^2 \\
& \sin(bb_1)^2 \\
& - 2. m_b^3 R^5 aa_F \sin(\omega t)^5 l \omega \cos(bb_1) \sin(bb_2)^2 \sin(bb_1)^2 \\
& - 2. m_b^3 R^5 aa_F \sin(\omega t)^3 l \omega \cos(bb_1) \cos(bb_2)^2 \sin(bb_1)^2 \\
& - 2. m_b^3 R^5 aa_F \sin(\omega t) l \omega \cos(bb_1) \cos(bb_2)^2 \cos(\omega t)^2 \\
& \sin(bb_1)^2 \\
& + 4. m_b^3 R^5 aa_F \sin(\omega t)^3 l \omega \cos(bb_2) \cos(\omega t)^2 \sin(bb_2)^2 \\
& \sin(bb_1)^2 \\
& + 2. m_b^3 R^5 aa_F \sin(\omega t) l \omega \cos(bb_2) \cos(\omega t)^2 \sin(bb_2)^2 \\
& \cos(bb_1)^2 \\
& + 2. m_b^3 R^5 aa_F \sin(\omega t) l \omega \cos(bb_2) \cos(\omega t)^4 \sin(bb_2)^2 \\
& \sin(bb_1)^2 + 16. JB \cos(\omega t) kb bb_2 R^2 m_b \cos(bb_1)^2 \\
& + 4. JB \cos(\omega t) m_b^2 R^4 \cos(bb_2) \sin(bb_2) bb_F_2^2 \sin(\omega t)^2 \\
& \sin(bb_1)^2 \\
& + 4. JB \cos(\omega t) m_b^2 R^4 \cos(bb_2) \sin(bb_2) bb_F_2^2 \cos(bb_1)^2 \\
& - 8. JB \cos(\omega t) m_b^2 R^4 \sin(\omega t)^3 \omega \cos(bb_2)^2 aa_F \cos(bb_1)^2 \\
& - 8. JB \cos(\omega t) m_b^2 R^3 e \sin(\omega t)^5 \omega aa_F \cos(bb_2) \sin(bb_1)^2 \\
& - 8. JB \cos(\omega t) m_b^2 R^3 e \sin(\omega t)^3 \omega aa_F \cos(bb_2) \cos(bb_1)^2 \\
& + 16. JB \cos(\omega t) m_b^2 R^4 \sin(\omega t) \omega aa_F \cos(bb_2)^2 \cos(bb_1)^2 \\
& - 4. JB \cos(\omega t) m_b^2 R^4 \sin(\omega t)^4 \sin(bb_2) \cos(bb_2) bb_F_2^2 \\
& \sin(bb_1)^2 \\
& + 16. JB \cos(\omega t) m_b^2 aa_F \sin(\omega t)^3 \omega R^3 \cos(bb_2) e \sin(bb_1)^2 \\
& - 2. m_b^3 R^6 \cos(bb_2) \sin(bb_2)^3 bb_F_2 \sin(\omega t)^8 aa_F \sin(bb_1)^2
\end{aligned}$$

$$\begin{aligned}
& -2 \cdot m_b^3 R^6 \cos(bb_2) \sin(bb_2)^3 bb_F_2 \sin(om t)^6 aa_F \cos(bb_1)^2 \\
& -8 \cdot m_b^3 R^6 \cos(bb_2) \sin(bb_2)^3 bb_F_2 \sin(om t)^6 aa_F \cos(om t)^2 \\
& \sin(bb_1)^2 \\
& -4 \cdot m_b^3 R^6 \cos(bb_2)^3 \sin(bb_2) bb_F_2 \sin(om t)^2 aa_F \cos(om t)^2 \\
& \cos(bb_1)^2 \\
& -12 \cdot m_b^3 R^6 \cos(bb_2) \sin(bb_2)^3 bb_F_2 \cos(om t)^4 aa_F \sin(om t)^4 \\
& \sin(bb_1)^2 \\
& -6 \cdot m_b^3 R^6 \cos(bb_2) \sin(bb_2)^3 bb_F_2 \cos(om t)^4 aa_F \sin(om t)^2 \\
& \cos(bb_1)^2 \\
& -6 \cdot m_b^3 R^6 \cos(bb_2) \sin(bb_2)^3 bb_F_2 \sin(om t)^4 aa_F \cos(om t)^2 \\
& \cos(bb_1)^2 \\
& -8 \cdot m_b^2 R^4 \cos(bb_2) \sin(bb_2) bb_F_2 \sin(om t)^6 aa_F JB \sin(bb_1)^2 \\
& -8 \cdot m_b^2 R^4 \cos(bb_2) \sin(bb_2) bb_F_2 \sin(om t)^4 aa_F JB \cos(bb_1)^2 \\
& -24 \cdot m_b^2 R^4 \cos(bb_2) \sin(bb_2) bb_F_2 \sin(om t)^4 aa_F JB \cos(om t)^2 \\
& \sin(bb_1)^2 \\
& +2 \cdot m_b^3 R^5 aa_F \sin(om t)^5 l om \cos(bb_2) \sin(bb_2)^2 \sin(bb_1)^2 \\
& +2 \cdot m_b^3 R^5 aa_F \sin(om t)^3 l om \cos(bb_2) \sin(bb_2)^2 \cos(bb_1)^2 \\
& +8 \cdot m_b^2 R^3 aa_F \sin(om t) l om \cos(bb_2) \cos(om t)^2 \sin(bb_2)^2 JB \\
& +8 \cdot m_b^2 R^3 aa_F \sin(om t)^3 l om \cos(bb_2) \sin(bb_2)^2 JB \\
& -8 \cdot m_b^2 R^3 aa_F \sin(om t) l om \cos(bb_1) JB \cos(om t)^2 \sin(bb_1)^2 \\
& -8 \cdot m_b^2 R^3 aa_F \sin(om t)^3 l om \cos(bb_1) JB \sin(bb_1)^2 \\
& -4 \cdot m_b^2 R^4 \cos(om t) \sin(om t)^2 \sin(bb_2) \cos(bb_2)^3 bb_F_2^2 JB \\
& -8 \cdot m_b^2 R^4 \sin(om t)^6 \sin(bb_1)^3 aa_F \cos(bb_1) bb_F_1 JB \\
& -1 \cdot m_b^3 R^6 \cos(om t) aa_F^2 \sin(om t)^4 \sin(bb_2) \cos(bb_2)^3 \cos(bb_1)^2 \\
& +m_b^3 R^6 \cos(om t) \cos(bb_2)^3 \sin(bb_2) bb_F_2^2 \sin(om t)^2 \sin(bb_1)^2 \\
& -2 \cdot m_b^3 R^6 \sin(om t)^6 \sin(bb_1)^3 aa_F \cos(bb_1) bb_F_1 \cos(bb_2)^2 \\
& +2 \cdot m_b^3 R^5 \sin(bb_2)^3 e \cos(om t)^5 aa_F^2 \cos(bb_1)^2 \\
& +8 \cdot m_b^2 e \cos(om t) \cos(bb_2) kb bb_2 R^3 \sin(om t)^2 \sin(bb_1)^2 \\
& +8 \cdot m_b^2 e \cos(om t) R^3 \sin(om t)^2 \sin(bb_2) \cos(bb_2)^2 bb_F_2^2 JB \\
& +16 \cdot m_b^2 e bb_F_1 \sin(bb_1) aa_F \cos(om t)^2 R^3 \cos(bb_2)^2 JB \\
& -4 \cdot m_b^3 e \cos(bb_2) g_R^4 \sin(bb_2) \cos(om t)^2 \cos(aa) \cos(bb_1)^2 \\
& -4 \cdot m_b^3 e \cos(bb_2) g_R^4 \sin(bb_2) \cos(om t)^4 \cos(aa) \sin(bb_1)^2 \\
& +6 \cdot m_b^3 e R^5 aa_F^2 \sin(om t)^2 \sin(bb_1) \cos(bb_1)^2 \cos(om t)^5 \sin(bb_2)^2 \\
& +6 \cdot m_b^3 e R^5 aa_F^2 \sin(om t)^4 \sin(bb_1) \cos(bb_1)^2 \cos(om t)^3 \sin(bb_2)^2 \\
& +4 \cdot m_b^3 e R^5 aa_F^2 \sin(om t)^2 \sin(bb_1) \cos(bb_1)^2 \cos(om t)^3 \cos(bb_2)^2 \\
& -8 \cdot m_b^3 e^2 R^4 \sin(om t)^3 om aa_F \cos(bb_1)^2 \cos(om t)^3 \sin(bb_2)^2
\end{aligned}$$

$$\begin{aligned}
& -4 \cdot m_b^3 e^2 R^4 \sin(om t) om \cos(bb_1)^2 \cos(om t)^5 aa_F \sin(bb_2)^2 \\
& + 4 \cdot m_b^2 R^4 om \sin(om t)^5 \cos(bb_1)^2 bb_F_I \sin(bb_2)^2 JB \\
& + 4 \cdot m_b^2 R^4 om \sin(om t)^3 \cos(bb_1)^2 bb_F_I \cos(bb_2)^2 JB \\
& + 12 \cdot m_b^2 R^4 om \sin(om t)^3 bb_F_2 \cos(bb_2)^2 \sin(bb_2)^2 JB \\
& + 4 \cdot m_b^2 R^4 om \sin(om t) bb_F_2 \cos(bb_2)^4 JB \\
& + 8 \cdot m_b^2 R^4 om \sin(om t) bb_F_2 \cos(om t)^4 \sin(bb_2)^4 JB \\
& + 16 \cdot m_b^2 R^4 om \sin(om t)^3 bb_F_2 \cos(om t)^2 \sin(bb_2)^4 JB \\
& - 4 \cdot m_b^2 R^4 om \sin(om t) bb_F_2 \cos(om t)^2 \cos(bb_2)^4 JB \\
& + 8 \cdot m_b^2 R^4 om \sin(om t)^5 bb_F_2 \sin(bb_2)^4 JB \\
& - 8 \cdot m_b^2 R^4 om \sin(om t)^3 bb_F_2 \cos(om t)^2 \cos(bb_2)^2 \sin(bb_2)^2 JB \\
& - 4 \cdot m_b^2 R^4 om \sin(om t) bb_F_2 \cos(om t)^4 \cos(bb_2)^2 \sin(bb_2)^2 JB \\
& - 1 \cdot m_b^3 R^6 \cos(om t) aa_F^2 \sin(om t)^6 \sin(bb_2) \cos(bb_2)^3 \sin(bb_1)^2 \\
& - 1 \cdot m_b^3 R^6 \cos(om t) \sin(om t)^3 om \cos(bb_2)^4 aa_F \cos(bb_1)^2 \\
& + 2 \cdot m_b^3 R^6 \cos(bb_2)^3 \sin(bb_2) bb_F_2 aa_F \cos(om t)^4 \sin(bb_1)^2 \\
& + 2 \cdot m_b^3 R^4 l \cos(bb_2) e \cos(om t)^2 om^2 \sin(bb_2) \cos(bb_1)^2 \\
& - 16 \cdot m_b R l \cos(bb_1) JB^2 aa_F \sin(om t) \sin(bb_1)^2 om \\
& + 2 \cdot m_b^3 R^4 l \cos(bb_2) e \cos(om t)^4 om^2 \sin(bb_2) \sin(bb_1)^2 \\
& + 8 \cdot m_b^2 R^2 l \cos(bb_2) e \cos(om t)^2 om^2 \sin(bb_2) JB \\
& + 16 \cdot m_b R l \cos(bb_2) kb bb_2 JB \\
& + 4 \cdot m_b^2 R^3 l \sin(om t) om \cos(bb_1)^3 \cos(om t)^2 aa_F JB \\
& - 3 \cdot m_b^3 R^5 l aa_F^2 \sin(om t)^2 \sin(bb_1) \cos(bb_1)^2 \cos(om t)^4 \sin(bb_2)^2 \\
& - 3 \cdot m_b^3 R^5 l aa_F^2 \sin(om t)^4 \sin(bb_1) \cos(bb_1)^2 \cos(om t)^2 \sin(bb_2)^2 \\
& + 4 \cdot m_b^3 R^4 l e \sin(om t)^3 om aa_F \cos(bb_1)^2 \cos(om t)^2 \sin(bb_2)^2 \\
& + 2 \cdot m_b^3 R^4 l e \sin(om t)^5 om aa_F \cos(bb_1)^2 \sin(bb_2)^2 \\
& - 32 \cdot JB^2 aa_F \sin(om t) \sin(bb_2)^2 om R^2 m_b \cos(om t)^3 \sin(bb_1)^2 \\
& + 32 \cdot JB^2 aa_F \sin(om t) om R^2 m_b \cos(om t)^3 \sin(bb_1)^2 \\
& - 16 \cdot m_b R^2 \sin(om t) om \cos(bb_2)^2 aa_F \cos(om t)^3 JB^2 \\
& - 32 \cdot m_b R e \sin(om t) om aa_F \cos(om t)^3 \cos(bb_2) JB^2 \\
& + 32 \cdot JB^2 aa_F \sin(om t) om R^2 m_b \cos(om t)^3 \sin(bb_2)^2 \\
& + 32 \cdot m_b R^2 aa_F^2 \sin(om t)^2 \sin(bb_1) \cos(bb_1) \cos(om t)^3 JB^2 \\
& - 32 \cdot m_b R e \sin(om t) om \cos(bb_1) \cos(om t)^3 aa_F JB^2 \\
& + 16 \cdot m_b R \sin(bb_1) l aa_F^2 \cos(om t)^2 JB^2 \\
& + 128 \cdot \cos(om t) JB^3 aa_F \sin(om t) om \\
& - 24 \cdot m_b^2 R^4 \sin(om t)^4 \sin(bb_1)^3 aa_F \cos(bb_1) bb_F_I JB \cos(om t)^2 \\
& - 24 \cdot m_b^2 R^4 \sin(om t)^4 \sin(bb_1) aa_F \cos(bb_1) bb_F_I \cos(om t)^2 \\
& \sin(bb_2)^2 JB
\end{aligned}$$

$$\begin{aligned}
& -8 \cdot m_b^3 R^6 \sin(\omega t)^6 \sin(bb_1)^3 aa_F \cos(bb_1) bb_F I \cos(\omega t)^2 \\
& \quad \sin(bb_2)^2 \\
& -6 \cdot m_b^3 R^6 \sin(\omega t)^4 \sin(bb_1) aa_F \cos(bb_1)^3 bb_F I \cos(\omega t)^2 \\
& \quad \sin(bb_2)^2 \\
& -8 \cdot m_b^2 R^4 \sin(\omega t)^6 \sin(bb_1) aa_F \cos(bb_1) bb_F I \sin(bb_2)^2 JB \\
& -8 \cdot m_b^2 R^4 \sin(\omega t)^4 \sin(bb_1) aa_F \cos(bb_1) bb_F I \cos(bb_2)^2 JB \\
& -2 \cdot m_b^3 R^6 \sin(\omega t)^4 \sin(bb_1) aa_F \cos(bb_1)^3 bb_F I \cos(bb_2)^2 \\
& -6 \cdot m_b^3 R^6 \sin(\omega t)^4 \sin(bb_1)^3 aa_F \cos(bb_1) bb_F I \cos(bb_2)^2 \\
& \quad \cos(\omega t)^2 \\
& -8 \cdot m_b^2 R^3 \sin(\omega t)^5 \sin(bb_2)^2 \cos(\omega t) e \omega aa_F \cos(bb_2) JB \\
& +16 \cdot JB \cos(\omega t) m_b^2 aa_F \sin(\omega t) \omega R^3 \cos(bb_2) e \cos(bb_1)^2 \\
& -16 \cdot JB \cos(\omega t) kb bb_I R^2 m_b \cos(bb_2)^2 \\
& -16 \cdot JB \sin(\omega t)^4 \sin(bb_1)^3 aa_F \cos(bb_1) bb_F I R^4 m_b^2 \cos(\omega t)^2 \\
& \quad \sin(bb_2)^2 \\
& -8 \cdot JB \sin(\omega t)^2 \sin(bb_1) aa_F \cos(bb_1)^3 bb_F I R^4 m_b^2 \cos(\omega t)^2 \\
& \quad \sin(bb_2)^2 \\
& -8 \cdot JB \sin(\omega t)^2 \sin(bb_1)^3 aa_F \cos(bb_1) bb_F I R^4 m_b^2 \cos(\omega t)^4 \\
& \quad \sin(bb_2)^2 \\
& -8 \cdot JB \sin(\omega t)^6 \sin(bb_1)^3 aa_F \cos(bb_1) bb_F I R^4 m_b^2 \sin(bb_2)^2 \\
& -8 \cdot JB \sin(\omega t)^4 \sin(bb_1) aa_F \cos(bb_1)^3 bb_F I R^4 m_b^2 \sin(bb_2)^2 \\
& -8 \cdot JB \sin(\omega t)^4 \sin(bb_1)^3 aa_F \cos(bb_1) bb_F I R^4 m_b^2 \cos(bb_2)^2 \\
& -8 \cdot JB \sin(\omega t)^2 \sin(bb_1) aa_F \cos(bb_1)^3 bb_F I R^4 m_b^2 \cos(bb_2)^2 \\
& -8 \cdot JB \sin(\omega t)^2 \sin(bb_1)^3 aa_F \cos(bb_1) bb_F I R^4 m_b^2 \cos(bb_2)^2 \\
& \quad \cos(\omega t)^2 + 8 \cdot g \sin(aa) l m_b^2 JB R^2 \cos(bb_1)^2 \\
& -3 \cdot m_b^3 R^6 \sin(\omega t)^3 \omega \cos(bb_2)^2 aa_F \cos(\omega t)^5 \sin(bb_2)^2 \\
& \quad \sin(bb_1)^2 - 1 \cdot m_b^3 R^6 \sin(\omega t) \omega \cos(bb_2)^4 aa_F \cos(\omega t)^3 \cos(bb_1)^2 \\
& -1 \cdot m_b^3 R^6 \sin(\omega t) \omega \cos(bb_2)^4 aa_F \cos(\omega t)^5 \sin(bb_1)^2 \\
& -1 \cdot m_b^3 R^6 \sin(\omega t) \omega \cos(bb_2)^2 aa_F \cos(\omega t)^5 \sin(bb_2)^2 \\
& \quad \cos(bb_1)^2 \\
& -1 \cdot m_b^3 R^6 \sin(\omega t) \omega \cos(bb_2)^2 aa_F \cos(\omega t)^7 \sin(bb_2)^2 \\
& \quad \sin(bb_1)^2 \\
& -8 \cdot m_b^3 R^5 e \sin(\omega t)^3 \omega aa_F \cos(bb_2)^3 \cos(\omega t)^3 \sin(bb_1)^2 \\
& -6 \cdot m_b^3 R^5 e \sin(\omega t)^5 \omega aa_F \cos(bb_2) \cos(\omega t)^3 \sin(bb_2)^2 \\
& \quad \sin(bb_1)^2 \\
& -4 \cdot m_b^3 R^5 e \sin(\omega t)^3 \omega aa_F \cos(bb_2) \cos(\omega t)^3 \sin(bb_2)^2 \\
& \quad \cos(bb_1)^2
\end{aligned}$$

$$\begin{aligned}
& -6 \cdot m \cdot b^3 \cdot R^5 \cdot e \sin(om \cdot t)^3 \cdot om \cdot aa \cdot F \cos(bb_2) \cos(om \cdot t)^5 \sin(bb_2)^2 \\
& \quad \sin(bb_1)^2 \\
& -4 \cdot m \cdot b^3 \cdot R^5 \cdot e \sin(om \cdot t) \cdot om \cdot aa \cdot F \cos(om \cdot t)^3 \cos(bb_2)^3 \cos(bb_1)^2 \\
& -4 \cdot m \cdot b^3 \cdot R^5 \cdot e \sin(om \cdot t) \cdot om \cdot aa \cdot F \cos(om \cdot t)^5 \cos(bb_2)^3 \sin(bb_1)^2 \\
& -2 \cdot m \cdot b^3 \cdot R^6 \sin(om \cdot t)^2 \sin(bb_2) \cos(bb_2)^3 \cdot bb \cdot F \cdot 2^2 \cos(om \cdot t)^3 \\
& \quad \sin(bb_1)^2 \\
& -3 \cdot m \cdot b^3 \cdot R^6 \cdot aa \cdot F^2 \cos(om \cdot t)^5 \sin(bb_2) \cos(bb_2)^3 \sin(om \cdot t)^2 \sin(bb_1)^2 \\
& -12 \cdot m \cdot b^2 \cdot R^4 \cdot aa \cdot F^2 \sin(om \cdot t)^2 \sin(bb_2)^3 \cos(om \cdot t)^5 \cos(bb_2) \cdot JB \\
& +4 \cdot m \cdot b^3 \cdot R^5 \sin(bb_2) \cdot e \cos(om \cdot t)^3 \cdot aa \cdot F^2 \cos(bb_2)^2 \sin(om \cdot t)^2 \sin(bb_1)^2 \\
& +2 \cdot m \cdot b^3 \cdot R^5 \sin(bb_2)^3 \cdot e \cos(om \cdot t)^7 \cdot aa \cdot F^2 \sin(bb_1)^2 \\
& -1 \cdot m \cdot b^3 \cdot R^6 \cdot aa \cdot F^2 \cos(om \cdot t)^5 \sin(bb_2) \cos(bb_2)^3 \cos(bb_1)^2 \\
& -1 \cdot m \cdot b^3 \cdot R^6 \cdot aa \cdot F^2 \cos(om \cdot t)^7 \sin(bb_2) \cos(bb_2)^3 \sin(bb_1)^2 \\
& -1 \cdot m \cdot b^3 \cdot R^6 \cdot aa \cdot F^2 \cos(om \cdot t)^7 \sin(bb_2)^3 \cos(bb_2) \cos(bb_1)^2 \\
& -1 \cdot m \cdot b^3 \cdot R^6 \cdot aa \cdot F^2 \cos(om \cdot t)^9 \sin(bb_2)^3 \cos(bb_2) \sin(bb_1)^2 \\
& -2 \cdot m \cdot b^3 \cdot R^6 \sin(om \cdot t)^2 \sin(bb_2)^3 \cos(bb_2) \cdot bb \cdot F \cdot 2^2 \cos(om \cdot t)^3 \\
& \quad \cos(bb_1)^2 \\
& -3 \cdot m \cdot b^3 \cdot R^6 \sin(om \cdot t)^2 \sin(bb_2)^3 \cos(bb_2) \cdot bb \cdot F \cdot 2^2 \cos(om \cdot t)^5 \\
& \quad \sin(bb_1)^2 - 32 \cdot m \cdot b \cdot R \sin(bb_1) \cdot e \cos(om \cdot t)^3 \cdot aa \cdot F^2 \cdot JB^2 \\
& -32 \cdot m \cdot b \cdot g \cdot R \sin(bb_1) \cos(om \cdot t)^2 \cos(aa) \cdot JB^2 \\
& +16 \cdot m \cdot b \cdot R^2 \cos(om \cdot t)^5 \sin(bb_1) \cdot aa \cdot F^2 \cos(bb_1) \cdot JB^2 \\
& +16 \cdot m \cdot b \cdot R^2 \cos(om \cdot t)^3 \sin(bb_1) \cos(bb_1) \cdot bb \cdot F \cdot I^2 \cdot JB^2 \\
& -16 \cdot m \cdot b \cdot R^2 \sin(bb_1) \cdot aa \cdot F^2 \cos(om \cdot t)^3 \cos(bb_1) \cdot JB^2 \\
& +64 \cdot \cos(om \cdot t) \cdot m \cdot b \cdot aa \cdot F \sin(om \cdot t) \cdot om \cdot R \cos(bb_2) \cdot e \cdot JB^2 \\
& -32 \cdot \cos(om \cdot t) \cdot m \cdot b \cdot R \cdot e \sin(om \cdot t)^3 \cdot om \cdot aa \cdot F \cos(bb_2) \cdot JB^2 \\
& -16 \cdot \cos(om \cdot t) \cdot m \cdot b \cdot R^2 \sin(om \cdot t)^2 \sin(bb_2) \cos(bb_2) \cdot bb \cdot F \cdot 2^2 \cdot JB^2 \\
& -16 \cdot \cos(om \cdot t) \cdot m \cdot b \cdot R^2 \cdot aa \cdot F^2 \sin(om \cdot t)^4 \sin(bb_2) \cos(bb_2) \cdot JB^2 \\
& -16 \cdot \cos(om \cdot t) \cdot JB^2 \cdot aa \cdot F \sin(om \cdot t) \sin(bb_1)^2 \cdot om \cdot R^2 \cdot m \cdot b \cos(bb_2)^2 \\
& -64 \cdot \cos(om \cdot t) \cdot JB^3 \cos(bb_1)^2 \cdot aa \cdot F \sin(om \cdot t) \cdot om \\
& +64 \cdot \cos(om \cdot t) \cdot aa \cdot F^2 \sin(om \cdot t)^2 \sin(bb_1) \cdot JB^3 \cos(bb_1) \\
& -12 \cdot m \cdot b^3 \cdot R^6 \cos(om \cdot t)^4 \sin(bb_1)^3 \cdot bb \cdot F \cdot I \cos(bb_1) \cdot aa \cdot F \sin(om \cdot t)^4 \\
& \quad \sin(bb_2)^2 \\
& -6 \cdot m \cdot b^3 \cdot R^6 \cos(om \cdot t)^4 \sin(bb_1)^3 \cdot bb \cdot F \cdot I \cos(bb_1) \cdot aa \cdot F \sin(om \cdot t)^2 \\
& \quad \cos(bb_2)^2 \\
& -2 \cdot m \cdot b^3 \cdot R^6 \cos(om \cdot t)^6 \sin(bb_1) \cdot bb \cdot F \cdot I \cos(bb_1)^3 \cdot aa \cdot F \sin(bb_2)^2 \\
& -6 \cdot m \cdot b^3 \cdot R^6 \cos(om \cdot t)^4 \sin(bb_1) \cdot bb \cdot F \cdot I \cos(bb_1)^3 \cdot aa \cdot F \sin(om \cdot t)^2 \\
& \quad \sin(bb_2)^2
\end{aligned}$$

$$\begin{aligned}
& -2 \cdot m_b^3 R^6 \cos(om t)^4 \sin(bb_1) bb_F 1 \cos(bb_1)^3 aa_F \cos(bb_2)^2 \\
& -2 \cdot m_b^3 R^6 \cos(om t)^8 \sin(bb_1)^3 bb_F 1 \cos(bb_1) aa_F \sin(bb_2)^2 \\
& -2 \cdot m_b^3 R^6 \cos(om t)^6 \sin(bb_1)^3 bb_F 1 \cos(bb_1) aa_F \cos(bb_2)^2 \\
& +4 \cdot m_b^3 R^6 \cos(om t)^7 \sin(bb_1)^3 aa_F^2 \sin(om t)^2 \cos(bb_1) \sin(bb_2)^2 \\
& +6 \cdot m_b^3 R^6 \cos(om t)^5 \sin(bb_1)^3 aa_F^2 \sin(om t)^4 \cos(bb_1) \sin(bb_2)^2 \\
& +3 \cdot m_b^3 R^6 \cos(om t)^5 \sin(bb_1)^3 aa_F^2 \sin(om t)^2 \cos(bb_1) \cos(bb_2)^2 \\
& -6 \cdot m_b^3 R^5 \cos(om t)^5 \sin(bb_1)^2 e \sin(om t)^3 om aa_F \cos(bb_1) \\
& \quad \sin(bb_2)^2 \\
& -6 \cdot m_b^3 R^5 \cos(om t)^3 \sin(bb_1)^2 e \sin(om t)^5 om aa_F \cos(bb_1) \\
& \quad \sin(bb_2)^2 \\
& +8 \cdot m_b^2 e \cos(om t) \cos(bb_1) JB aa_F \sin(om t) \sin(bb_1)^2 om R^3 \\
& \quad \cos(bb_2)^2 \\
& -4 \cdot m_b^3 e^2 \cos(om t) \cos(bb_1) R^4 \sin(om t)^4 om^2 \sin(bb_1) \sin(bb_2)^2 \\
& -4 \cdot m_b^3 e^2 \cos(om t) \cos(bb_1) R^4 \sin(om t)^2 om^2 \sin(bb_1) \cos(bb_2)^2 \\
& +8 \cdot m_b^2 e \cos(om t) \cos(bb_1) JB aa_F \sin(om t)^3 \sin(bb_2)^2 om R^3 \\
& \quad \sin(bb_1)^2 - 16 \cdot m_b^2 e^2 \cos(om t) \cos(bb_1) R^2 \sin(om t)^2 om^2 \sin(bb_1) JB \\
& +48 \cdot m_b^2 e^2 \cos(om t) aa_F \sin(om t) om R^2 \cos(bb_2)^2 JB \\
& -16 \cdot m_b^2 e^2 \cos(om t) R^2 \sin(om t)^3 om aa_F \cos(bb_2)^2 JB \\
& -8 \cdot m_b^2 e \cos(om t) R^3 aa_F^2 \sin(om t)^4 \sin(bb_2) \cos(bb_2)^2 JB \\
& -4 \cdot m_b^3 e^2 \cos(om t) R^4 \sin(om t)^5 om aa_F \cos(bb_2)^2 \sin(bb_1)^2 \\
& -8 \cdot m_b^2 e \cos(om t) JB \sin(om t) om aa_F \cos(bb_2)^3 R^3 \cos(bb_1)^2 \\
& -8 \cdot m_b^2 e \cos(om t) aa_F^2 \sin(om t)^4 \sin(bb_2) JB \cos(bb_2)^2 R^3 \\
& \quad \sin(bb_1)^2 \\
& -16 \cdot \cos(om t) JB^2 \cos(bb_1)^2 aa_F \sin(om t)^3 om R^2 m_b \sin(bb_2)^2 \\
& +16 \cdot \cos(om t) aa_F^2 \sin(om t)^4 \sin(bb_1) JB^2 \cos(bb_1) R^2 m_b \\
& \quad \sin(bb_2)^2 \\
& +16 \cdot \cos(om t) aa_F^2 \sin(om t)^2 \sin(bb_1) JB^2 \cos(bb_1) R^2 m_b \\
& \quad \cos(bb_2)^2 + 32 \cdot \cos(om t) JB^2 aa_F \sin(om t)^3 om R^2 m_b \sin(bb_2)^2 \\
& -32 \cdot \cos(om t) m_b R e \sin(om t)^3 om aa_F \cos(bb_1) JB^2 \\
& -64 \cdot \cos(om t) JB^3 \sin(om t) om aa_F \cos(bb_2)^2 \\
& -16 \cdot \cos(om t) JB^2 \sin(om t)^3 om aa_F \cos(bb_2)^2 R^2 m_b \sin(bb_1)^2 \\
& -32 \cdot \cos(om t) JB^2 \sin(om t) om aa_F \cos(bb_2)^2 R^2 m_b \cos(bb_1)^2 \\
& -64 \cdot \cos(om t) aa_F^2 \sin(om t)^2 \sin(bb_2) JB^3 \cos(bb_2) \\
& -16 \cdot \cos(om t) aa_F^2 \sin(om t)^4 \sin(bb_2) JB^2 \cos(bb_2) R^2 m_b \\
& \quad \sin(bb_1)^2 \\
& -16 \cdot \cos(om t) aa_F^2 \sin(om t)^2 \sin(bb_2) JB^2 \cos(bb_2) R^2 m_b
\end{aligned}$$

$$\begin{aligned}
& \cos(bb_1)^2 + 16. g_ \sin(aa) l m_t JB^2 \\
& + g_ \sin(aa) l m_t R^4 m_b^2 \cos(bb_2)^2 \sin(om t)^2 \sin(bb_1)^2 \\
& + g_ \sin(aa) l m_t R^4 m_b^2 \cos(bb_2)^2 \cos(bb_1)^2 \\
& + g_ \sin(aa) l m_t R^4 m_b^2 \cos(bb_2)^2 \cos(om t)^2 \sin(bb_1)^2 \\
& + 16. g_ \sin(aa) l R^2 m_b^2 \cos(om t)^2 \sin(bb_2)^2 JB \\
& + 16. g_ \sin(aa) l R^2 m_b^2 \sin(om t)^2 \sin(bb_2)^2 JB \\
& + 16. g_ \sin(aa) l m_b^2 JB R^2 \sin(om t)^2 \sin(bb_1)^2 \\
& + 4. g_ \sin(aa) l m_t R^2 m_b \sin(om t)^2 \sin(bb_2)^2 JB \\
& + 4. g_ \sin(aa) l m_t R^2 m_b \cos(bb_2)^2 JB \\
& + 4. g_ \sin(aa) l m_t R^2 m_b \cos(om t)^2 \sin(bb_2)^2 JB \\
& + 8. g_ \sin(aa) l R^4 m_b^3 \cos(om t)^2 \sin(bb_2)^2 \sin(om t)^2 \sin(bb_1)^2 \\
& + 2. g_ \sin(aa) l R^4 m_b^3 \cos(om t)^2 \sin(bb_2)^2 \cos(bb_1)^2 \\
& - 16. JB^2 om \sin(om t)^3 bb_F_1 R^2 m_b \sin(bb_2)^2 \\
& + 16. g_ \sin(aa) l m_b^2 JB R^2 \cos(om t)^2 \sin(bb_1)^2 \\
& - 16. JB^2 om \sin(om t) \sin(bb_1)^2 bb_F_1 R^2 m_b \cos(om t)^2 \sin(bb_2)^2 \\
& - 16. JB^2 om \sin(om t) aa_F \cos(om t) \sin(bb_2)^2 R^2 m_b \cos(bb_2)^2 \\
& - 16. JB^2 om \sin(om t) bb_F_2 \cos(bb_2)^2 R^2 m_b \cos(om t)^2 \sin(bb_2)^2 \\
& + 16. JB^2 om \sin(om t) \cos(bb_1)^4 bb_F_1 R^2 m_b \\
& + 16. JB^2 om \sin(om t) \cos(bb_1)^2 bb_F_1 R^2 m_b \cos(om t)^2 \sin(bb_1)^2 \\
& - 16. JB^2 om \sin(om t) bb_F_2 \cos(bb_2)^2 R^2 m_b \cos(om t)^2 \sin(bb_1)^2 \\
& + 8. JB om \sin(om t)^3 \cos(bb_1)^2 bb_F_1 R^4 m_b^2 \cos(om t)^2 \sin(bb_2)^2 \\
& \sin(bb_1)^2 \\
& + 4. JB om \sin(om t) \cos(bb_1)^4 bb_F_1 R^4 m_b^2 \cos(om t)^2 \sin(bb_2)^2 \\
& + 4. JB om \sin(om t) \cos(bb_1)^2 bb_F_1 R^4 m_b^2 \cos(om t)^4 \sin(bb_2)^2 \\
& \sin(bb_1)^2 \\
& + 4. JB om \sin(om t)^5 \cos(bb_1)^2 bb_F_1 R^4 m_b^2 \sin(bb_2)^2 \sin(bb_1)^2 \\
& - 8. m_b^2 e \cos(om t) aa_F^2 \sin(om t)^2 \sin(bb_2) JB \cos(bb_2)^2 R^3 \\
& \cos(bb_1)^2 \\
& + 8. m_b^2 e \cos(om t) \sin(bb_2) bb_F_2^2 JB R^3 \sin(om t)^2 \sin(bb_1)^2 \\
& + 16. m_b^2 e om \sin(om t)^3 \cos(bb_1) \cos(om t)^2 bb_F_1 R^3 \sin(bb_2)^2 JB \\
& + 8. m_b^2 e om \sin(om t) \cos(bb_1) \cos(om t)^2 bb_F_1 R^3 \cos(bb_2)^2 JB \\
& - 2. m_b^3 e om \sin(om t)^3 bb_F_1 \cos(bb_1) R^5 \cos(bb_2)^2 \sin(bb_1)^2 \\
& - 2. m_b^3 e om \sin(om t) bb_F_1 \cos(bb_1) R^5 \cos(bb_2)^2 \cos(om t)^2 \\
& \sin(bb_1)^2 \\
& - 4. m_b^3 e om \sin(om t)^3 bb_F_1 \cos(bb_1) R^5 \sin(bb_2)^2 \cos(om t)^2 \\
& \sin(bb_1)^2 - 8. m_b^2 e om \sin(om t)^3 bb_F_1 \cos(bb_1) JB R^3 \sin(bb_1)^2
\end{aligned}$$

$$\begin{aligned}
& -8 \cdot m \cdot b^2 \cdot e \cdot om \sin(om t) \cdot bb_F_1 \cos(bb_1) \cdot JB \cdot R^3 \cos(om t)^2 \sin(bb_1)^2 \\
& + 8 \cdot m \cdot b^2 \cdot e \cdot om \sin(om t)^5 \cos(bb_1) \cdot bb_F_1 \cdot JB \cdot R^3 \sin(bb_1)^2 \\
& + 16 \cdot m \cdot b^2 \cdot e \cdot om \sin(om t)^3 \cos(bb_1) \cdot bb_F_1 \cdot JB \cdot R^3 \cos(om t)^2 \sin(bb_1)^2 \\
& - 4 \cdot m \cdot b^3 \cdot R^5 \cos(om t)^3 \sin(bb_1)^2 \cdot e \sin(om t)^3 \cdot om \cdot aa_F \cos(bb_1) \\
& \cos(bb_2)^2 \\
& - 2 \cdot m \cdot b^3 \cdot R^5 \cos(om t)^7 \sin(bb_1)^2 \cdot e \sin(om t) \cdot om \cos(bb_1) \cdot aa_F \\
& \sin(bb_2)^2 \\
& - 2 \cdot m \cdot b^3 \cdot R^5 \cos(om t)^5 \sin(bb_1)^2 \cdot e \sin(om t) \cdot om \cos(bb_1) \cdot aa_F \\
& \cos(bb_2)^2 + m \cdot b^3 \cdot R^5 \cos(om t)^6 \sin(bb_1)^3 \cdot l \cdot aa_F^2 \sin(bb_2)^2 \\
& + 2 \cdot m \cdot b^3 \cdot R^5 \cos(om t)^4 \sin(bb_1)^3 \cdot l \cdot aa_F^2 \sin(om t)^2 \sin(bb_2)^2 \\
& + m \cdot b^3 \cdot R^5 \cos(om t)^4 \sin(bb_1)^3 \cdot l \cdot aa_F^2 \cos(bb_2)^2 \\
& - 2 \cdot m \cdot b^3 \cdot R^5 \cos(om t)^7 \sin(bb_1)^3 \cdot e \cdot aa_F^2 \sin(bb_2)^2 \\
& - 4 \cdot m \cdot b^3 \cdot R^5 \cos(om t)^5 \sin(bb_1)^3 \cdot e \cdot aa_F^2 \sin(om t)^2 \sin(bb_2)^2 \\
& - 2 \cdot m \cdot b^3 \cdot R^5 \cos(om t)^5 \sin(bb_1)^3 \cdot e \cdot aa_F^2 \cos(bb_2)^2 \\
& + 2 \cdot m \cdot b^3 \cdot e \cdot om \sin(om t) \cos(bb_1)^3 \cos(om t)^2 \cdot bb_F_1 \cdot R^5 \cos(bb_2)^2 \\
& + 2 \cdot m \cdot b^3 \cdot e \cdot om \sin(om t) \cos(bb_1) \cos(om t)^4 \cdot bb_F_1 \cdot R^5 \cos(bb_2)^2 \\
& \sin(bb_1)^2 \\
& + 2 \cdot m \cdot b^3 \cdot e \cdot om \sin(om t)^5 \cos(bb_1) \cdot bb_F_1 \cdot R^5 \cos(bb_2)^2 \sin(bb_1)^2 \\
& - 6 \cdot m \cdot b^3 \cdot e \cdot om \sin(om t)^3 \cdot bb_F_2 \cos(om t)^4 \cos(bb_2) \cdot R^5 \sin(bb_2)^2 \\
& \sin(bb_1)^2 \\
& - 2 \cdot m \cdot b^3 \cdot e \cdot om \sin(om t) \cdot bb_F_2 \cos(om t)^4 \cos(bb_2) \cdot R^5 \sin(bb_2)^2 \\
& \cos(bb_1)^2 \\
& - 2 \cdot m \cdot b^3 \cdot e \cdot om \sin(om t) \cdot bb_F_2 \cos(om t)^6 \cos(bb_2) \cdot R^5 \sin(bb_2)^2 \\
& \sin(bb_1)^2 \\
& - 6 \cdot m \cdot b^3 \cdot e \cdot om \sin(om t)^5 \cdot bb_F_2 \cos(om t)^2 \cos(bb_2) \cdot R^5 \sin(bb_2)^2 \\
& \sin(bb_1)^2 \\
& - 4 \cdot m \cdot b^3 \cdot e \cdot om \sin(om t)^3 \cdot bb_F_2 \cos(om t)^2 \cos(bb_2) \cdot R^5 \sin(bb_2)^2 \\
& \cos(bb_1)^2 \\
& - 4 \cdot m \cdot b^3 \cdot e \cdot om \sin(om t)^3 \cdot bb_F_2 \cos(om t)^2 \cos(bb_2)^3 \cdot R^5 \sin(bb_1)^2 \\
& - 2 \cdot m \cdot b^3 \cdot e \cdot om \sin(om t) \cdot bb_F_2 \cos(om t)^2 \cos(bb_2)^3 \cdot R^5 \cos(bb_1)^2 \\
& - 2 \cdot m \cdot b^3 \cdot e \cdot om \sin(om t) \cdot bb_F_2 \cos(om t)^4 \cos(bb_2)^3 \cdot R^5 \sin(bb_1)^2 \\
& + 2 \cdot m \cdot b^3 \cdot R^5 \cdot g_ \sin(bb_2)^3 \cos(aa) \sin(om t)^4 \sin(bb_1)^2 \\
& + 2 \cdot m \cdot b^3 \cdot R^5 \cdot g_ \sin(bb_2)^3 \cos(aa) \sin(om t)^2 \cos(bb_1)^2 \\
& + 2 \cdot m \cdot b^3 \cdot R^5 \cdot g_ \sin(bb_2) \cos(aa) \cos(bb_2)^2 \sin(om t)^2 \sin(bb_1)^2 \\
& + 2 \cdot m \cdot b^3 \cdot R^5 \cdot g_ \sin(bb_2) \cos(aa) \cos(bb_2)^2 \cos(bb_1)^2 \\
& + 2 \cdot m \cdot b^3 \cdot R^5 \cdot g_ \sin(bb_2) \cos(aa) \cos(bb_2)^2 \cos(om t)^2 \sin(bb_1)^2
\end{aligned}$$

$$\begin{aligned}
& + 8 \cdot m_b^2 R^3 g_- \sin(bb_1)^3 \cos(aa) JB \sin(om t)^2 \\
& + 8 \cdot m_b^2 R^3 g_- \sin(bb_1) \cos(aa) JB \cos(bb_1)^2 \\
& + 8 \cdot m_b^2 R^3 g_- \sin(bb_1)^3 \cos(aa) JB \cos(om t)^2 \\
& + 2 \cdot m_b^3 R^5 g_- \sin(bb_1) \cos(aa) \cos(om t)^2 \sin(bb_2)^2 \cos(bb_1)^2 \\
& + 2 \cdot m_b^3 R^5 g_- \sin(bb_1)^3 \cos(aa) \cos(om t)^4 \sin(bb_2)^2 \\
& + 2 \cdot m_b^3 R^5 g_- \sin(bb_1)^3 \cos(aa) \sin(om t)^4 \sin(bb_2)^2 \\
& + 2 \cdot m_b^3 R^5 g_- \sin(bb_1) \cos(aa) \sin(om t)^2 \sin(bb_2)^2 \cos(bb_1)^2 \\
& + 2 \cdot m_b^3 R^5 g_- \sin(bb_1)^3 \cos(aa) \cos(bb_2)^2 \sin(om t)^2 \\
& + 8 \cdot m_b^2 e om \sin(om t) bb_F_2 \cos(bb_2) JB R^3 \cos(bb_1)^2 \\
& + 8 \cdot m_b^2 e om \sin(om t) bb_F_2 \cos(bb_2) JB R^3 \cos(om t)^2 \sin(bb_1)^2 \\
& - 16 \cdot m_b^2 e om \sin(om t)^3 bb_F_2 \cos(bb_2) JB R^3 \cos(om t)^2 \sin(bb_1)^2 \\
& - 2 \cdot m_b^3 e om \sin(om t) bb_F_1 \cos(bb_1)^3 R^5 \cos(om t)^2 \sin(bb_2)^2 \\
& - 2 \cdot m_b^3 e om \sin(om t) bb_F_1 \cos(bb_1) R^5 \cos(om t)^4 \sin(bb_2)^2 \\
& \sin(bb_1)^2 \\
& + 6 \cdot m_b^3 e om \sin(om t)^3 \cos(bb_1) \cos(om t)^4 bb_F_1 R^5 \sin(bb_2)^2 \\
& \sin(bb_1)^2 \\
& + 2 \cdot m_b^3 e om \sin(om t) \cos(bb_1)^3 \cos(om t)^4 bb_F_1 R^5 \sin(bb_2)^2 \\
& + 2 \cdot m_b^3 e om \sin(om t) \cos(bb_1) \cos(om t)^6 bb_F_1 R^5 \sin(bb_2)^2 \\
& \sin(bb_1)^2 \\
& + 6 \cdot m_b^3 e om \sin(om t)^5 \cos(bb_1) \cos(om t)^2 bb_F_1 R^5 \sin(bb_2)^2 \\
& \sin(bb_1)^2 \\
& + 4 \cdot m_b^3 e om \sin(om t)^3 \cos(bb_1)^3 \cos(om t)^2 bb_F_1 R^5 \sin(bb_2)^2 \\
& + 4 \cdot m_b^3 e om \sin(om t)^3 \cos(bb_1) \cos(om t)^2 bb_F_1 R^5 \cos(bb_2)^2 \\
& \sin(bb_1)^2 \\
& - 16 \cdot JB \sin(om t)^4 \sin(bb_2)^3 aa_F \cos(bb_2) bb_F_2 R^4 m_b^2 \cos(om t)^2 \\
& \sin(bb_1)^2 \\
& - 8 \cdot JB \sin(om t)^2 \sin(bb_2)^3 aa_F \cos(bb_2) bb_F_2 R^4 m_b^2 \cos(om t)^2 \\
& \cos(bb_1)^2 \\
& - 8 \cdot JB \sin(om t)^2 \sin(bb_2)^3 aa_F \cos(bb_2) bb_F_2 R^4 m_b^2 \cos(om t)^4 \\
& \sin(bb_1)^2 \\
& - 8 \cdot JB \sin(om t)^6 \sin(bb_2)^3 aa_F \cos(bb_2) bb_F_2 R^4 m_b^2 \sin(bb_1)^2 \\
& - 8 \cdot JB \sin(om t)^4 \sin(bb_2)^3 aa_F \cos(bb_2) bb_F_2 R^4 m_b^2 \cos(bb_1)^2 \\
& - 8 \cdot JB \sin(om t)^4 \sin(bb_2) aa_F \cos(bb_2)^3 bb_F_2 R^4 m_b^2 \sin(bb_1)^2 \\
& - 8 \cdot JB \sin(om t)^2 \sin(bb_2) aa_F \cos(bb_2)^3 bb_F_2 R^4 m_b^2 \cos(bb_1)^2 \\
& - 8 \cdot JB \sin(om t)^2 \sin(bb_2) aa_F \cos(bb_2)^3 bb_F_2 R^4 m_b^2 \cos(om t)^2 \\
& \sin(bb_1)^2 + 8 \cdot g_- \sin(aa) l R^2 m_b^2 \cos(bb_2)^2 JB
\end{aligned}$$

$$\begin{aligned}
& + 4 \cdot g_{_sin}(aa) l R^4 m_{_b}^3 \cos(om t)^4 \sin(bb_2)^2 \sin(bb_1)^2 \\
& + 4 \cdot g_{_sin}(aa) l R^4 m_{_b}^3 \sin(om t)^4 \sin(bb_2)^2 \sin(bb_1)^2 \\
& + 2 \cdot m_{_b}^3 R^4 l e \sin(om t) om \cos(bb_1)^2 \cos(om t)^4 aa_F \sin(bb_2)^2 \\
& + 16 \cdot m_{_b} R l JB^2 \cos(bb_1)^3 aa_F \sin(om t) om \\
& + 4 \cdot m_{_b}^2 R^3 l JB \cos(bb_1)^3 aa_F \sin(om t) om \cos(om t)^2 \sin(bb_2)^2 \\
& + 4 \cdot m_{_b}^2 R^3 l JB \cos(bb_1)^3 aa_F \sin(om t)^3 om \sin(bb_2)^2 \\
& + 2 \cdot m_{_b}^3 R^4 l aa_F \sin(om t) om \cos(bb_1)^2 e \cos(om t)^2 \sin(bb_2)^2 \\
& + 2 \cdot m_{_b}^3 R^4 l aa_F \sin(om t)^3 om \cos(bb_1)^2 e \sin(bb_2)^2 \\
& - 4 \cdot m_{_b}^2 R^3 l aa_F^2 \sin(om t)^2 \sin(bb_1) JB \cos(bb_1)^2 \cos(om t)^2 \\
& \sin(bb_2)^2 \\
& - 4 \cdot m_{_b}^2 R^3 l aa_F^2 \sin(om t)^4 \sin(bb_1) JB \cos(bb_1)^2 \sin(bb_2)^2 \\
& - 4 \cdot m_{_b}^2 R^3 l aa_F^2 \sin(om t)^2 \sin(bb_1) JB \cos(bb_1)^2 \cos(bb_2)^2 \\
& + 4 \cdot m_{_b}^3 e bb_F_1 \sin(bb_1) aa_F \cos(om t)^4 R^5 \sin(bb_2)^2 \cos(bb_1)^2 \\
& + 4 \cdot m_{_b}^3 e bb_F_1 \sin(bb_1)^3 aa_F \cos(om t)^2 R^5 \sin(om t)^4 \sin(bb_2)^2 \\
& + 4 \cdot m_{_b}^3 e bb_F_1 \sin(bb_1) aa_F \cos(om t)^2 R^5 \sin(om t)^2 \sin(bb_2)^2 \\
& \cos(bb_1)^2 \\
& + 4 \cdot m_{_b}^3 e bb_F_1 \sin(bb_1)^3 aa_F \cos(om t)^2 R^5 \cos(bb_2)^2 \sin(om t)^2 \\
& + 4 \cdot m_{_b}^3 e bb_F_1 \sin(bb_1) aa_F \cos(om t)^2 R^5 \cos(bb_2)^2 \cos(bb_1)^2 \\
& - 8 \cdot m_{_b}^2 e bb_F_1^2 \sin(bb_1)^3 JB R^3 \cos(om t)^3 \\
& - 2 \cdot m_{_b}^3 e bb_F_1^2 \sin(bb_1)^3 R^5 \cos(om t)^5 \sin(bb_2)^2 \\
& - 2 \cdot m_{_b}^3 e bb_F_1^2 \sin(bb_1)^3 R^5 \cos(bb_2)^2 \cos(om t)^3 \\
& + 16 \cdot m_{_b}^2 e bb_F_1 \sin(bb_1) aa_F \cos(om t)^4 R^3 \sin(bb_2)^2 JB \\
& + 16 \cdot m_{_b}^2 e bb_F_1 \sin(bb_1) aa_F \cos(om t)^2 R^3 \sin(om t)^2 \sin(bb_2)^2 JB \\
& + 16 \cdot m_{_b}^2 e \sin(bb_2) bb_F_2 aa_F \cos(om t)^2 R^3 \cos(bb_2)^2 JB \\
& + 8 \cdot m_{_b}^2 e \sin(bb_2)^3 bb_F_2^2 R^3 \cos(om t)^3 JB \\
& - 64 \cdot \cos(om t) JB^3 aa_F \sin(om t) \sin(bb_1)^2 om \\
& - 2 \cdot m_{_b}^3 R^6 \cos(bb_2)^3 \sin(bb_2) bb_F_2 \cos(om t)^6 aa_F \sin(bb_1)^2 \\
& - 1 \cdot m_{_b}^3 R^6 \cos(om t) \sin(om t)^2 \sin(bb_2) \cos(bb_2)^3 bb_F_2^2 \cos(bb_1)^2 \\
& - 8 \cdot m_{_b}^2 R^4 \cos(om t)^6 \sin(bb_1)^3 bb_F_1 \cos(bb_1) aa_F JB \\
& - 4 \cdot m_{_b}^2 R^4 \cos(om t) \sin(om t)^3 om \cos(bb_2)^4 aa_F JB \\
& - 4 \cdot m_{_b}^2 R^4 \cos(om t) aa_F^2 \sin(om t)^4 \sin(bb_2) \cos(bb_2)^3 JB \\
& - 1 \cdot m_{_b}^3 R^6 \cos(om t) \sin(om t)^4 \sin(bb_2) \cos(bb_2)^3 bb_F_2^2 \sin(bb_1)^2 \\
& + 4 \cdot m_{_b}^3 R^5 \cos(om t) aa_F \sin(om t) om \cos(bb_2)^3 e \cos(bb_1)^2 \\
& - 4 \cdot m_{_b}^2 R^4 \cos(om t) aa_F^2 \sin(om t)^4 \sin(bb_2) JB \cos(bb_2)^3 \sin(bb_1)^2 \\
& + 4 \cdot m_{_b}^3 R^5 \sin(bb_2) e \cos(om t)^5 aa_F^2 \cos(bb_2)^2 \sin(bb_1)^2 \\
& + 8 \cdot m_{_b}^2 R^4 \sin(om t)^2 \sin(bb_1)^3 aa_F \cos(bb_1) bb_F_1 JB \cos(om t)^2
\end{aligned}$$

$$\begin{aligned}
& + 8 \cdot m_b^2 R^4 \sin(om t)^2 \sin(bb_1) aa_F \cos(bb_1) bb_F_1 \cos(om t)^2 \\
& \quad \sin(bb_2)^2 JB \\
& + 2 \cdot m_b^3 R^6 \sin(om t)^4 \sin(bb_1)^3 aa_F \cos(bb_1) bb_F_1 \cos(om t)^2 \\
& \quad \sin(bb_2)^2 + 64 \cdot JB^3 om \sin(om t) \cos(bb_1)^2 bb_F_1 \\
& + 4 \cdot JB om \sin(om t)^3 \cos(bb_1)^2 bb_F_1 R^4 m_b^2 \cos(bb_2)^2 \sin(bb_1)^2 \\
& + 4 \cdot JB om \sin(om t) \cos(bb_1)^4 bb_F_1 R^4 m_b^2 \cos(bb_2)^2 \\
& + 4 \cdot JB om \sin(om t) \cos(bb_1)^2 bb_F_1 R^4 m_b^2 \cos(bb_2)^2 \cos(om t)^2 \\
& \quad \sin(bb_1)^2 \\
& - 8 \cdot JB om \sin(om t)^3 bb_F_2 \cos(bb_2)^2 R^4 m_b^2 \cos(om t)^2 \sin(bb_2)^2 \\
& \quad \sin(bb_1)^2 \\
& - 4 \cdot JB om \sin(om t) bb_F_2 \cos(bb_2)^2 R^4 m_b^2 \cos(om t)^2 \sin(bb_2)^2 \\
& \quad \cos(bb_1)^2 \\
& - 4 \cdot JB om \sin(om t) bb_F_2 \cos(bb_2)^2 R^4 m_b^2 \cos(om t)^4 \sin(bb_2)^2 \\
& \quad \sin(bb_1)^2 \\
& - 4 \cdot JB om \sin(om t)^5 bb_F_2 \cos(bb_2)^2 R^4 m_b^2 \sin(bb_2)^2 \sin(bb_1)^2 \\
& - 4 \cdot JB om \sin(om t)^3 bb_F_2 \cos(bb_2)^2 R^4 m_b^2 \sin(bb_2)^2 \cos(bb_1)^2 \\
& - 4 \cdot JB om \sin(om t)^3 bb_F_2 \cos(bb_2)^4 R^4 m_b^2 \sin(bb_1)^2 \\
& - 4 \cdot JB om \sin(om t) bb_F_2 \cos(bb_2)^4 R^4 m_b^2 \cos(bb_1)^2 \\
& + 16 \cdot JB^2 om \sin(om t)^3 \cos(bb_1)^2 bb_F_1 R^2 m_b \sin(bb_2)^2 \\
& + 8 \cdot m_b^2 R^3 l \sin(bb_2) bb_F_2 aa_F \cos(om t) \cos(bb_2)^2 JB \\
& + 4 \cdot m_b^2 R^3 l \sin(bb_2)^3 bb_F_2^2 \cos(om t)^2 JB \\
& + 8 \cdot m_b^2 R^3 l \sin(bb_2) bb_F_2 aa_F \cos(om t) JB \sin(om t)^2 \sin(bb_1)^2 \\
& + 8 \cdot m_b^2 R^3 l \sin(bb_2) bb_F_2 aa_F \cos(om t) JB \cos(bb_1)^2 \\
& + 4 \cdot m_b^2 R^3 l \cos(bb_1) kb bb_1 \cos(om t)^2 \sin(bb_2)^2 \\
& - 4 \cdot m_b^2 R^3 l \cos(bb_1) JB aa_F \sin(om t) \sin(bb_1)^2 om \cos(bb_2)^2 \\
& + 4 \cdot m_b^3 R^4 l \cos(bb_1) \sin(bb_1) e \cos(om t)^4 aa_F^2 \sin(bb_2)^2 \\
& + 4 \cdot m_b^3 R^4 l \cos(bb_1) \sin(bb_1) e \cos(om t)^2 aa_F^2 \sin(om t)^2 \sin(bb_2)^2 \\
& + 4 \cdot m_b^3 R^4 l \cos(bb_1) \sin(bb_1) e \cos(om t)^2 aa_F^2 \cos(bb_2)^2 \\
& + 4 \cdot m_b^3 R^4 l \cos(bb_1) e \sin(om t)^2 om^2 \sin(bb_1) \cos(om t)^2 \sin(bb_2)^2 \\
& + 2 \cdot m_b^3 R^4 l \cos(bb_1) e \sin(om t)^4 om^2 \sin(bb_1) \sin(bb_2)^2 \\
& - 8 \cdot m_b^2 R^3 \sin(om t)^2 \sin(bb_2)^3 \cos(om t)^2 g_{aa} \cos(aa) JB \\
& + 8 \cdot m_b^2 R^3 \sin(om t)^2 \sin(bb_2)^3 \cos(om t)^3 e aa_F^2 JB \\
& - 4 \cdot m_b^2 R^4 \sin(om t)^4 \sin(bb_2)^3 \cos(om t) \cos(bb_2) bb_F_2^2 JB \\
& + 4 \cdot m_b^2 R^3 \sin(om t)^2 \sin(bb_2)^3 \cos(om t)^2 l aa_F^2 JB \\
& - 4 \cdot m_b^2 R^4 \sin(om t)^6 \sin(bb_2)^3 \cos(om t) aa_F^2 \cos(bb_2) JB \\
& + 4 \cdot m_b^2 R^4 \sin(om t)^4 \sin(bb_2)^2 \cos(om t) kb bb_2 \sin(bb_1)^2
\end{aligned}$$

$$\begin{aligned}
& + 4 \cdot m_b^2 R^4 \sin(\omega t)^2 \sin(bb_2)^2 \cos(\omega t) kb bb_2 \cos(bb_1)^2 \\
& - 1 \cdot m_b^3 R^6 \sin(\omega t)^7 \sin(bb_2)^2 \cos(\omega t) \omega m \cos(bb_2)^2 aa_F \\
& \sin(bb_1)^2 \\
& - 1 \cdot m_b^3 R^6 \sin(\omega t)^5 \sin(bb_2)^2 \cos(\omega t) \omega m \cos(bb_2)^2 aa_F \\
& \cos(bb_1)^2 \\
& - 2 \cdot m_b^3 R^5 \sin(\omega t)^7 \sin(bb_2)^2 \cos(\omega t) e \omega m aa_F \cos(bb_2) \\
& \sin(bb_1)^2 \\
& - 2 \cdot m_b^3 R^5 \sin(\omega t)^5 \sin(bb_2)^2 \cos(\omega t) e \omega m aa_F \cos(bb_2) \\
& \cos(bb_1)^2 \\
& + 4 \cdot m_b^3 e \omega m \sin(\omega t)^3 bb_F_2 \cos(bb_2) R^5 \cos(\omega t)^2 \sin(bb_2)^2 \\
& \sin(bb_1)^2 \\
& + 2 \cdot m_b^3 e \omega m \sin(\omega t) bb_F_2 \cos(bb_2) R^5 \cos(\omega t)^2 \sin(bb_2)^2 \\
& \cos(bb_1)^2 \\
& + 2 \cdot m_b^3 e \omega m \sin(\omega t) bb_F_2 \cos(bb_2) R^5 \cos(\omega t)^4 \sin(bb_2)^2 \\
& \sin(bb_1)^2 \\
& + 2 \cdot m_b^3 e \omega m \sin(\omega t) bb_F_2 \cos(bb_2)^3 R^5 \cos(\omega t)^2 \sin(bb_1)^2 \\
& - 2 \cdot m_b^3 e \omega m \sin(\omega t)^7 bb_F_2 \cos(bb_2) R^5 \sin(bb_2)^2 \sin(bb_1)^2 \\
& - 2 \cdot m_b^3 e \omega m \sin(\omega t)^5 bb_F_2 \cos(bb_2) R^5 \sin(bb_2)^2 \cos(bb_1)^2 \\
& + 8 \cdot m_b^2 e \omega m \sin(\omega t) \cos(bb_1)^3 \cos(\omega t)^2 bb_F_1 JB R^3 \\
& + 8 \cdot m_b^2 e \omega m \sin(\omega t) \cos(bb_1) \cos(\omega t)^4 bb_F_1 JB R^3 \sin(bb_1)^2 \\
& - 8 \cdot m_b^2 e \omega m \sin(\omega t) bb_F_2 \cos(\omega t)^2 \cos(bb_2) JB R^3 \cos(bb_1)^2 \\
& - 8 \cdot m_b^2 e \omega m \sin(\omega t) bb_F_2 \cos(\omega t)^4 \cos(bb_2) JB R^3 \sin(bb_1)^2 \\
& - 8 \cdot m_b^2 e \omega m \sin(\omega t) bb_F_1 \cos(bb_1) R^3 \cos(bb_2)^2 JB \\
& + 2 \cdot m_b^3 R^6 \sin(\omega t)^2 \sin(bb_1) aa_F \cos(bb_1)^3 bb_F_1 \cos(\omega t)^2 \\
& \sin(bb_2)^2 \\
& + 4 \cdot m_b^3 R^6 \sin(\omega t)^2 \sin(bb_1)^3 aa_F \cos(bb_1) bb_F_1 \cos(\omega t)^4 \\
& \sin(bb_2)^2 \\
& + 2 \cdot m_b^3 R^6 \sin(\omega t)^2 \sin(bb_1)^3 aa_F \cos(bb_1) bb_F_1 \cos(bb_2)^2 \\
& \cos(\omega t)^2 \\
& + 8 \cdot m_b^2 R^4 \sin(\omega t)^2 \sin(bb_2) aa_F \cos(bb_2) bb_F_2 JB \cos(\omega t)^2 \\
& \sin(bb_1)^2 \\
& + 8 \cdot m_b^2 R^4 \sin(\omega t)^2 \sin(bb_2)^3 aa_F \cos(bb_2) bb_F_2 \cos(\omega t)^2 JB \\
& + 2 \cdot m_b^3 R^6 \sin(\omega t)^4 \sin(bb_2)^3 aa_F \cos(bb_2) bb_F_2 \cos(\omega t)^2 \\
& \sin(bb_1)^2 \\
& + 2 \cdot m_b^3 R^6 \sin(\omega t)^2 \sin(bb_2)^3 aa_F \cos(bb_2) bb_F_2 \cos(\omega t)^2 \\
& \cos(bb_1)^2
\end{aligned}$$

$$\begin{aligned}
& + 4 \cdot m_b^3 R^6 \sin(om t)^2 \sin(bb_2)^3 aa_F \cos(bb_2) bb_F 2 \cos(om t)^4 \\
& \quad \sin(bb_1)^2 \\
& + 2 \cdot m_b^3 R^6 \sin(om t)^2 \sin(bb_2) aa_F \cos(bb_2)^3 bb_F 2 \cos(om t)^2 \\
& \quad \sin(bb_1)^2 \\
& - 8 \cdot m_b^2 R^4 om \sin(om t)^3 bb_F 2 \cos(bb_2)^2 JB \cos(om t)^2 \sin(bb_1)^2 \\
& + 4 \cdot m_b^2 R^4 \sin(bb_2)^3 \cos(om t)^3 aa_F^2 \sin(om t)^2 \cos(bb_2) JB \\
& + 4 \cdot m_b^2 R^4 \sin(bb_2)^3 \cos(om t)^5 aa_F^2 \cos(bb_2) JB \\
& - 16 \cdot \cos(om t) JB^2 aa_F \sin(om t) \sin(bb_2)^2 om R^2 m_b \cos(bb_1)^2 \\
& + 16 \cdot \cos(om t) m_b R^2 \cos(bb_2) \sin(bb_2) bb_F 2^2 JB^2 \\
& - 16 \cdot \cos(om t) m_b R^2 \sin(om t)^3 om \cos(bb_2)^2 aa_F JB^2 \\
& + 64 \cdot \cos(om t) m_b aa_F \sin(om t) om R \cos(bb_1) e JB^2 \\
& - 16 \cdot \cos(om t) m_b R^2 \cos(bb_1) \sin(bb_1) bb_F 1^2 JB^2 \\
& - 16 \cdot \cos(om t) m_b R^2 \sin(om t)^3 om \cos(bb_1)^2 aa_F JB^2 \\
& + 16 \cdot \cos(om t) m_b R^2 \sin(bb_1) \sin(om t)^2 \cos(bb_1) bb_F 1^2 JB^2 \\
& - 32 \cdot \sin(om t)^2 \sin(bb_1) aa_F \cos(bb_1)^3 bb_F 1 JB^2 R^2 m_b \\
& - 32 \cdot \sin(om t)^2 \sin(bb_1)^3 aa_F \cos(bb_1) bb_F 1 JB^2 R^2 m_b \cos(om t)^2 \\
& - 32 \cdot \sin(om t)^2 \sin(bb_1) aa_F \cos(bb_1) bb_F 1 R^2 m_b \cos(om t)^2 \\
& \sin(bb_2)^2 JB^2 - 128 \cdot \sin(om t)^2 \sin(bb_2) aa_F \cos(bb_2) bb_F 2 JB^3 \\
& + 2 \cdot m_b^3 R^4 l \cos(bb_1) e \sin(om t)^2 om^2 \sin(bb_1) \cos(bb_2)^2 \\
& + 2 \cdot m_b^3 R^4 l \cos(bb_1) e \cos(om t)^2 om^2 \sin(bb_1) \cos(bb_2)^2 \\
& + 2 \cdot m_b^3 R^4 l \cos(bb_1) g_\sin(bb_1) \cos(om t)^3 \cos(aa) \sin(bb_2)^2 \\
& + 2 \cdot m_b^3 R^4 l \cos(bb_1) g_\sin(bb_1) \cos(om t) \cos(aa) \sin(om t)^2 \\
& \sin(bb_2)^2 \\
& + 2 \cdot m_b^3 R^4 l \cos(bb_1) g_\sin(bb_1) \cos(om t) \cos(aa) \cos(bb_2)^2 \\
& - 4 \cdot m_b^2 R^3 l \cos(bb_1) JB aa_F \sin(om t)^3 \sin(bb_2)^2 om \sin(bb_1)^2 \\
& - 4 \cdot m_b^2 R^3 l \cos(bb_1) JB aa_F \sin(om t) \sin(bb_2)^2 om \cos(om t)^2 \\
& \sin(bb_1)^2 + 8 \cdot m_b^2 R^2 l e \sin(om t) om \cos(bb_1)^2 \cos(om t)^2 aa_F JB \\
& + 8 \cdot m_b^2 R^2 l aa_F \sin(om t) om \cos(bb_1)^2 e JB \\
& - 4 \cdot m_b^2 R^3 l aa_F^2 \sin(om t)^4 \sin(bb_1) \cos(bb_1)^2 JB \\
& - 4 \cdot m_b^2 R^3 l \cos(om t)^4 \sin(bb_1) aa_F^2 \cos(bb_1)^2 JB \\
& + 4 \cdot m_b^2 R^3 l \sin(om t)^3 om \cos(bb_1)^3 aa_F JB \\
& + 4 \cdot m_b^2 R^3 l \cos(om t)^2 om^2 \cos(bb_1)^2 \sin(bb_1) JB \\
& + 4 \cdot m_b^2 R^3 l \cos(om t)^2 \sin(bb_1) \cos(bb_1)^2 bb_F 1^2 JB \\
& + 4 \cdot m_b^2 R^3 l \sin(bb_1) \sin(om t)^2 \cos(bb_1)^2 bb_F 1^2 JB \\
& + 8 \cdot m_b^2 R^3 l \sin(bb_1) aa_F^2 \cos(om t)^2 \cos(bb_1)^2 JB \\
& - 4 \cdot m_b^2 R^3 l aa_F^2 \sin(om t)^2 \sin(bb_2) JB \cos(bb_2)^2 \cos(om t)^2
\end{aligned}$$

$$\begin{aligned}
& \sin(bb_1)^2 + m_b^3 R^5 l \sin(om t)^3 om aa_F \cos(bb_2)^3 \sin(bb_1)^2 \\
& + 12. m_b^3 e^2 aa_F \sin(om t) om R^4 \cos(bb_2)^2 \cos(om t)^3 \sin(bb_1)^2 \\
& + 8. m_b^2 e JB om^2 \cos(bb_2)^2 \sin(bb_2) R^3 \cos(om t)^3 \sin(bb_1)^2 \\
& - 16. m_b^2 e^2 R^2 \sin(om t) om aa_F \cos(om t)^3 \cos(bb_2)^2 JB \\
& - 16. m_b^2 e \cos(bb_2) g_R^2 \sin(bb_2) \cos(om t)^2 \cos(aa) JB \\
& + 8. m_b^3 e^2 \cos(bb_2) R^4 \sin(om t)^2 om^2 \sin(bb_2) \cos(om t)^3 \sin(bb_1)^2 \\
& - 4. m_b^3 e \cos(bb_2) g_R^4 \sin(bb_2) \cos(om t)^2 \cos(aa) \sin(om t)^2 \\
& \sin(bb_1)^2 \\
& + 4. m_b^3 e^2 \cos(bb_2) R^4 \sin(bb_2) \cos(om t)^3 aa_F^2 \sin(om t)^2 \sin(bb_1)^2 \\
& + 8. m_b^2 e \cos(bb_2) JB aa_F \sin(om t) \sin(bb_2)^2 om R^3 \cos(om t)^3 \\
& \sin(bb_1)^2 + 16. m_b^2 e bb_F_1 \sin(bb_1)^3 aa_F \cos(om t)^2 JB R^3 \sin(om t)^2 \\
& + 16. m_b^2 e bb_F_1 \sin(bb_1)^3 aa_F \cos(om t)^4 R^5 \sin(bb_2)^2 \sin(om t)^2 \\
& + 2. m_b^3 R^5 g_ \sin(bb_1) \cos(aa) \cos(bb_2)^2 \cos(bb_1)^2 \\
& + 2. m_b^3 R^5 g_ \sin(bb_1)^3 \cos(aa) \cos(bb_2)^2 \cos(om t)^2 \\
& + 8. m_b^2 R^3 g_ \sin(bb_2)^3 \cos(aa) \cos(om t)^2 JB \\
& + 8. m_b^2 R^3 g_ \sin(bb_2)^3 \cos(aa) \sin(om t)^2 JB \\
& + 8. m_b^2 R^3 g_ \sin(bb_1) \cos(aa) \cos(om t)^2 \sin(bb_2)^2 JB \\
& + 8. m_b^2 R^3 g_ \sin(bb_1) \cos(aa) \sin(om t)^2 \sin(bb_2)^2 JB \\
& + 8. m_b^2 R^3 g_ \sin(bb_1) \cos(aa) \cos(bb_2)^2 JB \\
& + 8. m_b^2 R^3 g_ \sin(bb_2) \cos(aa) JB \cos(bb_1)^2 \\
& + 8. m_b^2 R^3 g_ \sin(bb_2) \cos(aa) \cos(bb_2)^2 JB \\
& + m_b^3 R^4 \cos(bb_2) \sin(bb_2) l^2 aa_F^2 \cos(om t) \cos(bb_1)^2 \\
& - 1. m_b^3 R^4 \cos(bb_1) \sin(bb_1) l^2 aa_F^2 \cos(om t)^3 \sin(bb_2)^2 \\
& - 1. m_b^3 R^4 \cos(bb_1) \sin(bb_1) l^2 aa_F^2 \cos(om t) \cos(bb_2)^2 \\
& + m_b^3 R^4 \cos(bb_2) \sin(bb_2) l^2 aa_F^2 \cos(om t)^3 \sin(bb_1)^2 \\
& + 4. m_b^2 R^3 l \cos(bb_1) kb bb_I \cos(bb_2)^2 \\
& - 4. m_b^2 R^3 l \cos(bb_1) JB aa_F \sin(om t) om \cos(om t)^2 \sin(bb_2)^2 \\
& + 16. m_b^2 R^2 l \cos(bb_1) \sin(bb_1) e \cos(om t)^2 aa_F^2 JB \\
& + 8. m_b^2 R^2 l \cos(bb_1) e \sin(om t)^2 om^2 \sin(bb_1) JB \\
& + 8. m_b^2 R^2 l \cos(bb_1) e \cos(om t)^2 om^2 \sin(bb_1) JB \\
& + 8. m_b^2 R^2 l \cos(bb_1) g_ \sin(bb_1) \cos(om t) \cos(aa) JB \\
& - 8. m_b^2 R^2 l aa_F \sin(om t) om \cos(bb_2)^2 e JB \\
& - 8. m_b^2 R^3 l aa_F^2 \sin(om t)^2 \sin(bb_2) \cos(om t)^2 \cos(bb_2)^2 JB \\
& + 4. m_b^2 R^3 l \sin(om t) om aa_F \cos(bb_2)^3 JB \\
& - 4. m_b^2 R^3 l aa_F^2 \cos(om t)^4 \sin(bb_2) \cos(bb_2)^2 JB
\end{aligned}$$

$$\begin{aligned}
& + 4 \cdot m_b^2 R^3 l \sin(om t)^2 \sin(bb_2) \cos(bb_2)^2 bb_F^2 JB \\
& + 16 \cdot m_b^2 e \sin(bb_2) bb_F^2 aa_F \cos(om t)^2 JB R^3 \sin(om t)^2 \sin(bb_1)^2 \\
& + 16 \cdot m_b^2 e \sin(bb_2) bb_F^2 aa_F \cos(om t)^2 JB R^3 \cos(bb_1)^2 \\
& - 4 \cdot m_b^3 e^2 \cos(bb_1) R^4 \sin(bb_1) \cos(om t)^3 aa_F^2 \sin(om t)^2 \sin(bb_2)^2 \\
& - 8 \cdot m_b^3 e^2 \cos(bb_1) R^4 \sin(om t)^2 om^2 \sin(bb_1) \cos(om t)^3 \sin(bb_2)^2 \\
& - 4 \cdot m_b^3 e \cos(bb_1) g_R^4 \sin(bb_1) \cos(om t)^4 \cos(aa) \sin(bb_2)^2 \\
& - 4 \cdot m_b^3 e \cos(bb_1) g_R^4 \sin(bb_1) \cos(om t)^2 \cos(aa) \sin(om t)^2 \\
& \sin(bb_2)^2 \\
& - 4 \cdot m_b^3 e \cos(bb_1) g_R^4 \sin(bb_1) \cos(om t)^2 \cos(aa) \cos(bb_2)^2 \\
& + 8 \cdot m_b^2 e \cos(bb_1) JB aa_F \sin(om t) \sin(bb_2)^2 om R^3 \cos(om t)^3 \\
& \sin(bb_1)^2 - 16 \cdot m_b^2 e \cos(bb_1) g_R^2 \sin(bb_1) \cos(om t)^2 \cos(aa) JB \\
& - 16 \cdot m_b^2 e R^3 aa_F^2 \sin(om t)^2 \sin(bb_2) \cos(om t)^3 \cos(bb_2)^2 JB \\
& + 32 \cdot m_b e R \cos(om t) \cos(bb_2) kb bb_2 JB \\
& + 2 \cdot g_{\sin(aa)} l R^4 m_b^3 \sin(om t)^2 \sin(bb_2)^2 \cos(bb_1)^2 \\
& + 2 \cdot g_{\sin(aa)} l R^4 m_b^3 \cos(bb_2)^2 \sin(om t)^2 \sin(bb_1)^2 \\
& + 2 \cdot g_{\sin(aa)} l R^4 m_b^3 \cos(bb_2)^2 \cos(om t)^2 \sin(bb_1)^2 \\
& + 4 \cdot g_{\sin(aa)} l m_t JB R^2 m_b \sin(om t)^2 \sin(bb_1)^2 \\
& + 4 \cdot g_{\sin(aa)} l m_t JB R^2 m_b \cos(bb_1)^2 \\
& + 4 \cdot g_{\sin(aa)} l m_t JB R^2 m_b \cos(om t)^2 \sin(bb_1)^2 \\
& + 2 \cdot g_{\sin(aa)} l m_t R^4 m_b^2 \cos(om t)^2 \sin(bb_2)^2 \sin(om t)^2 \sin(bb_1)^2 \\
& + g_{\sin(aa)} l m_t R^4 m_b^2 \cos(om t)^2 \sin(bb_2)^2 \cos(bb_1)^2 \\
& + g_{\sin(aa)} l m_t R^4 m_b^2 \cos(om t)^4 \sin(bb_2)^2 \sin(bb_1)^2 \\
& + g_{\sin(aa)} l m_t R^4 m_b^2 \sin(om t)^4 \sin(bb_2)^2 \sin(bb_1)^2 \\
& + g_{\sin(aa)} l m_t R^4 m_b^2 \sin(om t)^2 \sin(bb_2)^2 \cos(bb_1)^2 \\
& - 32 \cdot \sin(om t)^4 \sin(bb_1) aa_F \cos(bb_1) bb_F^2 R^2 m_b \sin(bb_2)^2 JB^2 \\
& - 32 \cdot \sin(om t)^2 \sin(bb_1) aa_F \cos(bb_1) bb_F^2 R^2 m_b \cos(bb_2)^2 JB^2 \\
& - 32 \cdot \sin(om t)^4 \sin(bb_2) aa_F \cos(bb_2) bb_F^2 R^2 m_b \sin(bb_1)^2 \\
& - 32 \cdot \sin(om t)^2 \sin(bb_2) aa_F \cos(bb_2) bb_F^2 R^2 m_b \cos(bb_1)^2 \\
& - 32 \cdot \sin(om t)^2 \sin(bb_2) aa_F \cos(bb_2) bb_F^2 R^2 m_b \cos(om t)^2 \\
& \sin(bb_1)^2 \\
& - 32 \cdot \sin(om t)^2 \sin(bb_2)^3 aa_F \cos(bb_2) bb_F^2 R^2 m_b \cos(om t)^2 JB^2 \\
& - 32 \cdot \sin(om t)^4 \sin(bb_2)^3 aa_F \cos(bb_2) bb_F^2 R^2 m_b JB^2 \\
& - 32 \cdot \sin(om t)^2 \sin(bb_2) aa_F \cos(bb_2)^3 bb_F^2 R^2 m_b JB^2 \\
& + 4 \cdot JB \cos(om t) m_b^2 R^4 aa_F^2 \sin(om t)^6 \sin(bb_1) \cos(bb_1) \sin(bb_2)^2 \\
& - 4 \cdot JB \cos(om t) m_b^2 R^4 aa_F^2 \sin(om t)^4 \sin(bb_2) \cos(bb_2) \cos(bb_1)^2 \\
& - 2 \cdot m_b^3 R^5 e \sin(om t) om aa_F \cos(om t)^5 \cos(bb_2) \sin(bb_2)^2
\end{aligned}$$

$$\begin{aligned}
& \cos(bb_1)^2 \\
& - 2. m_b^3 R^5 e \sin(om t) om aa_F \cos(om t)^7 \cos(bb_2) \sin(bb_2)^2 \\
& \sin(bb_1)^2 \\
& - 4. m_b^2 R^4 JB \sin(om t) om aa_F \cos(bb_2)^4 \cos(om t)^3 \sin(bb_1)^2 \\
& - 8. m_b^2 R^4 JB \sin(om t)^3 om aa_F \cos(bb_2)^2 \cos(om t)^3 \sin(bb_2)^2 \\
& \sin(bb_1)^2 \\
& - 4. m_b^2 R^4 JB \sin(om t) om aa_F \cos(bb_2)^2 \cos(om t)^3 \sin(bb_2)^2 \\
& \cos(bb_1)^2 \\
& - 4. m_b^2 R^4 JB \sin(om t) om aa_F \cos(bb_2)^2 \cos(om t)^5 \sin(bb_2)^2 \\
& \sin(bb_1)^2 \\
& - 4. m_b^2 R^4 aa_F^2 \sin(om t)^2 \sin(bb_2) JB \cos(bb_2)^3 \cos(om t)^3 \\
& \sin(bb_1)^2 \\
& - 8. m_b^2 R^4 aa_F^2 \sin(om t)^4 \sin(bb_2)^3 JB \cos(bb_2) \cos(om t)^3 \\
& \sin(bb_1)^2 \\
& - 4. m_b^2 R^4 aa_F^2 \sin(om t)^2 \sin(bb_2)^3 JB \cos(bb_2) \cos(om t)^3 \\
& \cos(bb_1)^2 \\
& - 4. m_b^2 R^4 aa_F^2 \sin(om t)^2 \sin(bb_2)^3 JB \cos(bb_2) \cos(om t)^5 \\
& \sin(bb_1)^2 + 2. m_b^3 R^5 e \cos(om t)^3 om^2 \sin(bb_2) \cos(bb_2)^2 \cos(bb_1)^2 \\
& + 24. m_b^2 R^3 \sin(bb_2)^2 \cos(om t) e \sin(om t)^3 om aa_F \cos(bb_2) JB \\
& + 4. m_b^2 R^4 \sin(bb_2)^3 \cos(om t) \sin(om t)^2 \cos(bb_2) bb_F_2^2 JB \\
& + 4. m_b^2 R^4 \sin(bb_2)^3 \cos(om t)^3 \cos(bb_2) bb_F_2^2 JB \\
& + m_b^3 R^6 \sin(bb_2)^3 \cos(om t)^3 aa_F^2 \sin(om t)^4 \cos(bb_2) \sin(bb_1)^2 \\
& + m_b^3 R^6 \sin(bb_2)^3 \cos(om t)^3 aa_F^2 \sin(om t)^2 \cos(bb_2) \cos(bb_1)^2 \\
& + 2. m_b^3 R^6 \sin(bb_2)^3 \cos(om t)^5 aa_F^2 \sin(om t)^2 \cos(bb_2) \sin(bb_1)^2 \\
& + m_b^3 R^6 \sin(bb_2)^2 \cos(om t) \sin(om t)^5 om \cos(bb_2)^2 aa_F \sin(bb_1)^2 \\
& + m_b^3 R^6 \sin(bb_2)^2 \cos(om t) \sin(om t)^3 om \cos(bb_2)^2 aa_F \cos(bb_1)^2 \\
& + 2. m_b^3 R^6 \sin(bb_2)^2 \cos(om t)^3 \sin(om t)^3 om \cos(bb_2)^2 aa_F \\
& \sin(bb_1)^2 \\
& + m_b^3 R^6 \sin(bb_2)^2 \cos(om t)^3 \sin(om t) om \cos(bb_2)^2 aa_F \cos(bb_1)^2 \\
& + m_b^3 R^6 \sin(bb_2)^2 \cos(om t)^5 \sin(om t) om \cos(bb_2)^2 aa_F \sin(bb_1)^2 \\
& + 6. m_b^3 R^5 \sin(bb_2)^2 \cos(om t) e \sin(om t)^5 om aa_F \cos(bb_2) \\
& \sin(bb_1)^2 + m_b^3 R^5 l \sin(om t) om aa_F \cos(bb_2)^3 \cos(bb_1)^2 \\
& + m_b^3 R^5 l \sin(om t) om aa_F \cos(bb_2)^3 \cos(om t)^2 \sin(bb_1)^2 \\
& - 1. m_b^3 R^5 l aa_F^2 \cos(om t)^4 \sin(bb_2) \cos(bb_2)^2 \cos(bb_1)^2 \\
& - 1. m_b^3 R^5 l aa_F^2 \cos(om t)^6 \sin(bb_2) \cos(bb_2)^2 \sin(bb_1)^2 \\
& + m_b^3 R^5 l \sin(om t)^4 \sin(bb_2) \cos(bb_2)^2 bb_F_2^2 \sin(bb_1)^2
\end{aligned}$$

$$\begin{aligned}
& + m_b^3 R^5 l \sin(om t)^2 \sin(bb_2) \cos(bb_2)^2 bb_F_2^2 \cos(bb_1)^2 \\
& + 2. m_b^3 R^5 l \sin(om t)^2 \sin(bb_2) \cos(bb_2)^2 bb_F_2^2 \cos(om t)^2 \\
& \sin(bb_1)^2 + m_b^3 R^5 l \sin(om t)^4 om^2 \cos(bb_2)^2 \sin(bb_2) \sin(bb_1)^2 \\
& + m_b^3 R^5 l \sin(om t)^2 om^2 \cos(bb_2)^2 \sin(bb_2) \cos(bb_1)^2 \\
& + 2. m_b^3 R^5 l \sin(om t)^2 om^2 \cos(bb_2)^2 \sin(bb_2) \cos(om t)^2 \sin(bb_1)^2 \\
& + m_b^3 R^5 l \cos(om t)^4 om^2 \cos(bb_2)^2 \sin(bb_2) \sin(bb_1)^2 \\
& + m_b^3 R^5 l \cos(om t)^2 \sin(bb_2) \cos(bb_2)^2 bb_F_2^2 \cos(bb_1)^2 \\
& + 4. m_b^2 R^3 l \cos(bb_2) kb bb_2 \cos(bb_1)^2 \\
& + 4. m_b^2 R^3 l \cos(bb_2) kb bb_2 \cos(om t)^2 \sin(bb_1)^2 \\
& - 2. m_b^3 R^4 l \cos(bb_2) g_ \sin(bb_2) \cos(om t) \cos(aa) \sin(om t)^2 \\
& \sin(bb_1)^2 \\
& + 4. m_b^3 R^4 l \cos(bb_2) e \cos(om t)^2 aa_F^2 \sin(om t)^2 \sin(bb_1)^2 \\
& + 16. m_b R l \cos(bb_2) JB^2 aa_F \sin(om t) \sin(bb_2)^2 om \\
& + 4. m_b^2 R^3 l \cos(bb_2) JB aa_F \sin(om t)^3 \sin(bb_2)^2 om \sin(bb_1)^2 \\
& + 4. m_b^2 R^3 l \cos(bb_2) JB aa_F \sin(om t) \sin(bb_2)^2 om \cos(bb_1)^2 \\
& + 4. m_b^2 R^3 l \cos(bb_2) JB aa_F \sin(om t) \sin(bb_2)^2 om \cos(om t)^2 \\
& \sin(bb_1)^2 + 4. m_b^2 R^3 l \cos(bb_2) JB aa_F \sin(om t)^3 om \sin(bb_1)^2 \\
& + 4. m_b^2 R^3 l \cos(bb_2) JB aa_F \sin(om t) om \cos(bb_1)^2 \\
& - 16. m_b^2 R^3 \cos(om t)^3 \cos(bb_1)^3 e \sin(om t) om aa_F JB \\
& - 16. m_b^2 R^3 \cos(om t)^3 \cos(bb_1)^2 \sin(bb_1) e aa_F^2 JB \\
& - 8. m_b^2 R^3 \cos(om t) \cos(bb_1)^2 e \sin(om t)^2 om^2 \sin(bb_1) JB \\
& - 8. m_b^2 R^3 \cos(om t)^3 \cos(bb_1)^2 e om^2 \sin(bb_1) JB \\
& - 8. m_b^2 R^3 \cos(om t)^2 \cos(bb_1)^2 g_ \sin(bb_1) \cos(aa) JB \\
& + 16. m_b^2 R^3 \cos(om t) \cos(bb_1)^3 aa_F \sin(om t) om e JB \\
& + 4. m_b^2 R^4 \cos(om t) \cos(bb_1)^3 aa_F^2 \sin(om t)^4 \sin(bb_1) JB \\
& + 4. m_b^2 R^4 \cos(om t)^5 \cos(bb_1)^3 \sin(bb_1) aa_F^2 JB \\
& - 4. m_b^2 R^4 \cos(om t) \cos(bb_1)^4 \sin(om t)^3 om aa_F JB \\
& + 4. m_b^2 R^4 \cos(om t)^3 \cos(bb_1)^3 \sin(bb_1) bb_F_I^2 JB \\
& + 4. m_b^2 R^4 \cos(om t) \cos(bb_1)^3 \sin(bb_1) \sin(om t)^2 bb_F_I^2 JB \\
& - 4. m_b^2 R^4 \cos(om t)^3 \cos(bb_1)^3 \sin(bb_1) aa_F^2 JB \\
& + 2. m_b^3 R^5 \sin(bb_2)^3 l aa_F^2 \cos(om t)^4 \sin(om t)^2 \sin(bb_1)^2 \\
& + m_b^3 R^5 \sin(bb_2)^3 l aa_F^2 \cos(om t)^4 \cos(bb_1)^2 \\
& + m_b^3 R^5 \sin(bb_2)^3 l aa_F^2 \cos(om t)^6 \sin(bb_1)^2 \\
& - 1. m_b^3 R^6 \cos(om t)^3 \sin(bb_2) \cos(bb_2)^3 bb_F_2^2 \cos(bb_1)^2 \\
& - 1. m_b^3 R^6 \cos(om t)^5 \sin(bb_2) \cos(bb_2)^3 bb_F_2^2 \sin(bb_1)^2 \\
& - 1. m_b^3 R^6 \cos(om t)^5 \sin(bb_2)^3 \cos(bb_2) bb_F_2^2 \cos(bb_1)^2
\end{aligned}$$

$$\begin{aligned}
& -1. m_b^3 R^6 \cos(om t)^7 \sin(bb_2)^3 \cos(bb_2) bb_F 2^2 \sin(bb_1)^2 \\
& + m_b^3 R^6 \sin(bb_2) aa_F^2 \cos(om t)^3 \cos(bb_2)^3 \sin(om t)^2 \sin(bb_1)^2 \\
& + 2. m_b^3 e om \sin(om t)^5 \cos(bb_1)^3 bb_F 1 R^5 \sin(bb_2)^2 \\
& + 4. m_b^3 e bb_F 1 \sin(bb_1)^3 aa_F \cos(om t)^6 R^5 \sin(bb_2)^2 \\
& - 8. m_b^2 e \cos(om t) \cos(bb_1) kb bb_1 R^3 \cos(bb_2)^2 \\
& + 8. m_b^2 e om \sin(om t)^3 \cos(bb_1)^3 bb_F 1 JB R^3 \\
& + 8. m_b^2 e \cos(om t) \sin(bb_2) bb_F 2^2 JB R^3 \cos(bb_1)^2 \\
& - 8. m_b^2 e R^3 aa_F^2 \cos(om t)^5 \sin(bb_2) \cos(bb_2)^2 JB \\
& - 2. m_b^3 e om \sin(om t)^5 bb_F 2 \cos(bb_2)^3 R^5 \sin(bb_1)^2 \\
& + 4. m_b^3 e bb_F 1 \sin(bb_1)^3 aa_F \cos(om t)^4 R^5 \cos(bb_2)^2 \\
& - 2. m_b^3 e R^5 \cos(om t)^5 \sin(bb_1) \cos(bb_1)^2 bb_F 1^2 \sin(bb_2)^2 \\
& - 2. m_b^3 e \cos(om t) bb_F 1^2 \sin(bb_1)^3 R^5 \sin(om t)^4 \sin(bb_2)^2 \\
& - 8. m_b^2 e om \sin(om t)^3 bb_F 1 \cos(bb_1) R^3 \sin(bb_2)^2 JB \\
& + 8. m_b^2 e om \sin(om t)^5 \cos(bb_1) bb_F 1 R^3 \sin(bb_2)^2 JB \\
& + 8. m_b^2 e om \sin(om t)^3 \cos(bb_1) bb_F 1 R^3 \cos(bb_2)^2 JB \\
& - 8. m_b^2 e om \sin(om t) bb_F 2 \cos(om t)^2 \cos(bb_2)^3 R^3 JB \\
& + 8. m_b^2 e om \sin(om t) bb_F 2 \cos(bb_2) R^3 \cos(om t)^2 \sin(bb_2)^2 JB \\
& + 8. m_b^2 e om \sin(om t)^3 bb_F 2 \cos(bb_2) R^3 \sin(bb_2)^2 JB \\
& - 8. m_b^2 e om \sin(om t)^5 bb_F 2 \cos(bb_2) R^3 \sin(bb_2)^2 JB \\
& - 8. m_b^2 e om \sin(om t) bb_F 2 \cos(om t)^4 \cos(bb_2) R^3 \sin(bb_2)^2 JB \\
& + 8. m_b^2 e om \sin(om t) \cos(bb_1) \cos(om t)^4 bb_F 1 R^3 \sin(bb_2)^2 JB \\
& - 16. m_b^2 e om \sin(om t)^3 bb_F 2 \cos(om t)^2 \cos(bb_2) R^3 \sin(bb_2)^2 JB \\
& - 8. m_b^2 e om \sin(om t) bb_F 1 \cos(bb_1) R^3 \cos(om t)^2 \sin(bb_2)^2 JB \\
& + 2. m_b^3 R^5 e \cos(om t)^5 om^2 \sin(bb_2) \cos(bb_2)^2 \sin(bb_1)^2 \\
& - 2. m_b^3 R^5 g_- \sin(bb_2) \cos(om t)^2 \cos(aa) \cos(bb_2)^2 \sin(om t)^2 \\
& \sin(bb_1)^2 \\
& - 2. m_b^3 R^5 g_- \sin(bb_2) \cos(om t)^2 \cos(aa) \cos(bb_2)^2 \cos(bb_1)^2 \\
& - 2. m_b^3 R^5 g_- \sin(bb_2) \cos(om t)^4 \cos(aa) \cos(bb_2)^2 \sin(bb_1)^2 \\
& - 4. m_b^3 R^5 g_- \sin(bb_2)^3 \cos(om t)^4 \cos(aa) \sin(om t)^2 \sin(bb_1)^2 \\
& - 2. m_b^3 R^5 g_- \sin(bb_2)^3 \cos(om t)^4 \cos(aa) \cos(bb_1)^2 \\
& - 2. m_b^3 R^5 g_- \sin(bb_2)^3 \cos(om t)^6 \cos(aa) \sin(bb_1)^2 \\
& + 8. m_b^2 R^3 \sin(bb_2)^3 e \cos(om t)^5 aa_F^2 JB \\
& - 4. JB om \sin(om t) bb_F 2 \cos(bb_2)^4 R^4 m_b^2 \cos(om t)^2 \sin(bb_1)^2 \\
& + 16. JB^2 om \sin(om t) \cos(bb_1)^2 bb_F 1 R^2 m_b \cos(om t)^2 \sin(bb_2)^2 \\
& + 16. JB^2 om \sin(om t) \cos(bb_1)^2 bb_F 1 R^2 m_b \cos(bb_2)^2 \\
& - 16. JB^2 om \sin(om t)^3 bb_F 2 \cos(bb_2)^2 R^2 m_b \sin(bb_2)^2
\end{aligned}$$

$$\begin{aligned}
& -16. JB^2 om \sin(om t) bb_F_2 \cos(bb_2)^4 R^2 m_b \\
& + 64. JB^3 om \sin(om t) bb_F_2 \sin(bb_2)^2 \\
& - 48. JB^2 om \sin(om t)^3 bb_F_1 R^2 m_b \sin(bb_1)^2 \\
& - 32. JB^2 om \sin(om t) bb_F_1 R^2 m_b \cos(bb_1)^2 \\
& - 48. JB^2 om \sin(om t) bb_F_1 R^2 m_b \cos(om t)^2 \sin(bb_1)^2 \\
& + 16. JB^2 om \sin(om t)^3 bb_F_2 R^2 m_b \sin(bb_1)^2 \\
& + 16. JB^2 om \sin(om t) bb_F_2 R^2 m_b \cos(bb_1)^2 \\
& + 16. JB^2 om \sin(om t) bb_F_2 R^2 m_b \cos(om t)^2 \sin(bb_1)^2 \\
& - 16. JB^2 om \sin(om t)^3 \sin(bb_1)^4 bb_F_1 R^2 m_b \\
& - 8. m_b^2 e \cos(om t) \cos(bb_1) kb bb_1 R^3 \sin(om t)^2 \sin(bb_2)^2 \\
& - 8. m_b^2 e om \sin(om t)^3 bb_F_2 \cos(bb_2) JB R^3 \cos(bb_1)^2 \\
& + 2. m_b^3 e om \sin(om t)^5 bb_F_2 \cos(bb_2) R^5 \sin(bb_2)^2 \sin(bb_1)^2 \\
& - 8. m_b^2 e om \sin(om t)^5 bb_F_2 \cos(bb_2) JB R^3 \sin(bb_1)^2 \\
& + 8. m_b^2 e om \sin(om t)^3 bb_F_2 \cos(bb_2) JB R^3 \sin(bb_1)^2 \\
& + 2. m_b^3 e \cos(om t) R^5 aa_F^2 \sin(om t)^4 \sin(bb_1) \cos(bb_1)^2 \cos(bb_2)^2 \\
& + 8. m_b^2 e \cos(om t) R^3 aa_F^2 \sin(om t)^4 \sin(bb_1) \cos(bb_1)^2 JB \\
& + 2. m_b^3 e \cos(om t) R^5 aa_F^2 \sin(om t)^6 \sin(bb_1) \cos(bb_1)^2 \sin(bb_2)^2 \\
& - 8. m_b^2 e \cos(om t) bb_F_1^2 \sin(bb_1) R^3 \sin(om t)^2 \sin(bb_2)^2 JB \\
& - 2. m_b^3 e om \sin(om t)^5 bb_F_1 \cos(bb_1) R^5 \sin(bb_2)^2 \sin(bb_1)^2 \\
& + 2. m_b^3 e om \sin(om t)^7 \cos(bb_1) bb_F_1 R^5 \sin(bb_2)^2 \sin(bb_1)^2 \\
& - 32. m_b e R \cos(om t) JB^2 \cos(bb_1)^3 aa_F \sin(om t) om \\
& - 4. m_b^2 R^4 \cos(om t)^5 \sin(bb_1)^2 JB \cos(bb_1)^2 aa_F \sin(om t) om \\
& \sin(bb_2)^2 \\
& - 8. m_b^2 R^4 \cos(om t)^3 \sin(bb_1)^2 JB \cos(bb_1)^2 aa_F \sin(om t)^3 om \\
& \sin(bb_2)^2 \\
& - 4. m_b^2 R^4 \cos(om t)^3 \sin(bb_1)^2 JB \cos(bb_1)^2 aa_F \sin(om t) om \\
& \cos(bb_2)^2 - 2. m_b^3 R^5 \cos(om t)^6 \sin(bb_1)^3 g_ \cos(aa) \sin(bb_2)^2 \\
& - 4. m_b^3 R^5 \cos(om t)^4 \sin(bb_1)^3 g_ \cos(aa) \sin(om t)^2 \sin(bb_2)^2 \\
& - 2. m_b^3 R^5 \cos(om t)^4 \sin(bb_1)^3 g_ \cos(aa) \cos(bb_2)^2 \\
& + 4. m_b^2 R^4 \cos(om t)^5 \sin(bb_1)^3 aa_F^2 \sin(om t)^2 JB \cos(bb_1) \\
& \sin(bb_2)^2 \\
& + 8. m_b^2 R^4 \cos(om t)^3 \sin(bb_1)^3 aa_F^2 \sin(om t)^4 JB \cos(bb_1) \\
& \sin(bb_2)^2 \\
& + 4. m_b^2 R^4 \cos(om t)^3 \sin(bb_1)^3 aa_F^2 \sin(om t)^2 JB \cos(bb_1) \\
& \cos(bb_2)^2 \\
& + 4. m_b^3 R^6 \cos(om t)^3 \sin(bb_1)^3 aa_F^2 \sin(om t)^6 \cos(bb_1) \sin(bb_2)^2
\end{aligned}$$

$$\begin{aligned}
& -16 \cdot m \cdot b^2 \cdot R^3 \cdot e \sin(\omega m t)^3 \cdot \text{om} \cdot \text{aa_F} \cos(bb_2) \cos(\omega m t)^3 \sin(bb_2)^2 \cdot JB \\
& -16 \cdot m \cdot b^2 \cdot R^3 \cdot e \sin(\omega m t) \cdot \text{om} \cdot \text{aa_F} \cos(\omega m t)^3 \cos(bb_2)^3 \cdot JB \\
& -8 \cdot m \cdot b^2 \cdot R^3 \cdot e \sin(\omega m t) \cdot \text{om} \cdot \text{aa_F} \cos(\omega m t)^5 \cos(bb_2) \sin(bb_2)^2 \cdot JB \\
& -8 \cdot m \cdot b^2 \cdot R^3 \cdot g \cdot \sin(bb_2)^3 \cos(\omega m t)^4 \cos(aa) \cdot JB \\
& -3 \cdot m \cdot b^3 \cdot R^6 \sin(\omega m t)^4 \sin(bb_2)^3 \cos(bb_2) \cdot bb_F_2^2 \cos(\omega m t)^3 \\
& \sin(bb_1)^2 + 4 \cdot m \cdot b^3 \cdot R^5 \sin(bb_2) \cdot e \cos(\omega m t)^3 \cdot \text{aa_F}^2 \cos(bb_2)^2 \cos(bb_1)^2 \\
& + m \cdot b^3 \cdot R^6 \sin(\omega m t) \cdot \text{om} \cdot \text{aa_F} \cos(bb_2)^4 \cos(\omega m t)^3 \sin(bb_1)^2 \\
& + 8 \cdot m \cdot b^2 \cdot R^3 \cdot e \cos(\omega m t)^3 \cdot \text{om}^2 \sin(bb_2) \cos(bb_2)^2 \cdot JB \\
& -4 \cdot m \cdot b^3 \cdot R^6 \cdot \text{aa_F}^2 \cos(\omega m t)^7 \sin(bb_2)^3 \cos(bb_2) \sin(\omega m t)^2 \sin(bb_1)^2 \\
& -12 \cdot m \cdot b^2 \cdot R^4 \cdot \text{aa_F}^2 \sin(\omega m t)^4 \sin(bb_2)^3 \cos(bb_2) \cos(\omega m t)^3 \cdot JB \\
& -8 \cdot m \cdot b^2 \cdot R^3 \cdot g \cdot \sin(bb_2) \cos(\omega m t)^2 \cos(aa) \cos(bb_2)^2 \cdot JB \\
& + 16 \cdot m \cdot b^2 \cdot R^3 \sin(bb_2) \cdot e \cos(\omega m t)^3 \cdot \text{aa_F}^2 \cos(bb_2)^2 \cdot JB \\
& -4 \cdot m \cdot b^2 \cdot R^4 \cdot \text{aa_F}^2 \cos(\omega m t)^5 \sin(bb_2) \cos(bb_2)^3 \cdot JB \\
& -4 \cdot m \cdot b^2 \cdot R^4 \cdot \text{aa_F}^2 \cos(\omega m t)^7 \sin(bb_2)^3 \cos(bb_2) \cdot JB \\
& + 4 \cdot m \cdot b^2 \cdot R^3 \sin(bb_2)^3 \cdot l \cdot \text{aa_F}^2 \cos(\omega m t)^4 \cdot JB \\
& -4 \cdot m \cdot b^2 \cdot R^4 \cos(\omega m t)^3 \sin(bb_2) \cos(bb_2)^3 \cdot bb_F_2^2 \cdot JB \\
& -4 \cdot m \cdot b^2 \cdot R^4 \cos(\omega m t)^5 \sin(bb_2)^3 \cos(bb_2) \cdot bb_F_2^2 \cdot JB \\
& + 4 \cdot m \cdot b^2 \cdot R^4 \sin(bb_2) \cdot \text{aa_F}^2 \cos(\omega m t)^3 \cos(bb_2)^3 \cdot JB \\
& -8 \cdot m \cdot b^2 \cdot R^4 \sin(\omega m t)^3 \cdot \text{om} \cos(bb_2)^2 \cdot \text{aa_F} \cos(\omega m t)^3 \sin(bb_2)^2 \cdot JB \\
& -4 \cdot m \cdot b^2 \cdot R^4 \sin(\omega m t) \cdot \text{om} \cos(bb_2)^4 \cdot \text{aa_F} \cos(\omega m t)^3 \cdot JB \\
& -4 \cdot m \cdot b^2 \cdot R^4 \sin(\omega m t) \cdot \text{om} \cos(bb_2)^2 \cdot \text{aa_F} \cos(\omega m t)^5 \sin(bb_2)^2 \cdot JB \\
& -4 \cdot m \cdot b^2 \cdot R^3 \cdot l \sin(\omega m t)^3 \cdot \text{om} \cos(bb_2)^3 \cdot \text{aa_F} \cdot JB \\
& -4 \cdot m \cdot b^2 \cdot R^4 \cos(\omega m t)^5 \sin(bb_1)^2 \cdot kb \cdot bb_1 \sin(bb_2)^2 \\
& -4 \cdot m \cdot b^2 \cdot R^4 \cos(\omega m t)^3 \sin(bb_1)^2 \cdot kb \cdot bb_1 \cos(bb_2)^2 \\
& + 3 \cdot m \cdot b^3 \cdot R^6 \cos(\omega m t)^5 \sin(bb_1)^3 \cdot bb_F_1^2 \cos(bb_1) \sin(\omega m t)^2 \\
& \sin(bb_2)^2 \\
& + 3 \cdot m \cdot b^3 \cdot R^6 \cos(\omega m t)^3 \sin(bb_1)^3 \cdot bb_F_1^2 \cos(bb_1) \sin(\omega m t)^4 \\
& \sin(bb_2)^2 \\
& + 2 \cdot m \cdot b^3 \cdot R^6 \cos(\omega m t)^3 \sin(bb_1)^3 \cdot bb_F_1^2 \cos(bb_1) \sin(\omega m t)^2 \\
& \cos(bb_2)^2 + m \cdot b^3 \cdot R^6 \cos(\omega m t)^7 \sin(bb_1)^3 \cdot bb_F_1^2 \cos(bb_1) \sin(bb_2)^2 \\
& + m \cdot b^3 \cdot R^6 \cos(\omega m t)^5 \sin(bb_1)^3 \cdot bb_F_1^2 \cos(bb_1) \cos(bb_2)^2 \\
& -8 \cdot m \cdot b^2 \cdot R^4 \cos(\omega m t)^6 \sin(bb_1) \cdot bb_F_1 \cos(bb_1) \cdot \text{aa_F} \cdot JB \sin(bb_2)^2 \\
& -24 \cdot m \cdot b^2 \cdot R^4 \cos(\omega m t)^4 \sin(bb_1) \cdot bb_F_1 \cos(bb_1) \cdot \text{aa_F} \cdot JB \sin(\omega m t)^2 \\
& \sin(bb_2)^2 \\
& -8 \cdot m \cdot b^2 \cdot R^4 \cos(\omega m t)^4 \sin(bb_1) \cdot bb_F_1 \cos(bb_1) \cdot \text{aa_F} \cdot JB \cos(bb_2)^2 \\
& -8 \cdot m \cdot b^3 \cdot R^6 \cos(\omega m t)^6 \sin(bb_1)^3 \cdot bb_F_1 \cos(bb_1) \cdot \text{aa_F} \sin(\omega m t)^2
\end{aligned}$$

$$\begin{aligned}
& \sin(bb_2)^2 \\
& - 4 \cdot m_b^2 R^4 \sin(om t)^5 \sin(bb_2)^2 \cos(om t) JB om aa_F \cos(bb_2)^2 \\
& \sin(bb_1)^2 \\
& - 4 \cdot m_b^2 R^4 \sin(om t)^3 \sin(bb_2)^2 \cos(om t) JB om aa_F \cos(bb_2)^2 \\
& \cos(bb_1)^2 \\
& - 4 \cdot m_b^2 R^4 \sin(om t)^6 \sin(bb_2)^3 \cos(om t) aa_F^2 JB \cos(bb_2) \sin(bb_1)^2 \\
& - 4 \cdot m_b^2 R^4 \sin(om t)^4 \sin(bb_2)^3 \cos(om t) aa_F^2 JB \cos(bb_2) \\
& \cos(bb_1)^2 \\
& - 2 \cdot m_b^3 R^5 \sin(om t)^4 \sin(bb_2)^3 \cos(om t)^2 g_ \cos(aa) \sin(bb_1)^2 \\
& - 2 \cdot m_b^3 R^5 \sin(om t)^2 \sin(bb_2)^3 \cos(om t)^2 g_ \cos(aa) \cos(bb_1)^2 \\
& + 2 \cdot m_b^3 R^5 \sin(om t)^4 \sin(bb_2)^3 \cos(om t)^3 e aa_F^2 \sin(bb_1)^2 \\
& + 2 \cdot m_b^3 R^5 \sin(om t)^2 \sin(bb_2)^3 \cos(om t)^3 e aa_F^2 \cos(bb_1)^2 \\
& - 1 \cdot m_b^3 R^6 \sin(om t)^6 \sin(bb_2)^3 \cos(om t) \cos(bb_2) bb_F_2^2 \sin(bb_1)^2 \\
& - 1 \cdot m_b^3 R^6 \sin(om t)^4 \sin(bb_2)^3 \cos(om t) \cos(bb_2) bb_F_2^2 \cos(bb_1)^2 \\
& + 4 \cdot m_b^2 R^2 \cos(bb_2) \sin(bb_2) l^2 aa_F^2 \cos(om t) JB \\
& + m_b^3 R^4 \cos(bb_2) \sin(bb_2) l^2 aa_F^2 \cos(om t) \sin(om t)^2 \sin(bb_1)^2 \\
& - 1 \cdot m_b^3 R^4 \cos(bb_1) \sin(bb_1) l^2 aa_F^2 \cos(om t) \sin(om t)^2 \sin(bb_2)^2 \\
& - 4 \cdot m_b^2 R^2 \cos(bb_1) \sin(bb_1) l^2 aa_F^2 \cos(om t) JB \\
& - 8 \cdot m_b^2 R^3 l bb_F_1 \sin(bb_1) aa_F \cos(om t) \cos(bb_2)^2 JB \\
& - 2 \cdot m_b^3 R^4 l \cos(bb_2) g_ \sin(bb_2) \cos(om t) \cos(aa) \cos(bb_1)^2 \\
& + 2 \cdot m_b^3 R^4 l \cos(bb_1) e \cos(om t)^4 om^2 \sin(bb_1) \sin(bb_2)^2 \\
& - 6 \cdot m_b^3 e R^5 aa_F^2 \sin(om t)^4 \sin(bb_2) \cos(om t)^3 \cos(bb_2)^2 \sin(bb_1)^2 \\
& - 4 \cdot m_b^3 e R^5 aa_F^2 \sin(om t)^2 \sin(bb_2) \cos(om t)^3 \cos(bb_2)^2 \cos(bb_1)^2 \\
& - 6 \cdot m_b^3 e R^5 aa_F^2 \sin(om t)^2 \sin(bb_2) \cos(om t)^5 \cos(bb_2)^2 \sin(bb_1)^2 \\
& - 8 \cdot m_b^3 e^2 R^4 \sin(om t)^3 om aa_F \cos(bb_2)^2 \cos(om t)^3 \sin(bb_1)^2 \\
& - 4 \cdot m_b^3 e^2 R^4 \sin(om t) om aa_F \cos(om t)^5 \cos(bb_2)^2 \sin(bb_1)^2 \\
& - 8 \cdot m_b^2 e JB \sin(om t) om aa_F \cos(bb_2)^3 R^3 \cos(om t)^3 \sin(bb_1)^2 \\
& + 16 \cdot m_b^2 e \sin(bb_2) bb_F_2 aa_F \cos(om t)^4 JB R^3 \sin(bb_1)^2 \\
& + 8 \cdot m_b^3 e \sin(bb_2)^3 bb_F_2 aa_F \cos(om t)^4 R^5 \sin(om t)^2 \sin(bb_1)^2 \\
& + 4 \cdot m_b^3 e \sin(bb_2)^3 bb_F_2 aa_F \cos(om t)^2 R^5 \sin(om t)^4 \sin(bb_1)^2 \\
& + 4 \cdot m_b^3 e \sin(bb_2)^3 bb_F_2 aa_F \cos(om t)^2 R^5 \sin(om t)^2 \cos(bb_1)^2 \\
& + 4 \cdot m_b^3 e \sin(bb_2) bb_F_2 aa_F \cos(om t)^2 R^5 \cos(bb_2)^2 \sin(om t)^2 \\
& \sin(bb_1)^2 - 2 \cdot m_b^3 e om \sin(om t)^3 bb_F_2 \cos(bb_2)^3 R^5 \cos(bb_1)^2 \\
& + 6 \cdot m_b^3 R^5 \sin(bb_2)^2 \cos(om t) e \sin(om t)^3 om aa_F \cos(bb_2) \\
& \cos(bb_1)^2 \\
& + 12 \cdot m_b^3 R^5 \sin(bb_2)^2 \cos(om t)^3 e \sin(om t)^3 om aa_F \cos(bb_2)
\end{aligned}$$

$$\begin{aligned}
& \sin(bb_1)^2 \\
& + 6 \cdot m_b^3 R^5 \sin(bb_2)^2 \cos(om t)^3 e \sin(om t) om aa_F \cos(bb_2) \\
& \cos(bb_1)^2 \\
& + 6 \cdot m_b^3 R^5 \sin(bb_2)^2 \cos(om t)^5 e \sin(om t) om aa_F \cos(bb_2) \\
& \sin(bb_1)^2 + m_b^3 R^6 \sin(bb_2)^3 \cos(om t)^5 aa_F^2 \cos(bb_2) \cos(bb_1)^2 \\
& + m_b^3 R^6 \sin(bb_2)^3 \cos(om t)^7 aa_F^2 \cos(bb_2) \sin(bb_1)^2 \\
& + m_b^3 R^6 \sin(bb_2)^3 \cos(om t)^4 \sin(om t)^4 \cos(bb_2) bb_F_2^2 \sin(bb_1)^2 \\
& + m_b^3 R^6 \sin(bb_2)^3 \cos(om t)^2 \sin(om t)^2 \cos(bb_2) bb_F_2^2 \cos(bb_1)^2 \\
& + 2 \cdot m_b^3 R^6 \sin(bb_2)^3 \cos(om t)^3 \sin(om t)^2 \cos(bb_2) bb_F_2^2 \\
& \sin(bb_1)^2 + m_b^3 R^6 \sin(bb_2)^3 \cos(om t)^3 \cos(bb_2) bb_F_2^2 \cos(bb_1)^2 \\
& + m_b^3 R^6 \sin(bb_2)^3 \cos(om t)^5 \cos(bb_2) bb_F_2^2 \sin(bb_1)^2 \\
& + 4 \cdot m_b^2 R^4 \sin(bb_2)^2 \cos(om t) \sin(om t)^3 om \cos(bb_2)^2 aa_F JB \\
& + 32 \cdot m_b R g_ \sin(bb_1) \cos(aa) JB^2 \\
& - 4 \cdot JB \cos(om t) m_b^2 R^4 aa_F^2 \sin(om t)^6 \sin(bb_2) \cos(bb_2) \sin(bb_1)^2 \\
& - 4 \cdot JB \cos(om t) m_b^2 R^4 \sin(om t)^5 om \cos(bb_2)^2 aa_F \sin(bb_1)^2 \\
& + 12 \cdot JB \cos(om t) m_b^2 R^4 \sin(om t)^3 om aa_F \cos(bb_2)^2 \sin(bb_1)^2 \\
& + 12 \cdot JB m_b^2 R^4 aa_F^2 \sin(om t)^2 \sin(bb_1) \cos(bb_1) \cos(om t)^5 \\
& \sin(bb_2)^2 - 16 \cdot JB kb bb_1 R^2 m_b \cos(om t)^3 \sin(bb_2)^2 \\
& + 12 \cdot JB m_b^2 R^4 aa_F^2 \sin(om t)^4 \sin(bb_1) \cos(bb_1) \cos(om t)^3 \\
& \sin(bb_2)^2 \\
& + 8 \cdot JB m_b^2 R^4 aa_F^2 \sin(om t)^2 \sin(bb_1) \cos(bb_1) \cos(om t)^3 \\
& \cos(bb_2)^2 \\
& - 16 \cdot JB m_b^2 R^3 e \sin(om t)^3 om aa_F \cos(bb_1) \cos(om t)^3 \sin(bb_2)^2 \\
& - 8 \cdot JB m_b^2 R^3 e \sin(om t) om \cos(bb_1) \cos(om t)^5 aa_F \sin(bb_2)^2 \\
& - 8 \cdot JB m_b^2 R^3 \sin(bb_1) e \cos(om t)^3 aa_F^2 \cos(bb_2)^2 \\
& - 8 \cdot m_b^2 e \cos(om t) JB \sin(om t)^3 om aa_F \cos(bb_2)^3 R^3 \sin(bb_1)^2 \\
& - 32 \cdot m_b e R \cos(om t) JB^2 \sin(om t) om aa_F \cos(bb_2)^3 \\
& - 32 \cdot m_b e R \cos(om t) aa_F^2 \sin(om t)^2 \sin(bb_2) JB^2 \cos(bb_2)^2 \\
& + 32 \cdot m_b e R om \sin(om t) \cos(bb_1) \cos(om t)^2 bb_F_1 JB^2 \\
& - 32 \cdot m_b e R om \sin(om t) bb_F_2 \cos(om t)^2 \cos(bb_2) JB^2 \\
& + 32 \cdot m_b e R \cos(om t) aa_F^2 \sin(om t)^2 \sin(bb_1) JB^2 \cos(bb_1)^2 \\
& + 64 \cdot m_b^2 e^2 \sin(om t) om aa_F \cos(om t)^3 JB R^2 \sin(bb_1)^2 \\
& + 64 \cdot m_b^2 e^2 \sin(om t) om aa_F \cos(om t)^3 R^2 \sin(bb_2)^2 JB \\
& + 32 \cdot m_b^3 e^2 \sin(om t)^3 om aa_F \cos(om t)^3 R^4 \sin(bb_2)^2 \sin(bb_1)^2 \\
& + 16 \cdot m_b^3 e^2 \sin(om t) om aa_F \cos(om t)^5 R^4 \sin(bb_2)^2 \sin(bb_1)^2 \\
& + 64 \cdot m_b^2 e^2 \sin(om t)^3 om aa_F \cos(om t) R^2 \sin(bb_2)^2 JB
\end{aligned}$$

$$\begin{aligned}
& -32. m_b e R \cos(om t) \cos(bb_1) kb bb_1 JB \\
& + 4. m_b^3 e \sin(bb_2)^3 bb_F_2 aa_F \cos(om t)^4 R^5 \cos(bb_1)^2 \\
& - 4. m_b^3 e bb_F_I^2 \sin(bb_1)^3 R^5 \cos(om t)^3 \sin(bb_2)^2 \sin(om t)^2 \\
& + 8. m_b^2 e R^3 \cos(om t)^5 \sin(bb_1) aa_F^2 \cos(bb_1)^2 JB \\
& - 16. m_b R l aa_F^2 \sin(om t)^2 \sin(bb_1) JB^2 \cos(bb_1)^2 \\
& + 8. m_b^2 e R^3 \cos(om t)^3 \sin(bb_2) \cos(bb_2)^2 bb_F_2^2 JB \\
& + 8. m_b^2 R^3 l \sin(bb_2)^3 bb_F_2 aa_F \cos(om t)^3 JB \\
& - 16. JB^2 om \sin(om t) bb_F_2 \cos(bb_2)^2 R^2 m_b \cos(bb_1)^2 \\
& - 32. m_b e R om \sin(om t)^3 bb_F_2 \cos(bb_2) JB^2 \\
& - 16. m_b^2 e \cos(om t) g_R^2 \cos(bb_2)^2 \sin(aa) JB \\
& - 4. m_b^3 e^2 \cos(bb_1) R^4 \sin(bb_1) \cos(om t)^5 aa_F^2 \sin(bb_2)^2 \\
& + 4. m_b^3 e^2 \cos(bb_2) R^4 \cos(om t)^5 om^2 \sin(bb_2) \sin(bb_1)^2 \\
& + 4. m_b^3 e \sin(bb_2)^3 bb_F_2 aa_F \cos(om t)^6 R^5 \sin(bb_1)^2 \\
& - 1. m_b^3 R^5 l aa_F^2 \sin(om t)^6 \sin(bb_1) \cos(bb_1)^2 \sin(bb_2)^2 \\
& - 1. m_b^3 R^5 l aa_F^2 \sin(om t)^4 \sin(bb_1) \cos(bb_1)^2 \cos(bb_2)^2 \\
& - 1. m_b^3 R^5 l \cos(om t)^6 \sin(bb_1) aa_F^2 \cos(bb_1)^2 \sin(bb_2)^2 \\
& - 1. m_b^3 R^5 l \cos(om t)^4 \sin(bb_1) aa_F^2 \cos(bb_1)^2 \cos(bb_2)^2 \\
& + 2. m_b^3 R^5 l \sin(om t)^3 om \cos(bb_1)^3 aa_F \cos(om t)^2 \sin(bb_2)^2 \\
& + m_b^3 R^5 l \sin(om t)^5 om \cos(bb_1)^3 aa_F \sin(bb_2)^2 \\
& + m_b^3 R^5 l \cos(om t)^4 om^2 \cos(bb_1)^2 \sin(bb_1) \sin(bb_2)^2 \\
& + 2. m_b^3 R^5 l \cos(om t)^2 om^2 \cos(bb_1)^2 \sin(bb_1) \sin(om t)^2 \sin(bb_2)^2 \\
& + m_b^3 R^5 l \cos(om t)^2 om^2 \cos(bb_1)^2 \sin(bb_1) \cos(bb_2)^2 \\
& + 2. m_b^3 R^5 l \cos(om t)^2 \sin(bb_1) \cos(bb_1)^2 bb_F_I^2 \sin(om t)^2 \\
& \sin(bb_2)^2 + m_b^3 R^5 l \cos(om t)^2 \sin(bb_1) \cos(bb_1)^2 bb_F_I^2 \cos(bb_2)^2 \\
& - 1. m_b^3 R^5 l \cos(bb_1)^3 aa_F \sin(om t) om \cos(om t)^2 \sin(bb_2)^2 \\
& + 4. m_b^2 R^4 \sin(bb_2)^2 \cos(om t)^3 \sin(om t) om \cos(bb_2)^2 aa_F JB \\
& + 24. m_b^2 R^3 \sin(bb_2)^2 \cos(om t)^3 e \sin(om t) om aa_F \cos(bb_2) JB \\
& - 2. m_b^3 R^6 \cos(om t)^3 \sin(bb_1)^3 bb_F_I^2 \cos(bb_1) \sin(om t)^2 \\
& \sin(bb_2)^2 \\
& - 1. m_b^3 R^6 \cos(om t)^3 \sin(bb_1) bb_F_I^2 \cos(bb_1)^3 \sin(bb_2)^2 \\
& + 4. m_b^2 R^4 \cos(om t) \sin(bb_1)^2 \sin(om t)^3 om \cos(bb_1)^2 aa_F JB \\
& - 1. m_b^3 R^6 \cos(om t) \sin(bb_1) bb_F_I^2 \cos(bb_1)^3 \sin(om t)^2 \sin(bb_2)^2 \\
& - 1. m_b^3 R^6 \cos(om t) \sin(bb_1) bb_F_I^2 \cos(bb_1)^3 \cos(bb_2)^2 \\
& - 4. m_b^2 R^4 \cos(om t)^3 \sin(bb_1)^3 aa_F^2 \sin(om t)^2 \cos(bb_1) JB \\
& + 8. m_b^2 R^4 \cos(om t)^4 \sin(bb_1)^3 bb_F_I \cos(bb_1) aa_F JB \\
& - 1. m_b^3 R^6 \cos(om t) \sin(bb_1)^3 bb_F_I^2 \cos(bb_1) \sin(om t)^4 \sin(bb_2)^2
\end{aligned}$$

$$\begin{aligned}
& -1. m_b^3 R^6 \cos(om t) \sin(bb_1)^3 bb_F I^2 \cos(bb_1) \sin(om t)^2 \cos(bb_2)^2 \\
& -1. m_b^3 R^6 \cos(om t)^5 \sin(bb_1)^3 bb_F I^2 \cos(bb_1) \sin(bb_2)^2 \\
& -1. m_b^3 R^6 \cos(om t)^3 \sin(bb_1)^3 bb_F I^2 \cos(bb_1) \cos(bb_2)^2 \\
& -16. JB^2 om \sin(om t) \sin(bb_1)^2 bb_F I R^2 m_b \cos(bb_1)^2 \\
& -16. JB^2 om \sin(om t) \sin(bb_1)^4 bb_F I R^2 m_b \cos(om t)^2 \\
& +16. JB^2 om \sin(om t)^3 bb_F 2 \sin(bb_2)^2 R^2 m_b \sin(bb_1)^2 \\
& +16. JB^2 om \sin(om t) bb_F 2 \sin(bb_2)^2 R^2 m_b \cos(bb_1)^2 \\
& +16. JB^2 om \sin(om t) bb_F 2 \sin(bb_2)^2 R^2 m_b \cos(om t)^2 \sin(bb_1)^2 \\
& -24. JB om \sin(om t)^3 bb_F I R^4 m_b^2 \cos(om t)^2 \sin(bb_2)^2 \sin(bb_1)^2 \\
& -8. JB om \sin(om t) bb_F I R^4 m_b^2 \cos(om t)^2 \sin(bb_2)^2 \cos(bb_1)^2 \\
& -12. JB om \sin(om t) bb_F I R^4 m_b^2 \cos(om t)^4 \sin(bb_2)^2 \sin(bb_1)^2 \\
& -12. JB om \sin(om t)^5 bb_F I R^4 m_b^2 \sin(bb_2)^2 \sin(bb_1)^2 \\
& -8. JB om \sin(om t)^3 bb_F I R^4 m_b^2 \sin(bb_2)^2 \cos(bb_1)^2 \\
& -12. JB om \sin(om t)^3 bb_F I R^4 m_b^2 \cos(bb_2)^2 \sin(bb_1)^2 \\
& -8. JB om \sin(om t) bb_F I R^4 m_b^2 \cos(bb_2)^2 \cos(bb_1)^2 \\
& +8. m_b^2 R^4 \cos(om t)^4 \sin(bb_1) bb_F I \cos(bb_1) aa_F JB \sin(bb_2)^2 \\
& +8. m_b^2 R^4 \cos(om t)^2 \sin(bb_1) bb_F I \cos(bb_1) aa_F JB \cos(bb_2)^2 \\
& +2. m_b^3 R^6 \cos(om t)^4 \sin(bb_1) bb_F I \cos(bb_1)^3 aa_F \sin(bb_2)^2 \\
& +2. m_b^3 R^6 \cos(om t)^2 \sin(bb_1) bb_F I \cos(bb_1)^3 aa_F \cos(bb_2)^2 \\
& +2. m_b^3 R^6 \cos(om t)^6 \sin(bb_1)^3 bb_F I \cos(bb_1) aa_F \sin(bb_2)^2 \\
& +2. m_b^3 R^6 \cos(om t)^4 \sin(bb_1)^3 bb_F I \cos(bb_1) aa_F \cos(bb_2)^2 \\
& +6. m_b^3 R^5 \cos(om t)^5 \sin(bb_1)^2 aa_F \sin(om t) om \cos(bb_1) e \\
& \sin(bb_2)^2 \\
& +12. m_b^3 R^5 \cos(om t)^3 \sin(bb_1)^2 aa_F \sin(om t)^3 om \cos(bb_1) e \\
& \sin(bb_2)^2 \\
& +6. m_b^3 R^5 \cos(om t)^3 \sin(bb_1)^2 aa_F \sin(om t) om \cos(bb_1) e \\
& \cos(bb_2)^2 \\
& +m_b^3 R^6 \cos(om t)^5 \sin(bb_1)^2 \cos(bb_1)^2 aa_F \sin(om t) om \sin(bb_2)^2 \\
& +2. m_b^3 R^6 \cos(om t)^3 \sin(bb_1)^2 \cos(bb_1)^2 aa_F \sin(om t)^3 om \\
& \sin(bb_2)^2 - 1. m_b^3 R^6 \cos(om t)^7 \sin(bb_1)^3 aa_F^2 \cos(bb_1) \sin(bb_2)^2 \\
& +16. m_b^3 e^2 \sin(om t)^5 om aa_F \cos(om t) R^4 \sin(bb_2)^2 \sin(bb_1)^2 \\
& +32. m_b e R \cos(om t) \cos(bb_1) JB^2 aa_F \sin(om t) \sin(bb_1)^2 om \\
& +32. m_b e R \cos(om t) \cos(bb_2) JB^2 aa_F \sin(om t) \sin(bb_2)^2 om \\
& +32. m_b e R \cos(om t) \sin(bb_2) bb_F 2^2 JB^2 \\
& +32. m_b e R om \sin(om t) bb_F 2 \cos(bb_2) JB^2 \\
& +64. m_b e R bb_F I \sin(bb_1) aa_F \cos(om t)^2 JB^2
\end{aligned}$$

$$\begin{aligned}
& + 32. m_b e R \cos(om t) JB^2 om^2 \cos(bb_2)^2 \sin(bb_2) \\
& + 64. m_b^2 e^2 \sin(om t)^3 om aa_F \cos(om t) JB R^2 \sin(bb_1)^2 \\
& - 32. m_b e R \cos(om t) JB^2 om^2 \cos(bb_1)^2 \sin(bb_1) \\
& - 32. m_b e R \cos(om t) bb_F_I^2 \sin(bb_1) JB^2 \\
& - 8. m_b^2 e \cos(om t) bb_F_I^2 \sin(bb_1)^3 JB R^3 \sin(om t)^2 \\
& - 2. m_b^3 e om \sin(om t)^3 bb_F_I \cos(bb_1)^3 R^5 \sin(bb_2)^2 \\
& + 4. JB m_b^2 R^4 \cos(om t)^5 \sin(bb_1) \cos(bb_1) bb_F_I^2 \sin(bb_2)^2 \\
& + 8. JB m_b^2 R^4 \cos(om t)^3 \sin(bb_1) \cos(bb_1) bb_F_I^2 \sin(om t)^2 \\
& \sin(bb_2)^2 \\
& + 4. JB m_b^2 R^4 \cos(om t)^3 \sin(bb_1) \cos(bb_1) bb_F_I^2 \cos(bb_2)^2 \\
& + 12. JB m_b^2 R^4 \cos(bb_1)^2 aa_F \sin(om t) om \cos(om t)^3 \sin(bb_2)^2 \\
& - 4. JB m_b^2 R^4 \sin(om t) om \cos(bb_1)^2 \cos(om t)^5 aa_F \sin(bb_2)^2 \\
& - 4. JB m_b^2 R^4 \sin(bb_1) aa_F^2 \cos(om t)^5 \cos(bb_1) \sin(bb_2)^2 \\
& - 4. JB m_b^2 R^4 \sin(bb_1) aa_F^2 \cos(om t)^3 \cos(bb_1) \sin(om t)^2 \sin(bb_2)^2 \\
& - 4. JB m_b^2 R^4 \sin(bb_1) aa_F^2 \cos(om t)^3 \cos(bb_1) \cos(bb_2)^2 \\
& + 16. JB kb bb_2 R^2 m_b \cos(om t)^3 \sin(bb_1)^2 \\
& + 4. JB m_b^2 R^4 \cos(bb_2) \sin(bb_2) bb_F_2^2 \cos(om t)^3 \sin(bb_1)^2 \\
& - 8. JB m_b^2 g_R^3 \sin(bb_2) \cos(om t)^4 \cos(aa) \sin(bb_1)^2 \\
& + 4. m_b^2 R^3 l \cos(bb_1) kb bb_1 \sin(om t)^2 \sin(bb_2)^2 \\
& + 16. m_b^2 e^2 \cos(bb_2) R^2 \sin(bb_2) \cos(om t)^3 aa_F^2 JB \\
& + 2. m_b^3 e \cos(om t) \sin(bb_2)^3 bb_F_2^2 R^5 \sin(om t)^4 \sin(bb_1)^2 \\
& + 8. m_b^2 e \sin(bb_2) bb_F_2^2 JB R^3 \cos(om t)^3 \sin(bb_1)^2 \\
& + 4. JB om \sin(om t)^3 \cos(bb_1)^4 bb_F_1 R^4 m_b^2 \sin(bb_2)^2 \\
& - 4. m_b^3 e^2 \cos(bb_1) R^4 \cos(om t)^3 om^2 \sin(bb_1) \cos(bb_2)^2 \\
& - 16. JB^2 om \sin(om t)^3 bb_F_2 \cos(bb_2)^2 R^2 m_b \sin(bb_1)^2 \\
& + 2. m_b^3 e R^5 \cos(om t)^3 \sin(bb_2) \cos(bb_2)^2 bb_F_2^2 \cos(bb_1)^2 \\
& + 4. JB m_b^2 R^4 \sin(bb_2) aa_F^2 \cos(om t)^3 \cos(bb_2) \cos(bb_1)^2 \\
& - 8. m_b^2 e R^3 \cos(om t)^3 \sin(bb_1) \cos(bb_1)^2 bb_F_I^2 JB \\
& - 2. m_b^3 R^6 \sin(om t)^6 \sin(bb_1) aa_F \cos(bb_1)^3 bb_F_1 \sin(bb_2)^2 \\
& + 16. JB^2 om \sin(om t)^3 \cos(bb_1)^2 bb_F_1 R^2 m_b \sin(bb_1)^2 \\
& + 16. JB \cos(om t) kb bb_2 R^2 m_b \sin(om t)^2 \sin(bb_1)^2 \\
& + m_b^3 R^6 \cos(om t)^3 \sin(bb_1)^2 \cos(bb_1)^2 aa_F \sin(om t) om \cos(bb_2)^2 \\
& - 2. m_b^3 R^6 \cos(om t)^5 \sin(bb_1)^3 aa_F^2 \cos(bb_1) \sin(om t)^2 \sin(bb_2)^2 \\
& - 1. m_b^3 R^6 \cos(om t)^5 \sin(bb_1)^3 aa_F^2 \cos(bb_1) \cos(bb_2)^2 \\
& - 1. m_b^3 R^6 \cos(om t)^3 \sin(bb_1)^3 aa_F^2 \sin(om t)^4 \cos(bb_1) \sin(bb_2)^2 \\
& - 1. m_b^3 R^6 \cos(om t)^3 \sin(bb_1)^3 aa_F^2 \sin(om t)^2 \cos(bb_1) \cos(bb_2)^2
\end{aligned}$$

$$\begin{aligned}
& + 6 \cdot m_b^3 R^5 \cos(om t) \sin(bb_1)^2 e \sin(om t)^5 om aa_F \cos(bb_1) \\
& \sin(bb_2)^2 \\
& + 6 \cdot m_b^3 R^5 \cos(om t) \sin(bb_1)^2 e \sin(om t)^3 om aa_F \cos(bb_1) \\
& \cos(bb_2)^2 \\
& + m_b^3 R^6 \cos(om t) \sin(bb_1)^2 \sin(om t)^5 om \cos(bb_1)^2 aa_F \sin(bb_2)^2 \\
& + m_b^3 R^6 \cos(om t) \sin(bb_1)^2 \sin(om t)^3 om \cos(bb_1)^2 aa_F \cos(bb_2)^2 \\
& - 4 \cdot m_b^2 R^4 \cos(om t) \sin(bb_1)^3 bb_F_1^2 \cos(bb_1) \sin(om t)^2 JB \\
& - 4 \cdot m_b^2 R^4 \cos(om t) \sin(bb_1) bb_F_1^2 \cos(bb_1)^3 JB \\
& - 4 \cdot m_b^2 R^4 \cos(om t)^3 \sin(bb_1)^3 bb_F_1^2 \cos(bb_1) JB \\
& - 4 \cdot m_b^2 R^4 \cos(om t)^5 \sin(bb_1)^3 aa_F^2 \cos(bb_1) JB \\
& - 8 \cdot m_b^2 R^4 \sin(om t)^2 \sin(bb_2)^3 \cos(bb_2) bb_F_2^2 \cos(om t)^3 JB \\
& + 4 \cdot m_b^3 R^5 \sin(bb_2)^3 e \cos(om t)^5 aa_F^2 \sin(om t)^2 \sin(bb_1)^2 \\
& - 8 \cdot m_b^2 R^4 aa_F^2 \sin(om t)^2 \sin(bb_2) \cos(om t)^3 \cos(bb_2)^3 JB \\
& + 8 \cdot m_b^2 R^3 \cos(om t) e \sin(om t)^2 om^2 \sin(bb_2) \cos(bb_2)^2 JB \\
& + m_b^3 R^6 \cos(om t) \sin(om t) om aa_F \cos(bb_2)^4 \cos(bb_1)^2 \\
& + 4 \cdot m_b^3 R^5 \cos(om t) aa_F \sin(om t)^3 om \cos(bb_2)^3 e \sin(bb_1)^2 \\
& + 4 \cdot m_b^2 R^4 \cos(om t) kb bb_2 \cos(bb_2)^2 \cos(bb_1)^2 \\
& + 2 \cdot m_b^3 R^5 \cos(om t) e \sin(om t)^4 om^2 \sin(bb_2) \cos(bb_2)^2 \sin(bb_1)^2 \\
& + 2 \cdot m_b^3 R^5 \cos(om t) e \sin(om t)^2 om^2 \sin(bb_2) \cos(bb_2)^2 \cos(bb_1)^2 \\
& + m_b^3 R^6 \cos(om t) \cos(bb_2)^3 \sin(bb_2) bb_F_2^2 \cos(bb_1)^2 \\
& - 4 \cdot m_b^3 R^5 \cos(om t) e \sin(om t)^5 om aa_F \cos(bb_2)^3 \sin(bb_1)^2 \\
& - 4 \cdot m_b^3 R^5 \cos(om t) e \sin(om t)^3 om aa_F \cos(bb_2)^3 \cos(bb_1)^2 \\
& - 24 \cdot m_b^2 R^4 \cos(bb_2) \sin(bb_2) bb_F_2 \cos(om t)^4 aa_F JB \sin(om t)^2 \\
& \sin(bb_1)^2 \\
& - 8 \cdot m_b^2 R^4 \cos(bb_2) \sin(bb_2) bb_F_2 \cos(om t)^4 aa_F JB \cos(bb_1)^2 \\
& - 8 \cdot m_b^2 R^4 \cos(bb_2) \sin(bb_2) bb_F_2 \cos(om t)^6 aa_F JB \sin(bb_1)^2 \\
& + 8 \cdot m_b^2 R^4 \cos(bb_2) \sin(bb_2) bb_F_2 aa_F \cos(om t)^2 JB \cos(bb_1)^2 \\
& + 8 \cdot m_b^2 R^4 \cos(bb_2) \sin(bb_2) bb_F_2 aa_F \cos(om t)^4 JB \sin(bb_1)^2 \\
& - 16 \cdot m_b^2 R^4 \cos(bb_2) \sin(bb_2) bb_F_2 \sin(om t)^2 aa_F \cos(om t)^2 JB \\
& \cos(bb_1)^2 - 8 \cdot m_b^2 R^4 \cos(bb_2)^3 \sin(bb_2) bb_F_2 \cos(om t)^4 aa_F JB \\
& + 8 \cdot m_b^2 R^4 \cos(bb_2)^3 \sin(bb_2) bb_F_2 aa_F \cos(om t)^2 JB \\
& - 8 \cdot m_b^2 R^4 \cos(bb_2)^3 \sin(bb_2) bb_F_2 \sin(om t)^4 aa_F JB \\
& - 16 \cdot m_b^2 R^4 \cos(bb_2)^3 \sin(bb_2) bb_F_2 \sin(om t)^2 aa_F \cos(om t)^2 JB \\
& - 24 \cdot m_b^2 R^4 \cos(bb_2) \sin(bb_2)^3 bb_F_2 \cos(om t)^4 aa_F \sin(om t)^2 JB \\
& - 4 \cdot m_b^2 R^4 om \sin(om t)^3 bb_F_2 \cos(bb_2)^4 JB \\
& + 8 \cdot m_b^2 R^4 \cos(om t)^2 \sin(bb_1) bb_F_1 \cos(bb_1)^3 aa_F JB
\end{aligned}$$

$$\begin{aligned}
& + 24 \cdot m_b^2 R^3 \cos(om t)^3 \sin(bb_1)^2 aa_F \sin(om t) om \cos(bb_1) e JB \\
& + 4 \cdot m_b^2 R^4 \cos(om t)^3 \sin(bb_1)^2 \cos(bb_1)^2 aa_F \sin(om t) om JB \\
& + 24 \cdot m_b^2 R^3 \cos(om t) \sin(bb_1)^2 e \sin(om t)^3 om aa_F \cos(bb_1) JB \\
& - 16 \cdot m_b R^2 \cos(om t) aa_F^2 \sin(om t)^2 \sin(bb_2) JB^2 \cos(bb_2)^3 \\
& + 16 \cdot m_b R^2 kb bb_2 \cos(om t)^3 \sin(bb_2)^2 JB \\
& - 16 \cdot m_b R^2 aa_F^2 \sin(om t)^2 \sin(bb_2)^3 JB^2 \cos(bb_2) \cos(om t)^3 \\
& - 16 \cdot m_b R^2 \cos(om t) \cos(bb_1)^4 JB^2 aa_F \sin(om t) om \\
& + 16 \cdot m_b R^2 \cos(om t) \cos(bb_1)^3 aa_F^2 \sin(om t)^2 \sin(bb_1) JB^2 \\
& - 32 \cdot m_b R^2 \cos(om t)^4 \sin(bb_1) bb_F_1 \cos(bb_1) aa_F JB^2 \\
& + 16 \cdot m_b R^2 \cos(om t)^3 \sin(bb_1)^3 aa_F^2 \sin(om t)^2 JB^2 \cos(bb_1) \\
& - 16 \cdot m_b R^2 \sin(om t)^4 \sin(bb_2)^3 \cos(om t) aa_F^2 JB^2 \cos(bb_2) \\
& + 16 \cdot m_b R l JB^2 om^2 \cos(bb_1)^2 \sin(bb_1) \\
& - 4 \cdot m_b^2 R^4 \cos(om t) JB \sin(om t)^3 om aa_F \cos(bb_2)^4 \sin(bb_1)^2 \\
& - 4 \cdot m_b^2 R^4 \cos(om t) JB \sin(om t) om aa_F \cos(bb_2)^4 \cos(bb_1)^2 \\
& - 4 \cdot m_b^2 R^4 \cos(om t) aa_F^2 \sin(om t)^2 \sin(bb_2) JB \cos(bb_2)^3 \\
& \cos(bb_1)^2 - 16 \cdot m_b^2 R^3 \cos(om t) e \sin(om t)^3 om aa_F \cos(bb_2)^3 JB \\
& + 16 \cdot m_b^2 R^3 \cos(om t) aa_F \sin(om t) om \cos(bb_2)^3 e JB \\
& + 4 \cdot m_b^2 R^4 \cos(om t) \cos(bb_2)^3 \sin(bb_2) bb_F_2^2 JB \\
& - 4 \cdot m_b^2 R^4 \cos(om t)^3 \cos(bb_1)^4 \sin(om t) om aa_F JB \\
& + 3 \cdot m_b^3 R^6 \cos(om t)^5 \cos(bb_1)^3 aa_F^2 \sin(om t)^2 \sin(bb_1) \sin(bb_2)^2 \\
& - 4 \cdot m_b^2 R^4 \cos(om t) \cos(bb_1)^2 kb bb_1 \sin(om t)^2 \sin(bb_2)^2 \\
& - 4 \cdot m_b^2 R^4 \cos(om t)^3 \cos(bb_1)^2 kb bb_1 \sin(bb_2)^2 \\
& + 3 \cdot m_b^3 R^6 \cos(om t)^3 \cos(bb_1)^3 aa_F^2 \sin(om t)^4 \sin(bb_1) \sin(bb_2)^2 \\
& + 2 \cdot m_b^3 R^6 \cos(om t)^3 \cos(bb_1)^3 aa_F^2 \sin(om t)^2 \sin(bb_1) \cos(bb_2)^2 \\
& + 16 \cdot m_b R^2 \sin(om t)^2 \sin(bb_2)^2 \cos(om t) kb bb_2 JB \\
& - 16 \cdot m_b R^2 \sin(om t)^2 \cos(om t) \sin(bb_1)^2 kb bb_1 JB \\
& + 16 \cdot m_b R^2 \sin(om t)^4 \cos(om t) \sin(bb_1)^3 aa_F^2 JB^2 \cos(bb_1) \\
& - 32 \cdot m_b R^2 \cos(bb_2) \sin(bb_2) bb_F_2 \cos(om t)^4 aa_F JB^2 \\
& - 32 \cdot m_b R^2 \cos(bb_2) \sin(bb_2) bb_F_2 \sin(om t)^4 aa_F JB^2 \\
& + 16 \cdot m_b R^2 om \sin(om t) \cos(bb_1)^2 \cos(om t)^2 bb_F_1 JB^2 \\
& - 16 \cdot m_b R^2 om \sin(om t) bb_F_2 \cos(om t)^2 \cos(bb_2)^2 JB^2 \\
& + 32 \cdot m_b R^2 \cos(bb_2) \sin(bb_2) bb_F_2 aa_F \cos(om t)^2 JB^2 \\
& + 32 \cdot m_b R^2 \cos(om t)^2 \sin(bb_1) bb_F_1 \cos(bb_1) aa_F JB^2 \\
& + 32 \cdot m_b R l \sin(bb_2) bb_F_2 aa_F \cos(om t) JB^2 \\
& - 2 \cdot m_b^3 R^5 l bb_F_1 \sin(bb_1)^3 aa_F \cos(om t)^3 \cos(bb_2)^2 \\
& - 16 \cdot m_b R^2 \cos(om t)^3 \sin(bb_1)^2 JB^2 \cos(bb_1)^2 aa_F \sin(om t) om
\end{aligned}$$

$$\begin{aligned}
& + 4 \cdot m_b^3 R^5 g_{-} \sin(bb_1)^3 \cos(aa) \cos(om t)^2 \sin(bb_2)^2 \sin(om t)^2 \\
& - 12 \cdot JB \cdot om \sin(om t) bb_F_1 R^4 m_b^2 \cos(bb_2)^2 \cos(om t)^2 \sin(bb_1)^2 \\
& + 16 \cdot JB \cdot om \sin(om t)^3 aa_F \cos(om t)^3 R^4 m_b^2 \sin(bb_2)^2 \sin(bb_1)^2 \\
& + 8 \cdot JB \cdot om \sin(om t) aa_F \cos(om t)^5 R^4 m_b^2 \sin(bb_2)^2 \sin(bb_1)^2 \\
& + 8 \cdot JB \cdot om \sin(om t)^5 aa_F \cos(om t) R^4 m_b^2 \sin(bb_2)^2 \sin(bb_1)^2 \\
& - 8 \cdot JB \cdot om \sin(om t)^3 aa_F \cos(om t)^3 \sin(bb_2)^4 R^4 m_b^2 \sin(bb_1)^2 \\
& - 4 \cdot JB \cdot om \sin(om t) aa_F \cos(om t)^3 \sin(bb_2)^4 R^4 m_b^2 \cos(bb_1)^2 \\
& - 4 \cdot JB \cdot om \sin(om t) aa_F \cos(om t)^5 \sin(bb_2)^4 R^4 m_b^2 \sin(bb_1)^2 \\
& - 4 \cdot JB \cdot om \sin(om t)^5 aa_F \cos(om t) \sin(bb_2)^4 R^4 m_b^2 \sin(bb_1)^2 \\
& - 4 \cdot JB \cdot om \sin(om t)^3 aa_F \cos(om t) \sin(bb_2)^4 R^4 m_b^2 \cos(bb_1)^2 \\
& - 4 \cdot JB \cdot om \sin(om t)^3 aa_F \cos(om t) \sin(bb_2)^2 R^4 m_b^2 \cos(bb_2)^2 \\
& \sin(bb_1)^2 \\
& - 4 \cdot JB \cdot om \sin(om t) aa_F \cos(om t) \sin(bb_2)^2 R^4 m_b^2 \cos(bb_2)^2 \\
& \cos(bb_1)^2 - 4 \cdot m_b^3 e^2 \cos(bb_1) R^4 \sin(bb_1) \cos(om t)^3 aa_F^2 \cos(bb_2)^2 \\
& + 2 \cdot m_b^3 e R^5 \cos(om t)^5 \sin(bb_2) \cos(bb_2)^2 bb_F_2^2 \sin(bb_1)^2 \\
& + 8 \cdot m_b^2 e \cdot om \sin(om t) bb_F_2 \cos(bb_2)^3 R^3 JB \\
& + 4 \cdot m_b^3 e g_{-} R^4 \cos(bb_1)^2 \sin(aa) \cos(om t)^3 \sin(bb_2)^2 \\
& + 4 \cdot m_b^3 e^2 \cos(bb_2) R^4 \sin(bb_2) \cos(om t)^5 aa_F^2 \sin(bb_1)^2 \\
& + 32 \cdot m_b e R \cdot om \sin(om t)^3 \cos(bb_1) bb_F_1 JB^2 \\
& + 2 \cdot m_b^3 e R^5 \cos(om t)^7 \sin(bb_1) aa_F^2 \cos(bb_1)^2 \sin(bb_2)^2 \\
& + 4 \cdot m_b^3 e \sin(bb_2)^3 bb_F_2^2 R^5 \cos(om t)^3 \sin(om t)^2 \sin(bb_1)^2 \\
& - 8 \cdot JB \cdot m_b^2 g_{-} R^3 \sin(bb_2) \cos(om t)^2 \cos(aa) \cos(bb_1)^2 \\
& - 16 \cdot m_b^2 e^2 \cos(bb_1) R^2 \cos(om t)^3 om^2 \sin(bb_1) JB \\
& - 16 \cdot m_b^2 e^2 \cos(bb_1) R^2 \sin(bb_1) \cos(om t)^3 aa_F^2 JB \\
& - 8 \cdot m_b^2 e \cos(om t) bb_F_1^2 \sin(bb_1) R^3 \cos(bb_2)^2 JB \\
& - 8 \cdot JB \cdot m_b^2 R^3 \sin(bb_1) e \cos(om t)^5 aa_F^2 \sin(bb_2)^2 \\
& - 2 \cdot m_b^3 e R^5 aa_F^2 \cos(om t)^7 \sin(bb_2) \cos(bb_2)^2 \sin(bb_1)^2 \\
& + 2 \cdot m_b^3 e R^5 \cos(om t)^5 \sin(bb_1) aa_F^2 \cos(bb_1)^2 \cos(bb_2)^2 \\
& - 8 \cdot m_b^2 e \cos(bb_1) kb \cdot bb_1 R^3 \cos(om t)^3 \sin(bb_2)^2 \\
& + 2 \cdot m_b^3 e \cdot om \sin(om t)^3 \cos(bb_1)^3 bb_F_1 R^5 \cos(bb_2)^2 \\
& - 2 \cdot m_b^3 R^6 \cos(bb_2)^3 \sin(bb_2) bb_F_2 \sin(om t)^6 aa_F \sin(bb_1)^2 \\
& + 16 \cdot m_b^2 e^2 \cos(bb_2) R^2 \cos(om t)^3 om^2 \sin(bb_2) JB \\
& - 8 \cdot m_b^2 e bb_F_1^2 \sin(bb_1) R^3 \cos(om t)^3 \sin(bb_2)^2 JB \\
& - 2 \cdot m_b^3 e \cos(om t) bb_F_1^2 \sin(bb_1)^3 R^5 \cos(bb_2)^2 \sin(om t)^2 \\
& + 2 \cdot m_b^3 e \cdot om \sin(om t) bb_F_2 \cos(bb_2)^3 R^5 \cos(bb_1)^2 \\
& + 64 \cdot m_b e R \sin(bb_2) bb_F_2 aa_F \cos(om t)^2 JB^2
\end{aligned}$$

$$\begin{aligned}
& + 16. JB \cos(om t) m_b^2 aa_F \sin(om t)^3 om R^3 \cos(bb_1) e \sin(bb_2)^2 \\
& + 4. m_b^3 e \sin(bb_2) bb_F_2 aa_F \cos(om t)^2 R^5 \cos(bb_2)^2 \cos(bb_1)^2 \\
& + 4. m_b^3 e \sin(bb_2) bb_F_2 aa_F \cos(om t)^4 R^5 \cos(bb_2)^2 \sin(bb_1)^2 \\
& + 16. m_b^2 e \sin(bb_2)^3 bb_F_2 aa_F \cos(om t)^2 R^3 \sin(om t)^2 JB \\
& + 2. m_b^3 e \sin(bb_2)^3 bb_F_2^2 R^5 \cos(om t)^3 \cos(bb_1)^2 \\
& + 2. m_b^3 e \sin(bb_2)^3 bb_F_2^2 R^5 \cos(om t)^5 \sin(bb_1)^2 \\
& + 16. m_b^2 e^2 \cos(om t) \cos(bb_2) R^2 \sin(om t)^2 om^2 \sin(bb_2) JB \\
& - 4. m_b^3 e^2 \cos(om t) R^4 \sin(om t)^5 om aa_F \cos(bb_1)^2 \sin(bb_2)^2 \\
& - 8. m_b^3 e^2 \cos(om t) R^4 \sin(om t)^3 om aa_F \cos(bb_1)^2 \cos(bb_2)^2 \\
& - 8. m_b^2 e \cos(om t) JB \cos(bb_1)^3 aa_F \sin(om t)^3 om R^3 \sin(bb_2)^2 \\
& + 4. m_b^3 e \cos(om t) g_R^4 \cos(bb_1)^2 \sin(aa) \sin(om t)^2 \sin(bb_2)^2 \\
& + 12. m_b^3 e^2 \cos(om t) aa_F \sin(om t)^3 om R^4 \cos(bb_1)^2 \sin(bb_2)^2 \\
& + 8. m_b^3 e^2 \cos(om t) aa_F \sin(om t) om R^4 \cos(bb_1)^2 \cos(bb_2)^2 \\
& - 2. m_b^3 e R^5 \cos(om t)^3 \sin(bb_1) \cos(bb_1)^2 bb_F_1^2 \cos(bb_2)^2 \\
& - 16. JB \cos(om t) kb bb_1 R^2 m_b \sin(om t)^2 \sin(bb_2)^2 \\
& + 4. m_b^3 e^2 \cos(bb_2) R^4 \cos(om t)^3 om^2 \sin(bb_2) \cos(bb_1)^2 \\
& - 2. m_b^3 e R^5 aa_F^2 \cos(om t)^5 \sin(bb_2) \cos(bb_2)^2 \cos(bb_1)^2 \\
& + 4. JB m_b^2 R^3 \sin(bb_1) l aa_F^2 \cos(om t)^4 \sin(bb_2)^2 \\
& - 4. m_b^3 e^2 \cos(bb_1) R^4 \cos(om t)^5 om^2 \sin(bb_1) \sin(bb_2)^2 \\
& + 2. m_b^3 e om \sin(om t)^3 bb_F_2 \cos(bb_2)^3 R^5 \sin(bb_1)^2 \\
& - 4. JB \cos(om t) m_b^2 R^4 \sin(om t)^2 \sin(bb_2) \cos(bb_2) bb_F_2^2 \\
& \cos(bb_1)^2 + 16. m_b^2 e \sin(bb_2)^3 bb_F_2 aa_F \cos(om t)^4 R^3 JB \\
& + 8. m_b^2 e \cos(bb_2) kb bb_2 R^3 \cos(om t)^3 \sin(bb_1)^2 \\
& + 2. m_b^3 e \cos(om t) \sin(bb_2)^3 bb_F_2^2 R^5 \sin(om t)^2 \cos(bb_1)^2 \\
& - 8. m_b^2 e om \sin(om t)^3 bb_F_2 \cos(bb_2)^3 R^3 JB \\
& - 16. ka aa JB R^2 m_b \sin(om t)^2 \sin(bb_1)^2 \\
& - 16. ka aa JB R^2 m_b \cos(bb_1)^2 \\
& - 16. ka aa JB R^2 m_b \cos(om t)^2 \sin(bb_1)^2 \\
& - 16. ka aa R^2 m_b \cos(om t)^2 \sin(bb_2)^2 JB \\
& - 8. ka aa R^4 m_b^2 \cos(om t)^2 \sin(bb_2)^2 \sin(om t)^2 \sin(bb_1)^2 \\
& - 4. ka aa R^4 m_b^2 \cos(om t)^2 \sin(bb_2)^2 \cos(bb_1)^2 \\
& - 4. ka aa R^4 m_b^2 \cos(om t)^4 \sin(bb_2)^2 \sin(bb_1)^2 \\
& - 16. ka aa R^2 m_b \sin(om t)^2 \sin(bb_2)^2 JB \\
& - 4. ka aa R^4 m_b^2 \sin(om t)^4 \sin(bb_2)^2 \sin(bb_1)^2 \\
& - 4. ka aa R^4 m_b^2 \sin(om t)^2 \sin(bb_2)^2 \cos(bb_1)^2 \\
& - 16. ka aa R^2 m_b \cos(bb_2)^2 JB
\end{aligned}$$

$$\begin{aligned}
& -4. ka aa R^4 m_b^2 \cos(bb_2)^2 \sin(om t)^2 \sin(bb_1)^2 \\
& + 64. g_{aa} l m_b JB^2 \\
& - 1. m_b^3 R^5 l \cos(bb_1)^3 aa_F \sin(om t)^3 om \sin(bb_2)^2 \\
& + m_b^3 R^5 l \sin(bb_1) \sin(om t)^4 \cos(bb_1)^2 bb_F l^2 \sin(bb_2)^2 \\
& + m_b^3 R^5 l \sin(bb_1) \sin(om t)^2 \cos(bb_1)^2 bb_F l^2 \cos(bb_2)^2 \\
& + m_b^3 R^5 l \sin(om t) om \cos(bb_1)^3 \cos(om t)^4 aa_F \sin(bb_2)^2 \\
& + 2. m_b^3 R^5 l \sin(bb_1) aa_F^2 \cos(om t)^4 \cos(bb_1)^2 \sin(bb_2)^2 \\
& + 2. m_b^3 R^5 l \sin(bb_1) aa_F^2 \cos(om t)^2 \cos(bb_1)^2 \sin(om t)^2 \sin(bb_2)^2 \\
& + 2. m_b^3 R^5 l \sin(bb_1) aa_F^2 \cos(om t)^2 \cos(bb_1)^2 \cos(bb_2)^2 \\
& + m_b^3 R^5 l \sin(om t)^4 om^2 \cos(bb_1)^2 \sin(bb_1) \sin(bb_2)^2 \\
& + m_b^3 R^5 l \sin(om t)^2 om^2 \cos(bb_1)^2 \sin(bb_1) \cos(bb_2)^2 \\
& + 8. m_b^2 R^2 l e \sin(om t)^3 om aa_F \cos(bb_1)^2 JB \\
& + m_b^3 R^5 l \sin(om t)^3 om \cos(bb_2)^2 aa_F \cos(bb_1)^3 \\
& + m_b^3 R^5 l \sin(om t) om \cos(bb_2)^2 aa_F \cos(om t)^2 \cos(bb_1)^3 \\
& - 4. JB m_b^2 R^4 \cos(om t)^5 \sin(bb_2) \cos(bb_2) bb_F l^2 \sin(bb_1)^2 \\
& + 4. m_b^3 e^2 \cos(bb_2) R^4 \sin(bb_2) \cos(om t)^3 aa_F^2 \cos(bb_1)^2 \\
& - 2. m_b^3 e om \sin(om t) bb_F l \cos(bb_1)^3 R^5 \cos(bb_2)^2 \\
& - 8. m_b^2 e om \sin(om t) bb_F l \cos(bb_1)^3 JB R^3 \\
& + 4. JB m_b^2 R^3 \sin(bb_1) l aa_F^2 \cos(om t)^2 \cos(bb_2)^2 \\
& - 4. m_b^3 e g_{aa} R^4 \cos(bb_2)^2 \sin(aa) \cos(om t)^3 \sin(bb_1)^2 \\
& + 8. m_b^2 e \cos(om t) \sin(bb_2)^3 bb_F l^2 R^3 \sin(om t)^2 JB \\
& + 8. m_b^2 e \cos(om t) \cos(bb_2) kb bb_2 R^3 \cos(bb_1)^2 \\
& + 16. m_b^2 e \cos(om t) g_{aa} R^2 \cos(bb_1)^2 \sin(aa) JB \\
& - 4. JB \cos(om t) m_b^2 R^4 \cos(bb_1) \sin(bb_1) bb_F l^2 \cos(bb_2)^2 \\
& - 8. JB m_b^2 R^3 e \sin(om t) om \cos(bb_1) \cos(om t)^3 aa_F \cos(bb_2)^2 \\
& + 4. JB m_b^2 R^3 \sin(bb_1) l aa_F^2 \cos(om t)^2 \sin(om t)^2 \sin(bb_2)^2 \\
& - 8. JB m_b^2 R^3 \sin(bb_1) e \cos(om t)^3 aa_F^2 \sin(om t)^2 \sin(bb_2)^2 \\
& - 8. JB m_b^2 g_{aa} R^3 \sin(bb_1) \cos(om t)^4 \cos(aa) \sin(bb_2)^2 \\
& - 8. JB m_b^2 g_{aa} R^3 \sin(bb_1) \cos(om t)^2 \cos(aa) \sin(om t)^2 \sin(bb_2)^2 \\
& - 8. JB m_b^2 g_{aa} R^3 \sin(bb_1) \cos(om t)^2 \cos(aa) \cos(bb_2)^2 \\
& + 16. JB m_b^2 aa_F \sin(om t) om R^3 \cos(bb_1) e \cos(om t)^3 \sin(bb_2)^2 \\
& - 4. JB m_b^2 R^4 \cos(bb_1) \sin(bb_1) bb_F l^2 \cos(om t)^3 \sin(bb_2)^2 \\
& + 4. JB m_b^2 R^4 \cos(om t)^7 \sin(bb_1) aa_F^2 \cos(bb_1) \sin(bb_2)^2 \\
& + 4. JB m_b^2 R^4 \cos(om t)^5 \sin(bb_1) aa_F^2 \cos(bb_1) \cos(bb_2)^2 \\
& - 8. JB m_b^2 R^4 \sin(om t)^3 om \cos(bb_1)^2 aa_F \cos(om t)^3 \sin(bb_2)^2 \\
& - 4. ka aa R^4 m_b^2 \cos(bb_2)^2 \cos(bb_1)^2
\end{aligned}$$

$$\begin{aligned}
& -4. ka aa R^4 m_b^2 \cos(bb_2)^2 \cos(om t)^2 \sin(bb_1)^2 \\
& + 48. \cos(om t) m_b R^2 \sin(om t) om aa_F \cos(bb_2)^2 JB^2 \\
& - 128. \sin(om t)^2 \sin(bb_1) aa_F \cos(bb_1) bb_F_1 JB^3 \\
& - 64. \cos(om t) JB^3 aa_F \sin(om t) \sin(bb_2)^2 om \\
& + 32. \cos(om t) JB^2 aa_F \sin(om t)^3 om R^2 m_b \sin(bb_1)^2 \\
& + 48. \cos(om t) JB^2 aa_F \sin(om t) om R^2 m_b \cos(bb_1)^2 \\
& - 32. \sin(om t)^4 \sin(bb_1)^3 aa_F \cos(bb_1) bb_F_1 JB^2 R^2 m_b \\
& + 16. \cos(om t) m_b R^2 aa_F^2 \sin(om t)^4 \sin(bb_1) \cos(bb_1) JB^2 \\
& - 32. \cos(om t) JB^2 aa_F \sin(om t)^3 \sin(bb_2)^2 om R^2 m_b \sin(bb_1)^2 \\
& - 16. m_b R^2 \sin(om t) om \cos(bb_1)^2 \cos(om t)^3 aa_F JB^2 \\
& - 32. m_b R^2 aa_F^2 \sin(om t)^2 \sin(bb_2) \cos(om t)^3 \cos(bb_2) JB^2 \\
& - 2. m_b^3 R^6 \cos(bb_2) \sin(bb_2)^3 bb_F_2 \cos(om t)^8 aa_F \sin(bb_1)^2 \\
& + 8. m_b^2 R^4 \cos(bb_2) \sin(bb_2)^3 bb_F_2 aa_F \cos(om t)^4 JB \\
& - 24. m_b^2 R^4 \cos(bb_2) \sin(bb_2)^3 bb_F_2 \sin(om t)^4 aa_F \cos(om t)^2 JB \\
& - 8. m_b^2 R^4 \cos(bb_2) \sin(bb_2)^3 bb_F_2 \sin(om t)^6 aa_F JB \\
& - 2. m_b^3 R^6 \cos(bb_2) \sin(bb_2)^3 bb_F_2 \cos(om t)^6 aa_F \cos(bb_1)^2 \\
& + 12. m_b^2 R^4 om \sin(om t) bb_F_2 \cos(bb_2)^2 \cos(om t)^2 \sin(bb_2)^2 JB \\
& + 8. m_b^2 R^4 om \sin(om t)^3 \cos(bb_1)^2 \cos(om t)^2 bb_F_1 JB \sin(bb_1)^2 \\
& + 4. m_b^2 R^4 om \sin(om t) \cos(bb_1)^4 \cos(om t)^2 bb_F_1 JB \\
& + 4. m_b^2 R^4 om \sin(om t) \cos(bb_1)^2 \cos(om t)^4 bb_F_1 JB \sin(bb_1)^2 \\
& - 4. m_b^2 R^4 om \sin(om t) \cos(bb_1)^4 bb_F_1 JB \\
& - 12. m_b^2 R^4 om \sin(om t) \cos(bb_1)^2 bb_F_1 JB \cos(om t)^2 \sin(bb_1)^2 \\
& - 8. m_b^2 R^4 om \sin(om t)^5 \sin(bb_1)^4 bb_F_1 JB \\
& + 8. m_b^2 e \cos(om t) aa_F^2 \sin(om t)^4 \sin(bb_1) JB \cos(bb_1)^2 R^3 \\
& \sin(bb_2)^2 \\
& + 8. m_b^2 e \cos(om t) aa_F^2 \sin(om t)^2 \sin(bb_1) JB \cos(bb_1)^2 R^3 \\
& \cos(bb_2)^2 \\
& - 2. m_b^3 e \cos(om t) R^5 \sin(bb_1) \sin(om t)^4 \cos(bb_1)^2 bb_F_1^2 \\
& \sin(bb_2)^2 - 16. m_b^2 e^2 \cos(om t) R^2 \sin(om t)^3 om aa_F \cos(bb_1)^2 JB \\
& - 8. m_b^2 e \cos(om t) JB \sin(om t) om aa_F \cos(bb_2)^2 R^3 \cos(bb_1)^3 \\
& - 8. m_b^2 e \cos(om t) JB om^2 \cos(bb_1)^2 \sin(bb_1) R^3 \sin(om t)^2 \sin(bb_2)^2 \\
& - 8. m_b^2 e \cos(om t) JB om^2 \cos(bb_1)^2 \sin(bb_1) R^3 \cos(bb_2)^2 \\
& + 48. m_b^2 e^2 \cos(om t) aa_F \sin(om t) om R^2 \cos(bb_1)^2 JB \\
& - 8. m_b^2 e \cos(om t) R^3 \sin(bb_1) \sin(om t)^2 \cos(bb_1)^2 bb_F_1^2 JB
\end{aligned}$$

$$\begin{aligned}
& -4 \cdot m_b^3 e \cos(om t) g_R^4 \cos(bb_2)^2 \sin(aa) \sin(om t)^2 \sin(bb_1)^2 \\
& + 32 \cdot m_b R g_- \sin(bb_2) \cos(aa) JB^2 \\
& - 8 \cdot m_b^2 R^4 \cos(bb_2) \sin(bb_2)^3 bb_F^2 \cos(om t)^6 aa_F JB \\
& - 8 \cdot m_b^3 R^5 \cos(om t)^3 \cos(bb_1)^3 e \sin(om t)^3 om aa_F \sin(bb_2)^2 \\
& - 4 \cdot m_b^3 R^5 \cos(om t) \cos(bb_1)^3 e \sin(om t)^5 om aa_F \sin(bb_2)^2 \\
& - 4 \cdot m_b^3 R^5 \cos(om t) \cos(bb_1)^3 e \sin(om t)^3 om aa_F \cos(bb_2)^2 \\
& - 4 \cdot m_b^3 R^5 \cos(om t)^5 \cos(bb_1)^3 e \sin(om t) om aa_F \sin(bb_2)^2 \\
& - 4 \cdot m_b^3 R^5 \cos(om t)^3 \cos(bb_1)^3 e \sin(om t) om aa_F \cos(bb_2)^2 \\
& - 4 \cdot m_b^3 R^5 \cos(om t)^5 \cos(bb_1)^2 \sin(bb_1) e aa_F^2 \sin(bb_2)^2 \\
& - 4 \cdot m_b^3 R^5 \cos(om t)^3 \cos(bb_1)^2 \sin(bb_1) e aa_F^2 \sin(om t)^2 \sin(bb_2)^2 \\
& - 4 \cdot m_b^3 R^5 \cos(om t)^3 \cos(bb_1)^2 \sin(bb_1) e aa_F^2 \cos(bb_2)^2 \\
& - 4 \cdot m_b^3 R^5 \cos(om t)^3 \cos(bb_1)^2 e \sin(om t)^2 om^2 \sin(bb_1) \sin(bb_2)^2 \\
& + m_b^3 R^5 l \cos(om t)^4 \sin(bb_2) \cos(bb_2)^2 bb_F^2 \sin(bb_1)^2 \\
& + 2 \cdot m_b^3 R^5 l \sin(bb_2) aa_F^2 \cos(om t)^2 \cos(bb_2)^2 \sin(om t)^2 \sin(bb_1)^2 \\
& + 2 \cdot m_b^3 R^5 l \sin(bb_2) aa_F^2 \cos(om t)^2 \cos(bb_2)^2 \cos(bb_1)^2 \\
& + 2 \cdot m_b^3 R^5 l \sin(bb_2) aa_F^2 \cos(om t)^4 \cos(bb_2)^2 \sin(bb_1)^2 \\
& - 2 \cdot m_b^3 R^4 l aa_F \sin(om t)^3 om \cos(bb_2)^2 e \sin(bb_1)^2 \\
& - 2 \cdot m_b^3 R^4 l aa_F \sin(om t) om \cos(bb_2)^2 e \cos(om t)^2 \sin(bb_1)^2 \\
& - 1 \cdot m_b^3 R^5 l aa_F^2 \sin(om t)^6 \sin(bb_2) \cos(bb_2)^2 \sin(bb_1)^2 \\
& - 1 \cdot m_b^3 R^5 l aa_F^2 \sin(om t)^4 \sin(bb_2) \cos(bb_2)^2 \cos(bb_1)^2 \\
& + 4 \cdot m_b^2 R^3 l JB om^2 \cos(bb_2)^2 \sin(bb_2) \sin(om t)^2 \sin(bb_1)^2 \\
& + 4 \cdot m_b^2 R^3 l JB om^2 \cos(bb_2)^2 \sin(bb_2) \cos(bb_1)^2 \\
& - 12 \cdot JB m_b^2 R^4 aa_F^2 \sin(om t)^4 \sin(bb_2) \cos(om t)^3 \cos(bb_2) \\
& \sin(bb_1)^2 \\
& - 8 \cdot JB m_b^2 R^4 aa_F^2 \sin(om t)^2 \sin(bb_2) \cos(om t)^3 \cos(bb_2) \\
& \cos(bb_1)^2 \\
& - 12 \cdot JB m_b^2 R^4 aa_F^2 \sin(om t)^2 \sin(bb_2) \cos(om t)^5 \cos(bb_2) \\
& \sin(bb_1)^2 \\
& - 8 \cdot JB m_b^2 R^4 \sin(om t)^3 om \cos(bb_2)^2 aa_F \cos(om t)^3 \sin(bb_1)^2 \\
& - 8 \cdot JB m_b^2 R^4 \sin(om t) om \cos(bb_2)^2 aa_F \cos(om t)^3 \cos(bb_1)^2 \\
& - 4 \cdot JB m_b^2 R^4 \sin(om t) om \cos(bb_2)^2 aa_F \cos(om t)^5 \sin(bb_1)^2 \\
& - 16 \cdot JB m_b^2 R^3 e \sin(om t)^3 om aa_F \cos(bb_2) \cos(om t)^3 \sin(bb_1)^2 \\
& - 8 \cdot JB m_b^2 R^3 e \sin(om t) om aa_F \cos(om t)^3 \cos(bb_2) \cos(bb_1)^2 \\
& - 8 \cdot JB m_b^2 R^3 e \sin(om t) om aa_F \cos(om t)^5 \cos(bb_2) \sin(bb_1)^2 \\
& - 8 \cdot JB m_b^2 g_R^3 \sin(bb_2) \cos(om t)^2 \cos(aa) \sin(om t)^2 \sin(bb_1)^2 \\
& - 16 \cdot JB^2 om \sin(om t)^3 aa_F \cos(om t) \sin(bb_1)^4 R^2 m_b
\end{aligned}$$

$$\begin{aligned}
& -16. JB^2 om \sin(om t) aa_F \cos(om t) \sin(bb_1)^2 R^2 m_b \cos(bb_1)^2 \\
& -16. JB^2 om \sin(om t) aa_F \cos(om t)^3 \sin(bb_1)^4 R^2 m_b \\
& -16. JB^2 om \sin(om t) bb_F_1 R^2 m_b \cos(om t)^2 \sin(bb_2)^2 \\
& -16. JB^2 om \sin(om t) bb_F_1 R^2 m_b \cos(bb_2)^2 \\
& -16. JB^2 om \sin(om t) aa_F \cos(om t)^3 \sin(bb_2)^4 R^2 m_b \\
& -16. JB^2 om \sin(om t)^3 \sin(bb_1)^2 bb_F_1 R^2 m_b \sin(bb_2)^2 \\
& -16. JB^2 om \sin(om t) \sin(bb_1)^2 bb_F_1 R^2 m_b \cos(bb_2)^2 \\
& +16. JB^2 om \sin(om t) bb_F_2 \sin(bb_2)^4 R^2 m_b \cos(om t)^2 \\
& +16. JB^2 om \sin(om t)^3 bb_F_2 \sin(bb_2)^4 R^2 m_b \\
& +16. JB^2 om \sin(om t) bb_F_2 \sin(bb_2)^2 R^2 m_b \cos(bb_2)^2 \\
& +48. JB^2 om \sin(om t) bb_F_2 R^2 m_b \cos(om t)^2 \sin(bb_2)^2 \\
& +2. m_b^3 e \cos(om t) R^5 \sin(om t)^4 \sin(bb_2) \cos(bb_2)^2 bb_F_2^2 \\
& \sin(bb_1)^2 \\
& +2. m_b^3 e \cos(om t) R^5 \sin(om t)^2 \sin(bb_2) \cos(bb_2)^2 bb_F_2^2 \\
& \cos(bb_1)^2 \\
& +12. m_b^3 e^2 \cos(om t) aa_F \sin(om t)^3 om R^4 \cos(bb_2)^2 \sin(bb_1)^2 \\
& -2. m_b^3 e \cos(om t) R^5 aa_F^2 \sin(om t)^6 \sin(bb_2) \cos(bb_2)^2 \sin(bb_1)^2 \\
& -2. m_b^3 e \cos(om t) R^5 aa_F^2 \sin(om t)^4 \sin(bb_2) \cos(bb_2)^2 \cos(bb_1)^2 \\
& +8. m_b^2 e \cos(om t) JB om^2 \cos(bb_2)^2 \sin(bb_2) R^3 \sin(om t)^2 \sin(bb_1)^2 \\
& +8. m_b^2 e \cos(om t) JB om^2 \cos(bb_2)^2 \sin(bb_2) R^3 \cos(bb_1)^2 \\
& +4. m_b^3 e^2 \cos(om t) \cos(bb_2) R^4 \sin(om t)^4 om^2 \sin(bb_2) \sin(bb_1)^2 \\
& +4. m_b^3 e^2 \cos(om t) \cos(bb_2) R^4 \sin(om t)^2 om^2 \sin(bb_2) \cos(bb_1)^2 \\
& +8. m_b^2 e \cos(om t) \cos(bb_2) JB aa_F \sin(om t)^3 \sin(bb_2)^2 om R^3 \\
& \sin(bb_1)^2 \\
& +8. m_b^2 e \cos(om t) \cos(bb_2) JB aa_F \sin(om t) \sin(bb_2)^2 om R^3 \\
& \cos(bb_1)^2 - 64. JB^3 om \sin(om t) bb_F_2 \cos(bb_2)^2 \\
& +m_b^3 R^5 \sin(om t)^4 \sin(bb_2)^3 \cos(om t)^2 l aa_F^2 \sin(bb_1)^2 \\
& +m_b^3 R^5 \sin(om t)^2 \sin(bb_2)^3 \cos(om t)^2 l aa_F^2 \cos(bb_1)^2 \\
& -1. m_b^3 R^6 \sin(om t)^8 \sin(bb_2)^3 \cos(om t) aa_F^2 \cos(bb_2) \sin(bb_1)^2 \\
& -1. m_b^3 R^6 \sin(om t)^6 \sin(bb_2)^3 \cos(om t) aa_F^2 \cos(bb_2) \cos(bb_1)^2 \\
& -4. m_b^2 R^4 \sin(om t)^5 \sin(bb_2)^2 \cos(om t) om \cos(bb_2)^2 aa_F JB \\
& -4. m_b^2 R^4 \sin(om t)^5 \cos(om t) \sin(bb_1)^2 om \cos(bb_1)^2 aa_F JB \\
& +m_b^3 R^6 \sin(om t)^6 \cos(om t) \sin(bb_1)^3 bb_F_1^2 \cos(bb_1) \sin(bb_2)^2 \\
& +m_b^3 R^6 \sin(om t)^4 \cos(om t) \sin(bb_1)^3 bb_F_1^2 \cos(bb_1) \cos(bb_2)^2 \\
& -4. m_b^2 R^4 \sin(om t)^4 \cos(om t) \sin(bb_1)^2 kb bb_1 \sin(bb_2)^2 \\
& -4. m_b^2 R^4 \sin(om t)^2 \cos(om t) \sin(bb_1)^2 kb bb_1 \cos(bb_2)^2
\end{aligned}$$

$$\begin{aligned}
& -16. m_b^2 R^4 \sin(om t)^2 \cos(om t)^2 \sin(bb_1) bb_F_1 \cos(bb_1) aa_F J B \\
& \cos(bb_2)^2 + m_b^3 R^6 \sin(bb_2) aa_F^2 \cos(om t)^3 \cos(bb_2)^3 \cos(bb_1)^2 \\
& + m_b^3 R^6 \sin(bb_2) aa_F^2 \cos(om t)^5 \cos(bb_2)^3 \sin(bb_1)^2 \\
& + 4. m_b^3 R^5 aa_F \sin(om t) om \cos(bb_2)^3 e \cos(om t)^3 \sin(bb_1)^2 \\
& - 3. m_b^3 R^6 aa_F^2 \sin(om t)^4 \sin(bb_2) \cos(bb_2)^3 \cos(om t)^3 \sin(bb_1)^2 \\
& - 4. m_b^3 R^6 aa_F^2 \sin(om t)^6 \sin(bb_2)^3 \cos(bb_2) \cos(om t)^3 \sin(bb_1)^2 \\
& - 3. m_b^3 R^6 aa_F^2 \sin(om t)^4 \sin(bb_2)^3 \cos(bb_2) \cos(om t)^3 \cos(bb_1)^2 \\
& - 4. JB om \sin(om t) aa_F \cos(om t)^3 \sin(bb_1)^2 R^4 m_b^2 \sin(bb_2)^2 \\
& \cos(bb_1)^2 \\
& - 4. JB om \sin(om t)^5 aa_F \cos(om t) \sin(bb_1)^4 R^4 m_b^2 \sin(bb_2)^2 \\
& - 4. JB om \sin(om t)^3 aa_F \cos(om t) \sin(bb_1)^2 R^4 m_b^2 \sin(bb_2)^2 \\
& \cos(bb_1)^2 \\
& - 4. JB om \sin(om t)^3 aa_F \cos(om t) \sin(bb_1)^4 R^4 m_b^2 \cos(bb_2)^2 \\
& - 4. JB om \sin(om t) aa_F \cos(om t) \sin(bb_1)^2 R^4 m_b^2 \cos(bb_2)^2 \\
& \cos(bb_1)^2 \\
& - 4. JB om \sin(om t) aa_F \cos(om t)^3 \sin(bb_1)^4 R^4 m_b^2 \cos(bb_2)^2 \\
& + 24. JB om \sin(om t)^3 bb_F_2 R^4 m_b^2 \cos(om t)^2 \sin(bb_2)^2 \sin(bb_1)^2 \\
& + 12. JB om \sin(om t) bb_F_2 R^4 m_b^2 \cos(om t)^2 \sin(bb_2)^2 \cos(bb_1)^2 \\
& + 12. JB om \sin(om t) bb_F_2 R^4 m_b^2 \cos(om t)^4 \sin(bb_2)^2 \sin(bb_1)^2 \\
& + 12. JB om \sin(om t)^5 bb_F_2 R^4 m_b^2 \sin(bb_2)^2 \sin(bb_1)^2 \\
& + 8. JB om \sin(om t) bb_F_2 R^4 m_b^2 \cos(bb_2)^2 \cos(om t)^2 \sin(bb_1)^2 \\
& - 4. JB om \sin(om t) aa_F \cos(om t)^3 \sin(bb_2)^2 R^4 m_b^2 \cos(bb_2)^2 \\
& \sin(bb_1)^2 \\
& - 8. JB om \sin(om t)^3 \sin(bb_1)^4 bb_F_1 R^4 m_b^2 \cos(om t)^2 \sin(bb_2)^2 \\
& - 4. JB om \sin(om t) \sin(bb_1)^2 bb_F_1 R^4 m_b^2 \cos(om t)^2 \sin(bb_2)^2 \\
& \cos(bb_1)^2 \\
& - 4. JB om \sin(om t) \sin(bb_1)^4 bb_F_1 R^4 m_b^2 \cos(om t)^4 \sin(bb_2)^2 \\
& - 4. JB om \sin(om t)^5 \sin(bb_1)^4 bb_F_1 R^4 m_b^2 \sin(bb_2)^2 \\
& - 4. JB om \sin(om t)^3 \sin(bb_1)^2 bb_F_1 R^4 m_b^2 \sin(bb_2)^2 \cos(bb_1)^2 \\
& - 4. JB om \sin(om t)^3 \sin(bb_1)^4 bb_F_1 R^4 m_b^2 \cos(bb_2)^2 \\
& - 4. JB om \sin(om t) \sin(bb_1)^2 bb_F_1 R^4 m_b^2 \cos(bb_2)^2 \cos(bb_1)^2 \\
& - 4. JB om \sin(om t) \sin(bb_1)^4 bb_F_1 R^4 m_b^2 \cos(bb_2)^2 \cos(om t)^2 \\
& - 8. JB om \sin(om t)^3 aa_F \cos(om t)^3 \sin(bb_1)^4 R^4 m_b^2 \sin(bb_2)^2 \\
& - 4. JB om \sin(om t) aa_F \cos(om t)^5 \sin(bb_1)^4 R^4 m_b^2 \sin(bb_2)^2 \\
& - 32. m_b g_R \sin(bb_2) \cos(om t)^2 \cos(aa) JB^2 \\
& + 32. m_b R \sin(bb_2) e \cos(om t)^3 aa_F^2 JB^2
\end{aligned}$$

$$\begin{aligned}
& -16 \cdot m_b R^2 aa_F^2 \cos(om t)^5 \sin(bb_2) \cos(bb_2) JB^2 \\
& + 16 \cdot m_b R \sin(bb_2) l aa_F^2 \cos(om t)^2 JB^2 \\
& - 16 \cdot m_b R^2 \cos(om t)^3 \sin(bb_2) \cos(bb_2) bb_F_2^2 JB^2 \\
& + 16 \cdot m_b R^2 \sin(bb_2) aa_F^2 \cos(om t)^3 \cos(bb_2) JB^2 \\
& - 16 \cdot JB^2 \cos(bb_1)^2 aa_F \sin(om t) om R^2 m_b \cos(om t)^3 \sin(bb_2)^2 \\
& + 16 \cdot aa_F^2 \sin(om t)^2 \sin(bb_1) JB^2 \cos(bb_1) R^2 m_b \cos(om t)^3 \\
& \sin(bb_2)^2 \\
& - 16 \cdot JB^2 \sin(om t) om aa_F \cos(bb_2)^2 R^2 m_b \cos(om t)^3 \sin(bb_1)^2 \\
& - 16 \cdot aa_F^2 \sin(om t)^2 \sin(bb_2) JB^2 \cos(bb_2) R^2 m_b \cos(om t)^3 \\
& \sin(bb_1)^2 - 16 \cdot m_b^2 R^4 om \sin(om t)^3 \sin(bb_1)^4 bb_F_1 JB \cos(om t)^2 \\
& + 4 \cdot m_b^2 R^4 om \sin(om t)^5 \cos(bb_1)^2 bb_F_1 JB \sin(bb_1)^2 \\
& + 4 \cdot m_b^2 R^4 om \sin(om t)^3 \cos(bb_1)^4 bb_F_1 JB \\
& - 4 \cdot m_b^2 R^4 om \sin(om t)^3 bb_F_2 \cos(bb_2)^2 JB \cos(bb_1)^2 \\
& - 6 \cdot m_b^3 R^6 om \sin(om t)^3 \cos(bb_1)^2 bb_F_1 \cos(om t)^2 \sin(bb_2)^2 \\
& \sin(bb_1)^2 \\
& - 1 \cdot m_b^3 R^6 om \sin(om t) \cos(bb_1)^4 bb_F_1 \cos(om t)^2 \sin(bb_2)^2 \\
& - 3 \cdot m_b^3 R^6 om \sin(om t) \cos(bb_1)^2 bb_F_1 \cos(om t)^4 \sin(bb_2)^2 \\
& \sin(bb_1)^2 \\
& - 3 \cdot m_b^3 R^6 om \sin(om t)^5 \cos(bb_1)^2 bb_F_1 \sin(bb_2)^2 \sin(bb_1)^2 \\
& - 1 \cdot m_b^3 R^6 om \sin(om t)^3 \cos(bb_1)^4 bb_F_1 \sin(bb_2)^2 \\
& - 3 \cdot m_b^3 R^6 om \sin(om t)^3 \cos(bb_1)^2 bb_F_1 \cos(bb_2)^2 \sin(bb_1)^2 \\
& - 1 \cdot m_b^3 R^6 om \sin(om t) \cos(bb_1)^4 bb_F_1 \cos(bb_2)^2 \\
& - 3 \cdot m_b^3 R^6 om \sin(om t) \cos(bb_1)^2 bb_F_1 \cos(bb_2)^2 \cos(om t)^2 \\
& \sin(bb_1)^2 + m_b^3 R^6 om \sin(om t) \cos(bb_1)^4 \cos(om t)^4 bb_F_1 \sin(bb_2)^2 \\
& + 48 \cdot JB^2 om \sin(om t)^3 bb_F_2 R^2 m_b \sin(bb_2)^2 \\
& - 16 \cdot JB^2 om \sin(om t)^3 aa_F \cos(om t) \sin(bb_2)^4 R^2 m_b \\
& + 32 \cdot JB^2 om \sin(om t) bb_F_2 R^2 m_b \cos(bb_2)^2 \\
& - 16 \cdot m_b R^2 \sin(om t)^3 \sin(bb_2)^2 \cos(om t) JB^2 om aa_F \cos(bb_2)^2 \\
& - 16 \cdot m_b R^2 \sin(om t)^3 \cos(om t) \sin(bb_1)^2 JB^2 \cos(bb_1)^2 aa_F om \\
& - 16 \cdot m_b R^2 om \sin(om t)^3 bb_F_2 \cos(bb_2)^2 JB^2 \\
& + 16 \cdot m_b R l JB^2 om^2 \cos(bb_2)^2 \sin(bb_2) \\
& + 8 \cdot m_b^2 R^3 g_- \sin(bb_2) \cos(aa) JB \sin(om t)^2 \sin(bb_1)^2 \\
& + 8 \cdot m_b^2 R^3 g_- \sin(bb_2) \cos(aa) JB \cos(om t)^2 \sin(bb_1)^2 \\
& + 4 \cdot m_b^3 R^5 g_- \sin(bb_2)^3 \cos(aa) \cos(om t)^2 \sin(om t)^2 \sin(bb_1)^2 \\
& + 2 \cdot m_b^3 R^5 g_- \sin(bb_2)^3 \cos(aa) \cos(om t)^2 \cos(bb_1)^2 \\
& + 2 \cdot m_b^3 R^5 g_- \sin(bb_2)^3 \cos(aa) \cos(om t)^4 \sin(bb_1)^2
\end{aligned}$$

$$\begin{aligned}
& + m_b^3 R^6 \sin(om t)^6 \cos(om t) \sin(bb_1)^3 aa_F^2 \cos(bb_1) \cos(bb_2)^2 \\
& - 2. m_b^3 R^5 \sin(om t)^7 \cos(om t) \sin(bb_1)^2 e om aa_F \cos(bb_1) \\
& \sin(bb_2)^2 \\
& - 2. m_b^3 R^5 \sin(om t)^5 \cos(om t) \sin(bb_1)^2 e om aa_F \cos(bb_1) \\
& \cos(bb_2)^2 \\
& - 4. m_b^2 R^4 \sin(om t)^5 \cos(om t) \sin(bb_1)^2 JB \cos(bb_1)^2 aa_F om \\
& \sin(bb_2)^2 \\
& - 4. m_b^2 R^4 \sin(om t)^3 \cos(om t) \sin(bb_1)^2 JB \cos(bb_1)^2 aa_F om \\
& \cos(bb_2)^2 \\
& - 1. m_b^3 R^6 \sin(om t)^7 \cos(om t) \sin(bb_1)^2 om \cos(bb_1)^2 aa_F \\
& \sin(bb_2)^2 \\
& - 1. m_b^3 R^6 \sin(om t)^5 \cos(om t) \sin(bb_1)^2 om \cos(bb_1)^2 aa_F \\
& \cos(bb_2)^2 \\
& + 4. m_b^2 R^4 \sin(om t)^4 \cos(om t) \sin(bb_1)^3 bb_F_I^2 \cos(bb_1) JB \\
& - 16. m_b^2 R^4 \sin(om t)^2 \cos(om t)^2 \sin(bb_1) bb_F_I \cos(bb_1)^3 aa_F JB \\
& - 64. m_b R^2 \sin(om t)^2 \cos(om t)^2 \sin(bb_1) bb_F_I \cos(bb_1) aa_F JB^2 \\
& + 4. m_b^2 R^3 l \cos(bb_2) kb bb_2 \sin(om t)^2 \sin(bb_1)^2 \\
& - 64. m_b R^2 \cos(bb_2) \sin(bb_2) bb_F_2 \sin(om t)^2 aa_F \cos(om t)^2 JB^2 \\
& + 2. m_b^3 R^5 l \sin(bb_2)^3 bb_F_2 aa_F \cos(om t)^3 \cos(bb_1)^2 \\
& + 4. m_b^2 R^3 l bb_F_I^2 \sin(bb_1) \sin(om t)^2 \sin(bb_2)^2 JB \\
& + 16. m_b R l \cos(bb_2) JB^2 aa_F \sin(om t) om \\
& + 16. m_b R^2 \cos(om t) kb bb_2 \cos(bb_2)^2 JB \\
& + 16. m_b R^2 om \sin(om t)^3 \cos(bb_1)^2 bb_F_I JB^2 \\
& - 16. m_b R l aa_F^2 \sin(om t)^2 \sin(bb_2) JB^2 \cos(bb_2)^2 \\
& - 4. m_b^2 R^3 l \cos(bb_1) \sin(om t) om aa_F \cos(bb_2)^2 JB \\
& - 16. m_b R l JB^2 \sin(om t) om aa_F \cos(bb_2)^3 \\
& + 4. m_b^2 R^3 l \sin(om t)^2 om^2 \cos(bb_1)^2 \sin(bb_1) JB \\
& - 2. m_b^3 R^5 \cos(om t) \cos(bb_1)^2 e \sin(om t)^4 om^2 \sin(bb_1) \sin(bb_2)^2 \\
& - 2. m_b^3 R^5 \cos(om t) \cos(bb_1)^2 e \sin(om t)^2 om^2 \sin(bb_1) \cos(bb_2)^2 \\
& - 4. m_b^2 R^4 \cos(om t)^3 \cos(bb_1)^4 JB aa_F \sin(om t) om \sin(bb_2)^2 \\
& - 4. m_b^2 R^4 \cos(om t) \cos(bb_1)^4 JB aa_F \sin(om t)^3 om \sin(bb_2)^2 \\
& - 2. m_b^3 R^5 \cos(om t)^5 \cos(bb_1)^2 e om^2 \sin(bb_1) \sin(bb_2)^2 \\
& - 2. m_b^3 R^5 \cos(om t)^3 \cos(bb_1)^2 e om^2 \sin(bb_1) \cos(bb_2)^2 \\
& - 2. m_b^3 R^5 \cos(om t)^4 \cos(bb_1)^2 g_{\sin(bb_1)} \cos(aa) \sin(bb_2)^2 \\
& - 2. m_b^3 R^5 \cos(om t)^2 \cos(bb_1)^2 g_{\sin(bb_1)} \cos(aa) \sin(om t)^2 \\
& \sin(bb_2)^2
\end{aligned}$$

$$\begin{aligned}
& -2 \cdot m \cdot b^3 \cdot R^5 \cos(om t)^2 \cos(bb_1)^2 g \sin(bb_1) \cos(aa) \cos(bb_2)^2 \\
& + 4 \cdot m \cdot b^3 \cdot R^5 \cos(om t)^3 \cos(bb_1)^3 aa_F \sin(om t) om e \sin(bb_2)^2 \\
& + 4 \cdot m \cdot b^3 \cdot R^5 \cos(om t) \cos(bb_1)^3 aa_F \sin(om t)^3 om e \sin(bb_2)^2 \\
& + 4 \cdot m \cdot b^3 \cdot R^5 \cos(om t) \cos(bb_1)^3 aa_F \sin(om t) om e \cos(bb_2)^2 \\
& + 4 \cdot m \cdot b^2 \cdot R^3 l \sin(om t)^2 om^2 \cos(bb_2)^2 \sin(bb_2) JB \\
& + 4 \cdot m \cdot b^2 \cdot R^3 l \cos(om t)^2 om^2 \cos(bb_2)^2 \sin(bb_2) JB \\
& + 4 \cdot m \cdot b^2 \cdot R^3 l \cos(om t)^2 \sin(bb_2) \cos(bb_2)^2 bb_F I^2 JB \\
& + 8 \cdot m \cdot b^2 \cdot R^3 l \sin(bb_2) aa_F^2 \cos(om t)^2 \cos(bb_2)^2 JB \\
& - 4 \cdot m \cdot b^2 \cdot R^3 l aa_F^2 \sin(om t)^4 \sin(bb_2) \cos(bb_2)^2 JB \\
& - 3 \cdot m \cdot b^3 \cdot R^5 l aa_F^2 \sin(om t)^4 \sin(bb_2) \cos(om t)^2 \cos(bb_2)^2 \sin(bb_1)^2 \\
& - 2 \cdot m \cdot b^3 \cdot R^5 l aa_F^2 \sin(om t)^2 \sin(bb_2) \cos(om t)^2 \cos(bb_2)^2 \cos(bb_1)^2 \\
& - 3 \cdot m \cdot b^3 \cdot R^5 l aa_F^2 \sin(om t)^2 \sin(bb_2) \cos(om t)^4 \cos(bb_2)^2 \sin(bb_1)^2 \\
& - 1 \cdot m \cdot b^3 \cdot R^5 l \sin(om t)^5 om \cos(bb_2)^3 aa_F \sin(bb_1)^2 \\
& - 1 \cdot m \cdot b^3 \cdot R^5 l \sin(om t)^3 om \cos(bb_2)^3 aa_F \cos(bb_1)^2 \\
& - 2 \cdot m \cdot b^3 \cdot R^5 l \sin(om t)^3 om \cos(bb_2)^3 aa_F \cos(om t)^2 \sin(bb_1)^2 \\
& + 4 \cdot m \cdot b^2 \cdot R^3 l JB \sin(om t) om aa_F \cos(bb_2)^2 \cos(bb_1)^3 \\
& - 1 \cdot m \cdot b^3 \cdot R^5 l \sin(om t) om aa_F \cos(bb_2)^2 \cos(bb_1)^3 \\
& - 4 \cdot m \cdot b^2 \cdot R^3 l JB aa_F \sin(om t) om \cos(bb_1)^3 \\
& + 4 \cdot m \cdot b^2 \cdot R^3 l JB om^2 \cos(bb_1)^2 \sin(bb_1) \cos(om t)^2 \sin(bb_2)^2 \\
& + 4 \cdot m \cdot b^2 \cdot R^3 l JB om^2 \cos(bb_1)^2 \sin(bb_1) \sin(om t)^2 \sin(bb_2)^2 \\
& + 4 \cdot m \cdot b^2 \cdot R^3 l JB om^2 \cos(bb_1)^2 \sin(bb_1) \cos(bb_2)^2 \\
& - 8 \cdot m \cdot b^2 \cdot R^3 l aa_F^2 \sin(om t)^2 \sin(bb_1) \cos(bb_1)^2 \cos(om t)^2 JB \\
& + 4 \cdot m \cdot b^2 \cdot R^4 \cos(om t)^3 \cos(bb_1)^3 aa_F^2 \sin(om t)^2 \sin(bb_1) JB \\
& \sin(bb_2)^2 \\
& + 4 \cdot m \cdot b^2 \cdot R^4 \cos(om t) \cos(bb_1)^3 aa_F^2 \sin(om t)^4 \sin(bb_1) JB \sin(bb_2)^2 \\
& + 4 \cdot m \cdot b^2 \cdot R^4 \cos(om t) \cos(bb_1)^3 aa_F^2 \sin(om t)^2 \sin(bb_1) JB \\
& \cos(bb_2)^2 \\
& + m \cdot b^3 \cdot R^6 \cos(om t) \cos(bb_1)^3 aa_F^2 \sin(om t)^6 \sin(bb_1) \sin(bb_2)^2 \\
& + m \cdot b^3 \cdot R^6 \cos(om t) \cos(bb_1)^3 aa_F^2 \sin(om t)^4 \sin(bb_1) \cos(bb_2)^2 \\
& + m \cdot b^3 \cdot R^6 \cos(om t)^7 \cos(bb_1)^3 \sin(bb_1) aa_F^2 \sin(bb_2)^2 \\
& + m \cdot b^3 \cdot R^6 \cos(om t)^5 \cos(bb_1)^3 \sin(bb_1) aa_F^2 \cos(bb_2)^2 \\
& - 2 \cdot m \cdot b^3 \cdot R^6 \cos(om t)^3 \cos(bb_1)^4 \sin(om t)^3 om aa_F \sin(bb_2)^2 \\
& - 1 \cdot m \cdot b^3 \cdot R^6 \cos(om t) \cos(bb_1)^4 \sin(om t)^5 om aa_F \sin(bb_2)^2 \\
& + m \cdot b^3 \cdot R^6 \cos(om t)^5 \cos(bb_1)^3 \sin(bb_1) bb_F I^2 \sin(bb_2)^2 \\
& + 2 \cdot m \cdot b^3 \cdot R^6 \cos(om t)^3 \cos(bb_1)^3 \sin(bb_1) bb_F I^2 \sin(om t)^2 \\
& \sin(bb_2)^2 + m \cdot b^3 \cdot R^6 \cos(om t)^3 \cos(bb_1)^3 \sin(bb_1) bb_F I^2 \cos(bb_2)^2
\end{aligned}$$

$$\begin{aligned}
& + m_b^3 R^6 \cos(om t)^3 \cos(bb_1)^4 aa_F \sin(om t) om \sin(bb_2)^2 \\
& + 8. JB m_b^2 R^3 \sin(bb_2) e \cos(om t)^3 aa_F^2 \sin(om t)^2 \sin(bb_1)^2 \\
& + 8. JB m_b^2 R^3 \sin(bb_2) e \cos(om t)^3 aa_F^2 \cos(bb_1)^2 \\
& + 8. JB m_b^2 R^3 \sin(bb_2) e \cos(om t)^5 aa_F^2 \sin(bb_1)^2 \\
& + 12. JB m_b^2 R^4 \sin(om t) om aa_F \cos(bb_2)^2 \cos(om t)^3 \sin(bb_1)^2 \\
& - 4. JB m_b^2 R^4 aa_F^2 \cos(om t)^5 \sin(bb_2) \cos(bb_2) \cos(bb_1)^2 \\
& - 4. JB m_b^2 R^4 aa_F^2 \cos(om t)^7 \sin(bb_2) \cos(bb_2) \sin(bb_1)^2 \\
& - 8. JB m_b^2 R^4 \sin(om t)^2 \sin(bb_2) \cos(bb_2) bb_F_2^2 \cos(om t)^3 \\
& \sin(bb_1)^2 \\
& + 4. JB m_b^2 R^3 \sin(bb_2) l aa_F^2 \cos(om t)^2 \sin(om t)^2 \sin(bb_1)^2)) / \\
& (16. JB^2 m_t l^2 + 128. JB^2 m_b l^2 + 128. R^2 m_b^2 \cos(om t)^4 \sin(bb_2)^2 JB e^2 \\
& + 256. JB^2 JT + 16. m_b^3 R^4 l \cos(om t)^3 \cos(bb_1)^2 e \sin(bb_2)^2 \\
& + 16. m_b^3 R^4 l \cos(om t) \cos(bb_1)^2 e \sin(om t)^2 \sin(bb_2)^2 \\
& + 16. JB R^4 m_b^2 \sin(om t)^2 \sin(bb_1)^2 \cos(om t)^2 \cos(bb_2)^2 \\
& + 32. JB R^4 m_b^2 \sin(om t)^2 \sin(bb_1)^2 \cos(om t)^4 \sin(bb_2)^2 \\
& + 16. JB R^4 m_b^2 \sin(om t)^2 \sin(bb_1)^2 \cos(bb_1)^2 \cos(om t)^2 \\
& + 16. JB R^4 m_b^2 \sin(om t)^2 \sin(bb_1)^4 \cos(om t)^4 \\
& + 64. JB R^4 m_b^2 \sin(om t)^4 \sin(bb_1)^2 \cos(om t)^2 \sin(bb_2)^2 \\
& + 32. JB R^4 m_b^2 \sin(om t)^4 \sin(bb_1)^4 \cos(om t)^2 \\
& + 16. JB R^4 m_b^2 \cos(bb_1)^2 \sin(om t)^2 \cos(om t)^2 \sin(bb_2)^2 \\
& + 64. JB R^2 m_b^2 \cos(bb_1)^2 \cos(om t)^2 e^2 \\
& + 16. R^4 m_b^2 \cos(om t)^4 \sin(bb_2)^4 JB \sin(om t)^2 \\
& + 32. R^4 m_b^2 \cos(om t)^2 \sin(bb_2)^4 JB \sin(om t)^4 \\
& + 4. R^6 m_b^3 \cos(om t)^4 \sin(bb_2)^2 \sin(om t)^2 \sin(bb_1)^2 \cos(bb_2)^2 \\
& + 4. R^6 m_b^3 \cos(om t)^6 \sin(bb_2)^4 \sin(om t)^2 \sin(bb_1)^2 \\
& + 4. R^6 m_b^3 \cos(om t)^4 \sin(bb_2)^2 \sin(om t)^2 \sin(bb_1)^2 \cos(bb_1)^2 \\
& + 4. R^6 m_b^3 \cos(om t)^6 \sin(bb_2)^2 \sin(om t)^2 \sin(bb_1)^4 \\
& + 12. R^6 m_b^3 \cos(om t)^4 \sin(bb_2)^4 \sin(om t)^4 \sin(bb_1)^2 \\
& + 12. R^6 m_b^3 \cos(om t)^4 \sin(bb_2)^2 \sin(om t)^4 \sin(bb_1)^4 \\
& + 12. R^6 m_b^3 \cos(om t)^2 \sin(bb_2)^4 \sin(om t)^6 \sin(bb_1)^2 \\
& + 12. R^6 m_b^3 \cos(om t)^2 \sin(bb_2)^2 \sin(om t)^6 \sin(bb_1)^4 \\
& + 4. R^4 m_b^3 \cos(om t)^2 \sin(bb_2)^2 \cos(bb_1)^2 l^2 \\
& + 4. R^6 m_b^3 \cos(om t)^4 \sin(bb_2)^4 \cos(bb_1)^2 \sin(om t)^2 \\
& + 8. R^6 m_b^3 \cos(om t)^2 \sin(bb_2)^4 \cos(bb_1)^2 \sin(om t)^4 \\
& + 8. R^6 m_b^3 \cos(om t)^2 \sin(bb_2)^2 \cos(bb_1)^2 \sin(bb_1)^2 \sin(om t)^4 \\
& + 16. R^4 m_b^3 \cos(om t)^4 \sin(bb_2)^2 \cos(bb_1)^2 e^2
\end{aligned}$$

$$\begin{aligned}
& + 16 \cdot R^4 m_b^2 \sin(om t)^2 \sin(bb_2)^2 JB \cos(om t)^2 \cos(bb_2)^2 \\
& + 8 \cdot R^6 m_b^3 \sin(om t)^4 \sin(bb_2)^2 \sin(bb_1)^2 \cos(om t)^2 \cos(bb_2)^2 \\
& + 4 \cdot R^6 m_b^3 \sin(om t)^2 \sin(bb_2)^2 \cos(bb_1)^2 \cos(om t)^2 \cos(bb_2)^2 \\
& + 16 \cdot R^2 m_b^2 \cos(bb_2)^2 JB l^2 \\
& - 16 \cdot m_b^3 R^4 l \cos(om t)^3 \cos(bb_2)^2 e \sin(bb_1)^2 \\
& + 64 \cdot m_b^2 R^2 l \cos(om t) \cos(bb_1)^2 e JB \\
& + 16 \cdot R^4 m_b^3 \sin(om t)^2 \sin(bb_2)^2 \cos(bb_1)^2 \cos(om t)^2 e^2 \\
& + 64 \cdot R^2 m_b^2 \cos(bb_2)^2 JB \cos(om t)^2 e^2 \\
& + 4 \cdot R^4 m_b^3 \cos(bb_2)^2 \sin(om t)^2 \sin(bb_1)^2 l^2 \\
& + 4 \cdot R^6 m_b^3 \cos(bb_2)^2 \sin(om t)^2 \sin(bb_1)^2 \cos(bb_1)^2 \cos(om t)^2 \\
& + 4 \cdot R^6 m_b^3 \cos(bb_2)^2 \sin(om t)^2 \sin(bb_1)^4 \cos(om t)^4 \\
& + 8 \cdot R^6 m_b^3 \cos(bb_2)^2 \sin(om t)^4 \sin(bb_1)^4 \cos(om t)^2 \\
& + 16 \cdot R^4 m_b^3 \cos(bb_2)^2 \sin(om t)^2 \sin(bb_1)^2 \cos(om t)^2 e^2 \\
& + 4 \cdot R^4 m_b^3 \cos(bb_2)^2 \cos(om t)^2 \sin(bb_1)^2 l^2 \\
& + 16 \cdot R^4 m_b^3 \cos(bb_2)^2 \cos(om t)^4 \sin(bb_1)^2 e^2 \\
& + 32 \cdot R^4 m_b^3 \sin(om t)^4 \sin(bb_2)^2 \sin(bb_1)^2 \cos(om t)^2 e^2 \\
& + 16 \cdot R^4 m_b^2 \sin(om t)^4 \sin(bb_2)^2 \cos(bb_1)^2 JB \sin(bb_1)^2 \\
& + R^4 m_b^2 \sin(om t)^2 \sin(bb_2)^2 \cos(bb_1)^2 m_t l^2 \\
& + 4 \cdot R^6 m_b^3 \sin(om t)^6 \sin(bb_2)^2 \cos(bb_1)^2 \sin(bb_1)^2 \\
& + 64 \cdot R^2 m_b \cos(bb_2)^2 JB^2 \sin(om t)^2 \sin(bb_2)^2 \\
& + 4 \cdot R^6 m_b^3 \sin(om t)^6 \sin(bb_2)^4 \cos(bb_1)^2 \\
& + 64 \cdot R^2 m_b \cos(bb_2)^2 JB^2 \sin(bb_1)^2 \sin(om t)^2 \\
& + 4 \cdot R^2 m_b \cos(bb_2)^2 JB m_t l^2 \\
& + 16 \cdot R^4 m_b^2 \cos(bb_2)^2 \sin(om t)^4 \sin(bb_1)^2 JB \sin(bb_2)^2 \\
& + 16 \cdot R^4 m_b^2 \cos(bb_2)^2 \sin(om t)^4 \sin(bb_1)^4 JB \\
& + R^4 m_b^2 \cos(bb_2)^2 \sin(om t)^2 \sin(bb_1)^2 m_t l^2 \\
& + 16 \cdot R^4 m_b^2 \cos(bb_2)^2 JB \sin(om t)^4 \sin(bb_2)^2 \\
& + 16 \cdot R^4 m_b^2 \cos(bb_2)^2 JB \sin(bb_1)^2 \sin(om t)^4 \\
& + R^4 m_b^2 \cos(om t)^2 \sin(bb_2)^2 \cos(bb_1)^2 m_t l^2 \\
& + 4 \cdot R^6 m_b^3 \cos(bb_2)^2 \sin(om t)^6 \sin(bb_1)^2 \sin(bb_2)^2 \\
& + 4 \cdot R^6 m_b^3 \cos(bb_2)^2 \sin(om t)^6 \sin(bb_1)^4 \\
& + R^4 m_b^2 \cos(bb_2)^2 \cos(bb_1)^2 m_t l^2 \\
& + 16 \cdot R^4 m_b^2 \cos(bb_2)^2 \cos(bb_1)^2 \sin(om t)^2 JB \sin(bb_2)^2 \\
& + 16 \cdot R^4 m_b^2 \cos(bb_2)^2 \cos(bb_1)^2 JB \sin(bb_1)^2 \sin(om t)^2 \\
& + 4 \cdot R^6 m_b^3 \cos(bb_2)^2 \cos(bb_1)^2 \sin(om t)^4 \sin(bb_2)^2 \\
& + 4 \cdot R^6 m_b^3 \cos(bb_2)^2 \cos(bb_1)^2 \sin(bb_1)^2 \sin(om t)^4
\end{aligned}$$

$$\begin{aligned}
& + 16 \cdot R^4 m_b^2 \cos(bb_2)^2 \cos(omt)^2 \sin(bb_1)^2 \sin(omt)^2 JB \sin(bb_2)^2 \\
& + 16 \cdot R^4 m_b^2 \cos(bb_2)^2 \cos(omt)^2 \sin(bb_1)^4 JB \sin(omt)^2 \\
& + R^4 m_b^2 \cos(bb_2)^2 \cos(omt)^2 \sin(bb_1)^2 m_t l^2 \\
& + 16 \cdot R^4 m_b^2 \cos(omt)^4 \sin(bb_2)^4 \sin(bb_1)^2 \sin(omt)^2 JB \\
& + 64 \cdot JB R^2 m_b \sin(omt)^2 \sin(bb_1)^2 JT + 64 \cdot JB R^2 m_b \cos(bb_1)^2 JT \\
& + 64 \cdot JB R^2 m_b \cos(omt)^2 \sin(bb_1)^2 JT \\
& + 64 \cdot R^2 m_b \cos(omt)^2 \sin(bb_2)^2 JB JT \\
& + 32 \cdot R^4 m_b^2 \cos(omt)^2 \sin(bb_2)^2 \sin(omt)^2 \sin(bb_1)^2 JT \\
& + 16 \cdot R^4 m_b^2 \cos(omt)^2 \sin(bb_2)^2 \cos(bb_1)^2 JT \\
& + 16 \cdot R^4 m_b^2 \cos(omt)^4 \sin(bb_2)^2 \sin(bb_1)^2 JT \\
& + 64 \cdot R^2 m_b \sin(omt)^2 \sin(bb_2)^2 JB JT \\
& + 16 \cdot R^4 m_b^2 \sin(omt)^4 \sin(bb_2)^2 \sin(bb_1)^2 JT \\
& + 16 \cdot R^4 m_b^2 \sin(omt)^2 \sin(bb_2)^2 \cos(bb_1)^2 JT \\
& + 64 \cdot R^2 m_b \cos(bb_2)^2 JB JT \\
& + 16 \cdot R^4 m_b^2 \cos(bb_2)^2 \sin(omt)^2 \sin(bb_1)^2 JT \\
& + 16 \cdot R^4 m_b^2 \cos(bb_2)^2 \cos(bb_1)^2 JT \\
& + 16 \cdot R^4 m_b^2 \cos(bb_2)^2 \cos(omt)^2 \sin(bb_1)^2 JT \\
& + 16 \cdot R^4 m_b^2 \cos(omt)^4 \sin(bb_2)^2 \sin(bb_1)^4 JB \sin(omt)^2 \\
& + 8 \cdot R^4 m_b^3 \cos(omt)^4 \sin(bb_2)^2 \sin(bb_1)^2 l^2 \\
& + R^4 m_b^2 \cos(omt)^4 \sin(bb_2)^2 \sin(bb_1)^2 m_t l^2 \\
& + 64 \cdot JB^2 m_b R^2 \sin(omt)^4 \sin(bb_2)^2 \\
& + 64 \cdot JB^2 m_b R^2 \sin(bb_1)^2 \sin(omt)^4 \\
& + 128 \cdot JB^2 R^2 m_b \sin(omt)^4 \sin(bb_1)^2 \sin(bb_2)^2 \\
& + 64 \cdot JB^2 R^2 m_b \sin(omt)^4 \sin(bb_1)^4 \\
& + 32 \cdot R^4 m_b^3 \cos(omt)^6 \sin(bb_2)^2 \sin(bb_1)^2 e^2 \\
& + 64 \cdot R^2 m_b \sin(omt)^4 \sin(bb_2)^4 JB^2 \\
& + 32 \cdot JB R^2 m_b^2 \sin(omt)^2 \sin(bb_1)^2 l^2 \\
& + 4 \cdot JB R^2 m_b \sin(omt)^2 \sin(bb_1)^2 m_t l^2 \\
& + 16 \cdot JB R^4 m_b^2 \sin(omt)^6 \sin(bb_1)^4 \\
& + 32 \cdot JB R^4 m_b^2 \sin(omt)^6 \sin(bb_1)^2 \sin(bb_2)^2 \\
& + 128 \cdot JB R^2 m_b^2 \sin(omt)^2 \sin(bb_1)^2 \cos(omt)^2 e^2 \\
& + 16 \cdot R^4 m_b^2 \sin(omt)^6 \sin(bb_2)^4 JB \\
& + 128 \cdot R^2 m_b^2 \sin(omt)^2 \sin(bb_2)^2 JB \cos(omt)^2 e^2 \\
& + 4 \cdot R^6 m_b^3 \sin(omt)^8 \sin(bb_2)^4 \sin(bb_1)^2 \\
& + 16 \cdot R^4 m_b^2 \sin(omt)^6 \sin(bb_2)^4 \sin(bb_1)^2 JB \\
& + 16 \cdot R^4 m_b^2 \sin(omt)^6 \sin(bb_2)^2 \sin(bb_1)^4 JB
\end{aligned}$$

$$\begin{aligned}
& + 8 \cdot R^4 m_b^3 \sin(om t)^4 \sin(bb_2)^2 \sin(bb_1)^2 l^2 \\
& + R^4 m_b^2 \sin(om t)^4 \sin(bb_2)^2 \sin(bb_1)^2 m_t l^2 \\
& + 4 \cdot R^6 m_b^3 \sin(om t)^8 \sin(bb_2)^2 \sin(bb_1)^4 \\
& + 16 \cdot R^4 m_b^2 \sin(om t)^4 \sin(bb_2)^4 \cos(bb_1)^2 JB \\
& + 64 \cdot R^4 m_b^3 \cos(om t)^4 \sin(bb_2)^2 \sin(om t)^2 \sin(bb_1)^2 e^2 \\
& + 16 \cdot R^4 m_b^2 \cos(om t)^2 \sin(bb_2)^4 \cos(bb_1)^2 \sin(om t)^2 JB \\
& + 16 \cdot R^4 m_b^2 \cos(om t)^2 \sin(bb_2)^2 \cos(bb_1)^2 JB \sin(bb_1)^2 \sin(om t)^2 \\
& + 64 \cdot JB^2 R^2 m_b \cos(bb_1)^2 \sin(bb_1)^2 \sin(om t)^2 \\
& + 4 \cdot JB R^2 m_b \cos(bb_1)^2 m_t l^2 \\
& + 64 \cdot JB^2 R^2 m_b \cos(bb_1)^2 \sin(om t)^2 \sin(bb_2)^2 \\
& + 16 \cdot JB R^4 m_b^2 \cos(bb_1)^2 \sin(om t)^4 \sin(bb_2)^2 \\
& + 16 \cdot JB R^4 m_b^2 \cos(bb_1)^2 \sin(bb_1)^2 \sin(om t)^4 \\
& + 128 \cdot JB^2 R^2 m_b \cos(om t)^2 \sin(bb_1)^2 \sin(om t)^2 \sin(bb_2)^2 \\
& + 64 \cdot JB^2 R^2 m_b \cos(om t)^2 \sin(bb_1)^4 \sin(om t)^2 \\
& + 4 \cdot JB R^2 m_b \cos(om t)^2 \sin(bb_1)^2 m_t l^2 \\
& + 32 \cdot JB R^2 m_b^2 \cos(om t)^2 \sin(bb_1)^2 l^2 \\
& + 128 \cdot JB R^2 m_b^2 \cos(om t)^4 \sin(bb_1)^2 e^2 \\
& + 64 \cdot R^2 m_b \cos(om t)^2 \sin(bb_2)^4 JB^2 \sin(om t)^2 \\
& + 32 \cdot R^2 m_b^2 \cos(om t)^2 \sin(bb_2)^2 JB l^2 \\
& + 4 \cdot R^2 m_b \cos(om t)^2 \sin(bb_2)^2 JB m_t l^2 \\
& + 32 \cdot R^4 m_b^2 \cos(om t)^2 \sin(bb_2)^4 \sin(om t)^4 \sin(bb_1)^2 JB \\
& + 32 \cdot R^4 m_b^2 \cos(om t)^2 \sin(bb_2)^2 \sin(om t)^4 \sin(bb_1)^4 JB \\
& + 16 \cdot R^4 m_b^3 \cos(om t)^2 \sin(bb_2)^2 \sin(om t)^2 \sin(bb_1)^2 l^2 \\
& + 32 \cdot R^2 m_b^2 \sin(om t)^2 \sin(bb_2)^2 JB l^2 \\
& + 4 \cdot R^2 m_b \sin(om t)^2 \sin(bb_2)^2 JB m_t l^2 \\
& + 2 \cdot R^4 m_b^2 \cos(om t)^2 \sin(bb_2)^2 \sin(om t)^2 \sin(bb_1)^2 m_t l^2 \\
& + 64 \cdot JB^2 m_b R^2 \sin(om t)^2 \cos(om t)^2 \sin(bb_2)^2 \\
& + 64 \cdot JB^2 m_b R^2 \sin(om t)^2 \sin(bb_1)^2 \cos(om t)^2 \\
& + 16 \cdot JB R^2 m_b^2 \cos(bb_1)^2 l^2 + 256 \cdot JB^3 \sin(om t)^2 \sin(bb_2)^2 \\
& + 256 \cdot JB^3 \sin(bb_1)^2 \sin(om t)^2 - 64 \cdot m_b^2 R^2 l \cos(om t) \cos(bb_2)^2 e JB \\
& - 16 \cdot m_b^3 R^4 l \cos(om t) \cos(bb_2)^2 e \sin(om t)^2 \sin(bb_1)^2 \\
& + 4 \cdot R^4 m_b^3 \sin(om t)^2 \sin(bb_2)^2 \cos(bb_1)^2 l^2 \\
& + 512 \cdot JB^2 m_b \cos(om t)^2 e^2
\end{aligned}$$

> `starting length` = length(%), `converting to horner` =
length(convert(% ,horner)), factoring=length(factor(%));
starting length=152986, converting to horner=89306, factoring=154090 (14.3.3.9)

```

> T5_eq_rho[full] := convert(T4_eq_rho[full], horner);
T5_eq_rhofull := (4. (( -64. ka aa
(14.3.3.10)
+ 64. cos(om t) aa_F2 sin(om t)2 sin(bb_1) cos(bb_1) JB) JB2
- 128. sin(om t)2 sin(bb_1) aa_F cos(bb_1) bb_F_1 JB3
- 64. cos(om t) aa_F2 sin(om t)2 sin(bb_2) JB3 cos(bb_2)
- 64. cos(om t) kb bb_1 JB2 + (64. m_b g_ sin(aa)
+ 16. m_t g_ sin(aa)) JB2 l
- 128. sin(om t)2 sin(bb_2) aa_F cos(bb_2) bb_F_2 JB3
+ 64. cos(om t) kb bb_2 JB2 + (( (128. - 64. sin(bb_1)2) sin(om t)
- 64. cos(bb_1)2 sin(om t)) cos(om t) aa_F JB3 + (( -64. sin(bb_1)2
- 64.) sin(om t) + 64. cos(bb_1)2 sin(om t)) JB3 bb_F_1
- 64. cos(om t) JB3 aa_F sin(om t) sin(bb_2)2
- 64. cos(om t) JB3 sin(om t) aa_F cos(bb_2)2
+ (64. JB3 sin(om t) sin(bb_2)2 - 64. JB3 sin(om t) cos(bb_2)2
+ 64. JB3 sin(om t) ) bb_F_2) om + (( -32. sin(bb_1) cos(om t)2 cos(aa)
+ 32. sin(bb_1) cos(aa)) g_ m_b JB2 + (32. cos(aa)
- 32. cos(om t)2 cos(aa)) g_ m_b JB2 sin(bb_2)
+ (( (16. sin(bb_1) cos(om t)2
- 16. sin(om t)2 sin(bb_1) cos(bb_1)2) aa_F2 m_b JB2 +
(-32. m_b sin(bb_1) aa_F cos(om t) JB2 + 16. m_b sin(bb_1) JB2 bb_F_1)
bb_F_1 + 16. m_b sin(bb_2) aa_F2 cos(om t)2 JB2
- 16. m_b aa_F2 sin(om t)2 sin(bb_2) JB2 cos(bb_2)2
+ 16. m_b cos(bb_1) kb bb_1 JB) l
+ (32. m_b l sin(bb_2) aa_F cos(om t) JB2
+ 16. m_b l sin(bb_2) JB2 bb_F_2) bb_F_2
+ 16. m_b l cos(bb_2) kb bb_2 JB + ((( (-16.
- 16. sin(bb_1)2) sin(om t) + 16. cos(bb_1)2 sin(om t))
cos(bb_1) aa_F m_b JB2 + (16. m_b JB2 aa_F sin(om t)
+ 16. m_b JB2 aa_F sin(om t) sin(bb_2)2
- 16. m_b JB2 aa_F sin(om t) cos(bb_2)2) cos(bb_2)) l
+ (16. m_b JB2 cos(bb_1)2 sin(bb_1)
+ 16. m_b JB2 cos(bb_2)2 sin(bb_2)) l om) om + ((( (-16. aa cos(bb_1)2
- 16. aa cos(om t)2 sin(bb_1)2 - 16. aa sin(om t)2 sin(bb_1)2) ka m_b
+ ((( (16. + 16. sin(bb_1)2) sin(bb_1) sin(om t)4
+ 16. sin(om t)2 sin(bb_1) cos(bb_1)2) cos(bb_1) + (( -16. sin(bb_1)
+ (32. + 16. sin(bb_1)2) sin(bb_1) sin(om t)2) cos(bb_1)
```

$$\begin{aligned}
& + 16. \sin(bb_1) \cos(bb_1) \cos(om t)^2 \cos(om t)^2 \\
& \cos(om t) aa_F^2 m_b JB) JB + ((((-32. \\
& - 32. \sin(bb_1)^2) \sin(bb_1) \sin(om t)^4 \\
& - 32. \sin(om t)^2 \sin(bb_1) \cos(bb_1)^2) \cos(bb_1) + ((32. \sin(bb_1) + (\\
& - 64. - 32. \sin(bb_1)^2) \sin(bb_1) \sin(om t)^2) \cos(bb_1) \\
& - 32. \sin(bb_1) \cos(bb_1) \cos(om t)^2) \cos(om t)^2) aa_F m_b JB^2 \\
& + ((16. \sin(om t)^2 \sin(bb_1) - 16. \sin(bb_1)) \cos(bb_1) \\
& + 16. \sin(bb_1) \cos(bb_1) \cos(om t)^2) \cos(om t) m_b JB^2 bb_F_1) bb_F_1 \\
& + (((-16. aa \sin(om t)^2 - 16. aa \cos(om t)^2) ka m_b \\
& + (16. \sin(om t)^4 \sin(bb_1) \cos(bb_1) \\
& + 16. \sin(om t)^2 \cos(om t)^2 \sin(bb_1) \cos(bb_1)) \\
& \cos(om t) aa_F^2 m_b JB) JB + (\\
& - 32. \sin(om t)^2 \cos(om t)^2 \sin(bb_1) \cos(bb_1) \\
& - 32. \sin(om t)^4 \sin(bb_1) \cos(bb_1)) aa_F m_b JB^2 bb_F_1) \sin(bb_2)^2 \\
& + ((((-16. - 16. \sin(bb_1)^2) \sin(om t)^4 - 16. \cos(bb_1)^2 \sin(om t)^2 \\
& + (16. + (-32. - 16. \sin(bb_1)^2) \sin(om t)^2 \\
& - 16. \cos(om t)^2) \cos(om t) aa_F^2 m_b JB^2 + (-16. \sin(om t)^4 \\
& - 16. \sin(om t)^2 \cos(om t)^2) \cos(om t) aa_F^2 m_b JB^2 \sin(bb_2)^2) \\
& \sin(bb_2) + ((-16. ka aa m_b \\
& + 16. \cos(om t) aa_F^2 \sin(om t)^2 \sin(bb_1) \cos(bb_1) m_b JB) JB \\
& - 32. \sin(om t)^2 \sin(bb_1) aa_F \cos(bb_1) bb_F_1 m_b JB^2 \\
& - 16. m_b \cos(om t) aa_F^2 \sin(om t)^2 \sin(bb_2) JB^2 \cos(bb_2)) \\
& \cos(bb_2)) \cos(bb_2) + ((-16. \sin(om t)^2 \sin(bb_1)^2 - 16. \cos(bb_1)^2 \\
& - 16. \sin(bb_1)^2 \cos(om t)^2) \cos(om t) kb m_b JB + (-16. \sin(om t)^2 \\
& - 16. \cos(om t)^2) \cos(om t) kb m_b JB \sin(bb_2)^2 \\
& - 16. m_b \cos(om t) kb \cos(bb_2)^2 JB) bb_1 \\
& + (((4. \sin(aa) \cos(om t)^2 \sin(bb_1)^2 + 4. \sin(aa) \cos(bb_1)^2 \\
& + 4. \sin(aa) \sin(om t)^2 \sin(bb_1)^2) g_m_t + (8. \sin(aa) \cos(bb_1)^2 \\
& + 16. \sin(aa) \sin(om t)^2 \sin(bb_1)^2 + (8. \cos(bb_1) \sin(bb_1) \cos(aa) \\
& + 16. \sin(aa) \sin(bb_1)^2 \cos(om t)) \cos(om t)) g_m_b) m_b JB \\
& + ((4. \sin(aa) \cos(om t)^2 + 4. \sin(aa) \sin(om t)^2) g_m_t \\
& + (16. \sin(aa) \cos(om t)^2 + 16. \sin(aa) \sin(om t)^2) g_m_b) \\
& m_b JB \sin(bb_2)^2 + (-8. m_b^2 g_m_t \sin(bb_2) \cos(om t) \cos(aa) JB \\
& + (4. m_t g_m_t \sin(aa) + 8. m_b g_m_t \sin(aa)) m_b JB \cos(bb_2)) \cos(bb_2) \\
& + (4. m_b^2 \cos(bb_2) \sin(bb_2) aa_F^2 \cos(om t) JB \\
& - 4. m_b^2 \cos(bb_1) \sin(bb_1) aa_F^2 \cos(om t) JB) l) l + (((((-32. \\
\end{aligned}$$

$$\begin{aligned}
& -32 \cdot \sin(bb_1)^2) \sin(om t)^4 - 32 \cdot \cos(bb_1)^2 \sin(om t)^2 + (32. + (-64. \\
& - 32 \cdot \sin(bb_1)^2) \sin(om t)^2 - 32 \cdot \cos(om t)^2) \cos(om t)^2) aa_F m_b JB^2 \\
& + (-32 \cdot \sin(om t)^2 \cos(om t)^2 - 32 \cdot \sin(om t)^4) aa_F m_b JB^2 \sin(bb_2)^2) \\
& \sin(bb_2) - 32 \cdot \sin(om t)^2 \sin(bb_2) aa_F m_b JB^2 \cos(bb_2)^2) \\
& \cos(bb_2) + (-16 \cdot \sin(om t)^2 + 16. \\
& - 16 \cdot \cos(om t)^2) \cos(om t) m_b JB^2 \sin(bb_2) \cos(bb_2) bb_F_2) bb_F_2 \\
& + ((16 \cdot \cos(bb_1)^2 + 16 \cdot \sin(om t)^2 \sin(bb_1)^2) \\
& + 16 \cdot \sin(bb_1)^2 \cos(om t)^2) \cos(om t) kb m_b JB + (16 \cdot \sin(om t)^2 \\
& + 16 \cdot \cos(om t)^2) \cos(om t) kb m_b JB \sin(bb_2)^2 \\
& + 16 \cdot m_b \cos(om t) kb \cos(bb_2)^2 JB) bb_2 + (((32. \\
& - 16 \cdot \sin(bb_1)^2) \sin(bb_1)^2 \sin(om t)^3 + ((-16 \cdot \sin(bb_1)^2 + 48. + (- \\
& - 16 \cdot \sin(bb_1)^2) \sin(om t)^2) \sin(om t) - 16 \cdot \cos(bb_1)^2 \sin(om t)) \\
& \cos(bb_1)^2 + ((32. - 16 \cdot \sin(bb_1)^2) \sin(bb_1)^2 \sin(om t) + (-16. \\
& - 16 \cdot \sin(bb_1)^2) \sin(om t) \cos(bb_1)^2) \cos(om t)^2) \\
& \cos(om t) aa_F m_b JB^2 + ((-48. - 16 \cdot \sin(bb_1)^2) \sin(bb_1)^2 \sin(om t)^3 \\
& + ((-32. - 16 \cdot \sin(bb_1)^2 + (16. \\
& + 16 \cdot \sin(bb_1)^2) \sin(om t)^2) \sin(om t) + 16 \cdot \cos(bb_1)^2 \sin(om t)) \\
& \cos(bb_1)^2 + ((-48. - 16 \cdot \sin(bb_1)^2) \sin(bb_1)^2 \sin(om t) + (16. \\
& + 16 \cdot \sin(bb_1)^2) \sin(om t) \cos(bb_1)^2) \cos(om t)^2) m_b JB^2 bb_F_1 \\
& + (((32. - 32 \cdot \sin(bb_1)^2) \sin(om t)^3 + (-16. \\
& - 16 \cdot \sin(om t)^2) \sin(om t) \cos(bb_1)^2 + ((32. \\
& - 32 \cdot \sin(bb_1)^2) \sin(om t) - 16 \cdot \cos(bb_1)^2 \sin(om t)) \cos(om t)^2) \\
& \cos(om t) aa_F m_b JB^2 + ((-16. - 16 \cdot \sin(bb_1)^2) \sin(om t)^3 \\
& + 16 \cdot \sin(om t)^3 \cos(bb_1)^2 + ((-16. - 16 \cdot \sin(bb_1)^2) \sin(om t) \\
& + 16 \cdot \cos(bb_1)^2 \sin(om t)) \cos(om t)^2) m_b JB^2 bb_F_1 + \\
& - 16 \cdot \sin(om t)^3 - 16 \cdot \sin(om t) \cos(om t)^2) \\
& \cos(om t) aa_F m_b JB^2 \sin(bb_2)^2) \sin(bb_2)^2 + ((((-16 \cdot \sin(bb_1)^2 \\
& + 48. + (-16. - 16 \cdot \sin(bb_1)^2) \sin(om t)^2) \sin(om t) \\
& - 32 \cdot \cos(bb_1)^2 \sin(om t) + (-16. \\
& - 16 \cdot \sin(bb_1)^2) \sin(om t) \cos(om t)^2) \cos(om t) aa_F m_b JB^2 + (((-16. \\
& - 16 \cdot \sin(bb_1)^2) \sin(om t) + 16 \cdot \cos(bb_1)^2 \sin(om t)) m_b JB^2 bb_F_1 \\
& + ((-16. - 16 \cdot \sin(om t)^2) \sin(om t) \\
& - 16 \cdot \sin(om t) \cos(om t)^2) \cos(om t) aa_F m_b JB^2 \sin(bb_2)^2 \\
& - 16 \cdot \cos(om t) m_b \sin(om t) aa_F \cos(bb_2)^2 JB^2) \cos(bb_2)^2 \\
& + ((16 \cdot \sin(om t) \cos(om t)^2 \sin(bb_1)^2 + 16 \cdot \cos(bb_1)^2 \sin(om t) \\
& + 16 \cdot \sin(om t)^3 \sin(bb_1)^2) m_b JB^2 + (((16 \cdot \sin(bb_1)^2
\end{aligned}$$

$$\begin{aligned}
& + 48.) \sin(om t)^3 + 16. \cos(bb_1)^2 \sin(om t) + (16. \sin(bb_1)^2 \\
& + 48.) \sin(om t) \cos(om t)^2 m_b JB^2 + (16. \sin(om t)^3 \\
& + 16. \sin(om t) \cos(om t)^2 m_b JB^2 \sin(bb_2)^2) \sin(bb_2)^2 + ((32. + (\\
& - 16. - 16. \sin(bb_1)^2) \sin(om t)^2) \sin(om t) - 16. \cos(bb_1)^2 \sin(om t) \\
& + (-16. - 16. \sin(bb_1)^2) \sin(om t) \cos(om t)^2) m_b JB^2 + ((\\
& - 16. \sin(om t)^2 + 16.) \sin(om t) - 16. \sin(om t) \cos(om t)^2) \\
& m_b JB^2 \sin(bb_2)^2 - 16. JB^2 \sin(om t) m_b \cos(bb_2)^2) \cos(bb_2)^2) \\
& bb_F_2) om + ((8. \sin(bb_1)^3 \cos(aa) \sin(om t)^2 \\
& + 8. \sin(bb_1) \cos(aa) \cos(bb_1)^2 + (-8. \sin(bb_1) \cos(aa) \cos(bb_1)^2 \\
& - 8. \sin(bb_1)^3 \cos(aa) \sin(om t)^2 + 8. \sin(bb_1)^3 \cos(aa) \\
& - 8. \sin(bb_1)^3 \cos(aa) \cos(om t)^2) \cos(om t)^2) g_m_b^2 JB \\
& + ((8. \cos(aa) \sin(om t)^2 \sin(bb_1)^2 + 8. \cos(aa) \cos(bb_1)^2 + (\\
& - 8. \cos(aa) \cos(bb_1)^2 + 8. \cos(aa) \sin(bb_1)^2 \\
& - 8. \cos(aa) \sin(om t)^2 \sin(bb_1)^2 - 8. \cos(aa) \cos(om t)^2 \sin(bb_1)^2) \\
& \cos(om t)^2) g_m_b^2 JB + ((8. \sin(bb_1) \cos(aa) \sin(om t)^2 \\
& + (8. \sin(bb_1) \cos(aa) - 8. \sin(bb_1) \cos(aa) \sin(om t)^2 \\
& - 8. \sin(bb_1) \cos(om t)^2 \cos(aa)) \cos(om t)^2) g_m_b^2 JB \\
& + (8. \cos(aa) \sin(om t)^2 + (8. \cos(aa) - 8. \cos(aa) \sin(om t)^2 \\
& - 8. \cos(om t)^2 \cos(aa)) \cos(om t)^2) g_m_b^2 JB \sin(bb_2)) \sin(bb_2)) \\
& \sin(bb_2) + ((8. \sin(bb_1) \cos(aa) \\
& - 8. \sin(bb_1) \cos(om t)^2 \cos(aa)) g_m_b^2 JB + (8. \cos(aa) \\
& - 8. \cos(om t)^2 \cos(aa)) g_m_b^2 JB \sin(bb_2)) \cos(bb_2)^2 + ((\\
& - 4. \sin(om t)^4 \sin(bb_1) \cos(bb_1)^2 + (4. \sin(bb_1)^3 \sin(om t)^2 + (\\
& - 8. \sin(om t)^2 \sin(bb_1) + 8. \sin(bb_1)) \cos(bb_1)^2 + (\\
& - 4. \sin(bb_1) \cos(bb_1)^2 + 4. \sin(bb_1)^3) \cos(om t)^2) \cos(om t)^2) \\
& aa_F^2 m_b^2 JB + ((-8. \sin(bb_1) \cos(bb_1)^2 - 8. \sin(bb_1)^3 \sin(om t)^2 \\
& - 8. \sin(bb_1)^3 \cos(om t)^2) \cos(om t) aa_F m_b^2 JB \\
& + (4. \sin(bb_1)^3 \sin(om t)^2 + 4. \sin(om t)^2 \sin(bb_1) \cos(bb_1)^2 \\
& + (4. \sin(bb_1) \cos(bb_1)^2 + 4. \sin(bb_1)^3) \cos(om t)^2) \\
& m_b^2 JB bb_F_1) bb_F_1 + ((4. \cos(bb_1)^2 + 4. \sin(om t)^2 \sin(bb_1)^2 \\
& + 4. \sin(bb_1)^2 \cos(om t)^2) \cos(om t)^2 aa_F^2 m_b^2 JB + ((\\
& - 4. \sin(om t)^4 \sin(bb_1) \cos(bb_1)^2 + (\\
& - 4. \sin(om t)^2 \sin(bb_1) \cos(bb_1)^2 + 4. \sin(om t)^2 \sin(bb_1) \\
& + 4. \sin(bb_1) \cos(om t)^2) \cos(om t)^2) aa_F^2 m_b^2 JB + ((\\
& - 8. \sin(om t)^2 \sin(bb_1) - 8. \sin(bb_1) \cos(om t)^2) \\
& \cos(om t) aa_F m_b^2 JB + (4. \sin(om t)^2 \sin(bb_1)
\end{aligned}$$

$$\begin{aligned}
& + 4 \cdot \sin(bb_1) \cos(om t)^2 m_b^2 JB bb_F_1) bb_F_1 + (4 \cdot \sin(om t)^2 \\
& + 4 \cdot \cos(om t)^2 \cos(om t)^2 aa_F^2 m_b^2 JB \sin(bb_2)) \sin(bb_2) \\
& \sin(bb_2) + ((4 \cdot \sin(bb_1) \cos(om t)^2 \\
& - 4 \cdot \sin(om t)^2 \sin(bb_1) \cos(bb_1)^2) aa_F^2 m_b^2 JB + (\\
& - 8 \cdot m_b^2 \sin(bb_1) aa_F \cos(om t) JB + 4 \cdot m_b^2 \sin(bb_1) JB bb_F_1) \\
& bb_F_1 + ((-4 \cdot -4 \cdot \sin(bb_1)^2) \sin(om t)^4 - 4 \cdot \cos(bb_1)^2 \sin(om t)^2 \\
& + (8 \cdot + (-8 \cdot -4 \cdot \sin(bb_1)^2) \sin(om t)^2 - 4 \cdot \cos(om t)^2) \cos(om t)^2) \\
& aa_F^2 m_b^2 JB \sin(bb_2)) \cos(bb_2)^2 + ((4 \cdot \cos(om t)^2 \cos(bb_1) \\
& + 4 \cdot \cos(bb_1) \sin(om t)^2) kb m_b^2 \sin(bb_2)^2 \\
& + 4 \cdot m_b^2 \cos(bb_1) kb \cos(bb_2)^2) bb_1) l \\
& + (((((8 \cdot \sin(om t)^2 \sin(bb_1)^2 + 8 \cdot \cos(bb_1)^2 \\
& + 8 \cdot \sin(bb_1)^2 \cos(om t)^2) \cos(om t) aa_F m_b^2 JB + (8 \cdot \sin(om t)^2 \\
& + 8 \cdot \cos(om t)^2) \cos(om t) aa_F m_b^2 JB \sin(bb_2)^2) \sin(bb_2) \\
& + 8 \cdot m_b^2 \sin(bb_2) aa_F \cos(om t) \cos(bb_2)^2 JB) l + (((4 \cdot \cos(bb_1)^2 \\
& + 4 \cdot \sin(om t)^2 \sin(bb_1)^2 + 4 \cdot \sin(bb_1)^2 \cos(om t)^2) m_b^2 JB \\
& + (4 \cdot \sin(om t)^2 + 4 \cdot \cos(om t)^2) m_b^2 JB \sin(bb_2)^2) \sin(bb_2) \\
& + (4 \cdot \sin(om t)^2 + 4 \cdot \cos(om t)^2) m_b^2 JB \sin(bb_2) \cos(bb_2)^2) \\
& l bb_F_2) bb_F_2 + (4 \cdot \cos(bb_1)^2 + 4 \cdot \sin(om t)^2 \sin(bb_1)^2 \\
& + 4 \cdot \sin(bb_1)^2 \cos(om t)^2) kb m_b^2 \cos(bb_2) l bb_2 + (((\\
& - 8 \cdot \sin(om t)^3 \sin(bb_1)^2 + (-4 \cdot + 4 \cdot \sin(om t)^2) \sin(om t) \cos(bb_1)^2 \\
& \cos(bb_1) + (-8 \cdot \sin(om t) \sin(bb_1)^2 \\
& + 4 \cdot \cos(bb_1)^2 \sin(om t)) \cos(bb_1) \cos(om t)^2) aa_F m_b^2 JB + ((((-4 \cdot \\
& - 4 \cdot \sin(bb_1)^2) \sin(om t)^3 + 4 \cdot \sin(om t)^3 \cos(bb_1)^2) \cos(bb_1) + ((\\
& - 4 \cdot -4 \cdot \sin(bb_1)^2) \sin(om t) + 4 \cdot \cos(bb_1)^2 \sin(om t)) \\
& \cos(bb_1) \cos(om t)^2) aa_F m_b^2 JB \sin(bb_2)^2 \\
& + ((4 \cdot \sin(om t) \cos(om t)^2 \sin(bb_1)^2 + 4 \cdot \sin(om t)^3 \sin(bb_1)^2 \\
& + 4 \cdot \cos(bb_1)^2 \sin(om t)) aa_F m_b^2 JB + ((8 \cdot \\
& + 4 \cdot \sin(bb_1)^2) \sin(om t)^3 + 4 \cdot \cos(bb_1)^2 \sin(om t) + (8 \cdot \\
& + 4 \cdot \sin(bb_1)^2) \sin(om t) \cos(om t)^2) aa_F m_b^2 JB \sin(bb_2)^2 + (((\\
& - 4 \cdot -4 \cdot \sin(bb_1)^2) \sin(om t) + 4 \cdot \cos(bb_1)^2 \sin(om t)) \\
& \cos(bb_1) aa_F m_b^2 JB + ((4 \cdot + (-4 \cdot \\
& - 4 \cdot \sin(bb_1)^2) \sin(om t)^2) \sin(om t) - 4 \cdot \cos(bb_1)^2 \sin(om t) + (-4 \cdot \\
& - 4 \cdot \sin(bb_1)^2) \sin(om t) \cos(om t)^2) aa_F m_b^2 JB \cos(bb_2)) \\
& \cos(bb_2)) \cos(bb_2)) l + ((4 \cdot \sin(bb_1) \cos(om t)^2 \cos(bb_1)^2 \\
& + 4 \cdot \sin(om t)^2 \sin(bb_1) \cos(bb_1)^2) m_b^2 JB \\
& + (4 \cdot \sin(bb_1) \cos(om t)^2 \cos(bb_1)^2)
\end{aligned}$$

$$\begin{aligned}
& + 4 \cdot \sin(\omega m t)^2 \sin(bb_1) \cos(bb_1)^2) m_b^2 JB \sin(bb_2)^2 \\
& + (4 \cdot m_b^2 JB \cos(bb_1)^2 \sin(bb_1) + ((4 + 4 \cdot \sin(bb_1)^2) \sin(\omega m t)^2 \\
& + 4 \cdot \cos(bb_1)^2 + (4 + 4 \cdot \sin(bb_1)^2) \cos(\omega m t)^2) m_b^2 JB \sin(bb_2)) \\
& \cos(bb_2)^2) l \omega m + (((4 \cdot \sin(\omega m t)^6 \sin(bb_1)^3 \\
& + 4 \cdot \sin(\omega m t)^4 \sin(bb_1) \cos(bb_1)^2) \cos(bb_1) + (((-4 \cdot \sin(bb_1)^3 \\
& + 12 \cdot \sin(bb_1)^3 \sin(\omega m t)^2) \sin(\omega m t)^2 + (-4 \cdot \sin(bb_1) \\
& + 8 \cdot \sin(\omega m t)^2 \sin(bb_1)) \cos(bb_1)^2) \cos(bb_1) + ((-4 \cdot \sin(bb_1)^3 \\
& + 12 \cdot \sin(bb_1)^3 \sin(\omega m t)^2 + 4 \cdot \sin(bb_1) \cos(bb_1)^2) \cos(bb_1) \\
& + 4 \cdot \sin(bb_1)^3 \cos(bb_1) \cos(\omega m t)^2) \cos(\omega m t)^2) \cos(\omega m t)^2) \\
& \cos(\omega m t) aa_F^2 m_b^2 JB + (((-8 \cdot \sin(\omega m t)^6 \sin(bb_1)^3 \\
& - 8 \cdot \sin(\omega m t)^4 \sin(bb_1) \cos(bb_1)^2) \cos(bb_1) + (((8 \cdot \sin(bb_1)^3 \\
& - 24 \cdot \sin(bb_1)^3 \sin(\omega m t)^2) \sin(\omega m t)^2 + (-16 \cdot \sin(\omega m t)^2 \sin(bb_1) \\
& + 8 \cdot \sin(bb_1)) \cos(bb_1)^2) \cos(bb_1) + ((8 \cdot \sin(bb_1)^3 \\
& - 24 \cdot \sin(bb_1)^3 \sin(\omega m t)^2 - 8 \cdot \sin(bb_1) \cos(bb_1)^2) \cos(bb_1) \\
& - 8 \cdot \sin(bb_1)^3 \cos(bb_1) \cos(\omega m t)^2) \cos(\omega m t)^2) \cos(\omega m t)^2) \\
& aa_F m_b^2 JB + (((-4 \cdot \sin(bb_1)^3 + 4 \cdot \sin(bb_1)^3 \sin(\omega m t)^2) \sin(\omega m t)^2 \\
& + (4 \cdot \sin(\omega m t)^2 \sin(bb_1) - 4 \cdot \sin(bb_1)) \cos(bb_1)^2) \cos(bb_1) \\
& + ((8 \cdot \sin(bb_1)^3 \sin(\omega m t)^2 - 4 \cdot \sin(bb_1)^3 \\
& + 4 \cdot \sin(bb_1) \cos(bb_1)^2) \cos(bb_1) \\
& + 4 \cdot \sin(bb_1)^3 \cos(bb_1) \cos(\omega m t)^2) \cos(\omega m t)^2) \\
& \cos(\omega m t) m_b^2 JB bb_F_1) bb_F_1 + ((-4 \cdot aa \sin(\omega m t)^4 \sin(bb_1)^2 \\
& - 4 \cdot aa \sin(\omega m t)^2 \cos(bb_1)^2 + (-8 \cdot aa \sin(\omega m t)^2 \sin(bb_1)^2 \\
& - 4 \cdot aa \cos(bb_1)^2 - 4 \cdot aa \cos(\omega m t)^2 \sin(bb_1)^2) \cos(\omega m t)^2) ka m_b^2 \\
& + (((4 + 4 \cdot \sin(bb_1)^2) \sin(bb_1) \sin(\omega m t)^6 \\
& + 4 \cdot \sin(\omega m t)^4 \sin(bb_1) \cos(bb_1)^2) \cos(bb_1) + (((-4 \cdot \sin(bb_1) \\
& + (12 + 8 \cdot \sin(bb_1)^2) \sin(bb_1) \sin(\omega m t)^2) \sin(\omega m t)^2 \\
& + 4 \cdot \sin(\omega m t)^2 \sin(bb_1) \cos(bb_1)^2) \cos(bb_1) + ((-4 \cdot \sin(bb_1) \\
& + (12 + 4 \cdot \sin(bb_1)^2) \sin(bb_1) \sin(\omega m t)^2) \cos(bb_1) \\
& + 4 \cdot \sin(bb_1) \cos(bb_1) \cos(\omega m t)^2) \cos(\omega m t)^2) \cos(\omega m t)^2) \\
& \cos(\omega m t) aa_F^2 m_b^2 JB + ((((-8 \cdot \\
& - 8 \cdot \sin(bb_1)^2) \sin(bb_1) \sin(\omega m t)^6 \\
& - 8 \cdot \sin(\omega m t)^4 \sin(bb_1) \cos(bb_1)^2) \cos(bb_1) + (((8 \cdot \sin(bb_1) + (\\
& - 24 \cdot -16 \cdot \sin(bb_1)^2) \sin(bb_1) \sin(\omega m t)^2) \sin(\omega m t)^2 \\
& - 8 \cdot \sin(\omega m t)^2 \sin(bb_1) \cos(bb_1)^2) \cos(bb_1) + ((8 \cdot \sin(bb_1) + (\\
& - 24 \cdot -8 \cdot \sin(bb_1)^2) \sin(bb_1) \sin(\omega m t)^2) \cos(bb_1) \\
& - 8 \cdot \sin(bb_1) \cos(bb_1) \cos(\omega m t)^2) \cos(\omega m t)^2) \cos(\omega m t)^2)
\end{aligned}$$

$$\begin{aligned}
& aa_F m_b^2 JB + ((4. \sin(om t)^2 \sin(bb_1) \\
& - 4. \sin(bb_1)) \sin(om t)^2 \cos(bb_1) + ((-4. \sin(bb_1) \\
& + 8. \sin(om t)^2 \sin(bb_1)) \cos(bb_1) \\
& + 4. \sin(bb_1) \cos(bb_1) \cos(om t)^2) \cos(om t)^2) \\
& \cos(om t) m_b^2 JB bb_F_1) bb_F_1) \sin(bb_2)^2 + (((\\
& -4. \sin(om t)^6 \sin(bb_1)^2 - 4. \sin(om t)^4 \cos(bb_1)^2 + ((4. \sin(bb_1)^2 \\
& - 12. \sin(om t)^2 \sin(bb_1)^2) \sin(om t)^2 + (4. - 8. \sin(om t)^2) \cos(bb_1)^2 \\
& + (-12. \sin(om t)^2 \sin(bb_1)^2 - 4. \cos(bb_1)^2 + 4. \sin(bb_1)^2 \\
& - 4. \sin(bb_1)^2 \cos(om t)^2) \cos(om t)^2) \cos(om t)^2) \\
& \cos(om t) aa_F^2 m_b^2 JB + ((-4. - 4. \sin(bb_1)^2) \sin(om t)^6 \\
& - 4. \sin(om t)^4 \cos(bb_1)^2 + ((4. + (-12. \\
& - 8. \sin(bb_1)^2) \sin(om t)^2) \sin(om t)^2 - 4. \cos(bb_1)^2 \sin(om t)^2 + (4. \\
& + (-4. \sin(bb_1)^2 - 12.) \sin(om t)^2 - 4. \cos(om t)^2) \cos(om t)^2) \\
& \cos(om t)^2) \cos(om t) aa_F^2 m_b^2 JB \sin(bb_2)^2) \sin(bb_2) + ((\\
& -4. aa \sin(om t)^2 \sin(bb_1)^2 - 4. aa \cos(om t)^2 \sin(bb_1)^2 \\
& - 4. aa \cos(bb_1)^2) ka m_b^2 + (((4. \\
& + 4. \sin(bb_1)^2) \sin(bb_1) \sin(om t)^4 \\
& + 4. \sin(om t)^2 \sin(bb_1) \cos(bb_1)^2) \cos(bb_1) + ((-4. \sin(bb_1) \\
& + (8. + 4. \sin(bb_1)^2) \sin(bb_1) \sin(om t)^2) \cos(bb_1) \\
& + 4. \sin(bb_1) \cos(bb_1) \cos(om t)^2) \cos(om t) aa_F^2 m_b^2 JB \\
& + ((((-8. - 8. \sin(bb_1)^2) \sin(bb_1) \sin(om t)^4 \\
& - 8. \sin(om t)^2 \sin(bb_1) \cos(bb_1)^2) \cos(bb_1) + ((8. \sin(bb_1) + (\\
& -16. - 8. \sin(bb_1)^2) \sin(bb_1) \sin(om t)^2) \cos(bb_1) \\
& - 8. \sin(bb_1) \cos(bb_1) \cos(om t)^2) \cos(om t)^2) aa_F m_b^2 JB \\
& + ((4. \sin(om t)^2 \sin(bb_1) - 4. \sin(bb_1)) \cos(bb_1) \\
& + 4. \sin(bb_1) \cos(bb_1) \cos(om t)^2) \cos(om t) m_b^2 JB bb_F_1) bb_F_1) \\
& + ((-4. - 4. \sin(bb_1)^2) \sin(om t)^4 - 4. \cos(bb_1)^2 \sin(om t)^2 + (4. + (\\
& -8. - 4. \sin(bb_1)^2) \sin(om t)^2 - 4. \cos(om t)^2) \cos(om t)^2) \\
& \cos(om t) aa_F^2 m_b^2 JB \sin(bb_2) \cos(bb_2) \cos(bb_2) \cos(bb_2) \\
& + ((-4. \sin(om t)^4 \sin(bb_1)^2 - 4. \cos(bb_1)^2 \sin(om t)^2 + (\\
& -4. \cos(bb_1)^2 - 8. \sin(om t)^2 \sin(bb_1)^2 - 4. \sin(bb_1)^2 \cos(om t)^2) \\
& \cos(om t)^2) \cos(om t) kb m_b^2 \sin(bb_2)^2 + (-4. \cos(bb_1)^2 \\
& - 4. \sin(om t)^2 \sin(bb_1)^2 - 4. \sin(bb_1)^2 \cos(om t)^2) \\
& \cos(om t) kb m_b^2 \cos(bb_2)^2) bb_1 + (((\sin(aa) \sin(om t)^2 \cos(bb_1)^2 \\
& + \sin(aa) \sin(om t)^4 \sin(bb_1)^2 + (2. \sin(aa) \sin(om t)^2 \sin(bb_1)^2 \\
& + \sin(aa) \cos(bb_1)^2 + \sin(aa) \cos(om t)^2 \sin(bb_1)^2) \cos(om t)^2)
\end{aligned}$$

$$\begin{aligned}
& g_m_t + (2 \cdot \sin(aa) \sin(om t)^2 \cos(bb_1)^2 \\
& + 4 \cdot \sin(aa) \sin(om t)^4 \sin(bb_1)^2 \\
& + (2 \cdot \cos(bb_1) \sin(bb_1) \cos(aa) \sin(om t)^2 + (2 \cdot \sin(aa) \cos(bb_1)^2 \\
& + 8 \cdot \sin(aa) \sin(om t)^2 \sin(bb_1)^2 + (2 \cdot \cos(bb_1) \sin(bb_1) \cos(aa) \\
& + 4 \cdot \sin(aa) \sin(bb_1)^2 \cos(om t)) \cos(om t) \cos(om t) \cos(om t)) \\
& g_m_b) m_b^2 \sin(bb_2)^2 + ((-2 \cdot \cos(aa) \cos(bb_1)^2 \\
& - 2 \cdot \cos(aa) \sin(om t)^2 \sin(bb_1)^2 - 2 \cdot \cos(aa) \cos(om t)^2 \sin(bb_1)^2) \\
& \cos(om t) g_m_b^3 \sin(bb_2) + ((\sin(aa) \cos(bb_1)^2 \\
& + \sin(aa) \cos(om t)^2 \sin(bb_1)^2 + \sin(aa) \sin(om t)^2 \sin(bb_1)^2) g_m_t \\
& + (2 \cdot \sin(aa) \sin(om t)^2 \sin(bb_1)^2 + (2 \cdot \cos(bb_1) \sin(bb_1) \cos(aa) \\
& + 2 \cdot \sin(aa) \sin(bb_1)^2 \cos(om t)) \cos(om t) g_m_b) m_b^2 \cos(bb_2)) \\
& \cos(bb_2) + ((-1 \cdot \sin(om t)^2 \sin(bb_1) \cos(bb_1) \\
& - 1 \cdot \sin(bb_1) \cos(bb_1) \cos(om t)^2) \cos(om t) aa_F^2 m_b^3 \sin(bb_2)^2 \\
& + ((\sin(om t)^2 \sin(bb_1)^2 + \cos(bb_1)^2 \\
& + \sin(bb_1)^2 \cos(om t)^2) \cos(om t) aa_F^2 m_b^3 \sin(bb_2) \\
& - 1 \cdot m_b^3 \cos(bb_1) \sin(bb_1) aa_F^2 \cos(om t) \cos(bb_2)) \cos(bb_2)) l) \\
& l + ((((-8 \cdot \sin(om t)^4 \cos(bb_1)^2 - 8 \cdot \sin(om t)^6 \sin(bb_1)^2 \\
& + ((8 \cdot \sin(bb_1)^2 - 24 \cdot \sin(om t)^2 \sin(bb_1)^2) \sin(om t)^2 + \\
& - 16 \cdot \sin(om t)^2 + 8) \cos(bb_1)^2 + (-8 \cdot \cos(bb_1)^2 + 8 \cdot \sin(bb_1)^2 \\
& - 24 \cdot \sin(om t)^2 \sin(bb_1)^2 - 8 \cdot \sin(bb_1)^2 \cos(om t)^2) \cos(om t)^2) \\
& \cos(om t)^2) aa_F m_b^2 JB + ((-8 \cdot -8 \cdot \sin(bb_1)^2) \sin(om t)^6 \\
& - 8 \cdot \sin(om t)^4 \cos(bb_1)^2 + ((8 \cdot + (-24 \cdot \\
& - 16 \cdot \sin(bb_1)^2) \sin(om t)^2) \sin(om t)^2 - 8 \cdot \cos(bb_1)^2 \sin(om t)^2 + (8 \cdot \\
& + (-24 \cdot -8 \cdot \sin(bb_1)^2) \sin(om t)^2 - 8 \cdot \cos(om t)^2) \cos(om t)^2) \\
& \cos(om t)^2) aa_F m_b^2 JB \sin(bb_2)^2) \sin(bb_2) + ((-8 \cdot \\
& - 8 \cdot \sin(bb_1)^2) \sin(om t)^4 - 8 \cdot \cos(bb_1)^2 \sin(om t)^2 + (8 \cdot + (-16 \cdot \\
& - 8 \cdot \sin(bb_1)^2) \sin(om t)^2 - 8 \cdot \cos(om t)^2) \cos(om t)^2) \\
& aa_F m_b^2 JB \sin(bb_2) \cos(bb_2)^2) \cos(bb_2) + (((((4 \cdot \sin(bb_1)^2 \\
& - 4 \cdot \sin(om t)^2 \sin(bb_1)^2) \sin(om t)^2 + (-4 \cdot \sin(om t)^2 + 4) \cos(bb_1)^2 \\
& + (-4 \cdot \cos(bb_1)^2 + 4 \cdot \sin(bb_1)^2 - 8 \cdot \sin(om t)^2 \sin(bb_1)^2 \\
& - 4 \cdot \sin(bb_1)^2 \cos(om t)^2) \cos(om t)^2) \cos(om t) m_b^2 JB + ((\\
& - 4 \cdot \sin(om t)^2 + 4) \sin(om t)^2 + (4 \cdot -8 \cdot \sin(om t)^2 \\
& - 4 \cdot \cos(om t)^2) \cos(om t)^2) \cos(om t) m_b^2 JB \sin(bb_2)^2) \sin(bb_2) \\
& + (-4 \cdot \sin(om t)^2 + 4) \\
& - 4 \cdot \cos(om t)^2) \cos(om t) m_b^2 JB \sin(bb_2) \cos(bb_2)^2) \\
& \cos(bb_2) bb_F_2) bb_F_2 + ((4 \cdot \sin(om t)^4 \sin(bb_1)^2
\end{aligned}$$

$$\begin{aligned}
& + 4 \cdot \cos(bb_1)^2 \sin(om t)^2 + (4 \cdot \cos(bb_1)^2 + 8 \cdot \sin(om t)^2 \sin(bb_1)^2 \\
& + 4 \cdot \sin(bb_1)^2 \cos(om t)^2) \cos(om t) kb m_b^2 \sin(bb_2)^2 \\
& + (4 \cdot \cos(bb_1)^2 + 4 \cdot \sin(om t)^2 \sin(bb_1)^2 \\
& + 4 \cdot \sin(bb_1)^2 \cos(om t)^2) \cos(om t) kb m_b^2 \cos(bb_2)^2) bb_2 \\
& + (((((4 \cdot \sin(bb_1)^2 - 4 \cdot \sin(om t)^2 \sin(bb_1)^2) \sin(om t)^3 + \\
& - 4 \cdot \sin(om t)^2 + 4.) \sin(om t) \cos(bb_1)^2) \cos(bb_1)^2 + (((4 \cdot \sin(bb_1)^2 \\
& - 8 \cdot \sin(om t)^2 \sin(bb_1)^2) \sin(om t) - 4 \cdot \cos(bb_1)^2 \sin(om t)) \\
& \cos(bb_1)^2 - 4 \cdot \sin(om t) \cos(bb_1)^2 \cos(om t)^2 \sin(bb_1)^2) \cos(om t)^2) \\
& \cos(om t) aa_F m_b^2 JB + (-8 \cdot \sin(om t)^5 \sin(bb_1)^4 + ((\\
& - 12 \cdot \sin(bb_1)^2 + 4 \cdot \sin(om t)^2 \sin(bb_1)^2) \sin(om t)^3 + (-4 \cdot \\
& + 4 \cdot \sin(om t)^2) \sin(om t) \cos(bb_1)^2) \cos(bb_1)^2 + (\\
& - 16 \cdot \sin(om t)^3 \sin(bb_1)^4 + ((-12 \cdot \sin(bb_1)^2 \\
& + 8 \cdot \sin(om t)^2 \sin(bb_1)^2) \sin(om t) + 4 \cdot \cos(bb_1)^2 \sin(om t)) \\
& \cos(bb_1)^2 + (4 \cdot \sin(om t) \sin(bb_1)^2 \cos(bb_1)^2 \\
& - 8 \cdot \sin(om t) \sin(bb_1)^4) \cos(om t)^2) \cos(om t)^2) m_b^2 JB bb_F_1 \\
& + (((8 \cdot - 4 \cdot \sin(bb_1)^2) \sin(bb_1)^2 \sin(om t)^5 + ((12 \cdot - 4 \cdot \sin(bb_1)^2 \\
& + (-4 \cdot - 4 \cdot \sin(bb_1)^2) \sin(om t)^2) \sin(om t)^3 \\
& - 4 \cdot \sin(om t)^3 \cos(bb_1)^2) \cos(bb_1)^2 + ((16 \cdot \\
& - 8 \cdot \sin(bb_1)^2) \sin(bb_1)^2 \sin(om t)^3 + ((12 \cdot - 4 \cdot \sin(bb_1)^2 + (-8 \cdot \\
& - 8 \cdot \sin(bb_1)^2) \sin(om t)^2) \sin(om t) - 4 \cdot \cos(bb_1)^2 \sin(om t)) \\
& \cos(bb_1)^2 + ((8 \cdot - 4 \cdot \sin(bb_1)^2) \sin(bb_1)^2 \sin(om t) + (-4 \cdot \\
& - 4 \cdot \sin(bb_1)^2) \sin(om t) \cos(bb_1)^2) \cos(om t)^2) \cos(om t)^2) \\
& \cos(om t) aa_F m_b^2 JB + ((-4 \cdot \sin(bb_1)^2 - 12.) \sin(bb_1)^2 \sin(om t)^5 \\
& + ((-8 \cdot - 4 \cdot \sin(bb_1)^2 + (4 \cdot + 4 \cdot \sin(bb_1)^2) \sin(om t)^2) \sin(om t)^3 \\
& + 4 \cdot \sin(om t)^3 \cos(bb_1)^2) \cos(bb_1)^2 + ((-24 \cdot \\
& - 8 \cdot \sin(bb_1)^2) \sin(bb_1)^2 \sin(om t)^3 + ((-8 \cdot - 4 \cdot \sin(bb_1)^2 + (8 \cdot \\
& + 8 \cdot \sin(bb_1)^2) \sin(om t)^2) \sin(om t) + 4 \cdot \cos(bb_1)^2 \sin(om t)) \\
& \cos(bb_1)^2 + ((-4 \cdot \sin(bb_1)^2 - 12.) \sin(bb_1)^2 \sin(om t) + (4 \cdot \\
& + 4 \cdot \sin(bb_1)^2) \sin(om t) \cos(bb_1)^2) \cos(om t)^2) \cos(om t)^2) \\
& m_b^2 JB bb_F_1 + (-4 \cdot \sin(om t)^5 \sin(bb_1)^2 - 4 \cdot \sin(om t)^3 \cos(bb_1)^2 \\
& + (-4 \cdot \cos(bb_1)^2 \sin(om t) - 8 \cdot \sin(om t)^3 \sin(bb_1)^2 \\
& - 4 \cdot \sin(om t) \cos(om t)^2 \sin(bb_1)^2) \cos(om t)^2) \\
& \cos(om t) aa_F m_b^2 JB \sin(bb_2)^2) \sin(bb_2)^2 + (((((12 \cdot \\
& - 4 \cdot \sin(bb_1)^2) \sin(bb_1)^2 - 4 \cdot \sin(om t)^2 \sin(bb_1)^2) \sin(om t)^3 \\
& + ((16 \cdot - 4 \cdot \sin(bb_1)^2 + (-8 \cdot - 4 \cdot \sin(bb_1)^2) \sin(om t)^2) \sin(om t) \\
& - 4 \cdot \cos(bb_1)^2 \sin(om t)) \cos(bb_1)^2 + (((12 \cdot
\end{aligned}$$

$$\begin{aligned}
& -4 \cdot \sin(bb_1)^2 \sin(bb_1)^2 - 8 \cdot \sin(om\ t)^2 \sin(bb_1)^2 \sin(om\ t) + (-8. \\
& -4 \cdot \sin(bb_1)^2 \sin(om\ t) \cos(bb_1)^2 \\
& -4 \cdot \sin(om\ t) \cos(om\ t)^2 \sin(bb_1)^2 \cos(om\ t)^2 \cos(om\ t) aa_F m_b^2 JB \\
& + ((-4 \cdot \sin(bb_1)^2 - 12.) \sin(bb_1)^2 \sin(om\ t)^3 + ((-8. - 4 \cdot \sin(bb_1)^2 \\
& + (4. + 4 \cdot \sin(bb_1)^2) \sin(om\ t)^2) \sin(om\ t) + 4 \cdot \cos(bb_1)^2 \sin(om\ t)) \\
& \cos(bb_1)^2 + ((-4 \cdot \sin(bb_1)^2 - 12.) \sin(bb_1)^2 \sin(om\ t) + (4. \\
& + 4 \cdot \sin(bb_1)^2) \sin(om\ t) \cos(bb_1)^2) \cos(om\ t)^2) m_b^2 JB bb_F_I \\
& + ((4. - 4 \cdot \sin(bb_1)^2 + (-4. - 4 \cdot \sin(bb_1)^2) \sin(om\ t)^2) \sin(om\ t)^3 \\
& + (-4. - 4 \cdot \sin(om\ t)^2) \sin(om\ t) \cos(bb_1)^2 + ((4. - 4 \cdot \sin(bb_1)^2 + \\
& - 8. - 8 \cdot \sin(bb_1)^2) \sin(om\ t)^2) \sin(om\ t) - 4 \cdot \cos(bb_1)^2 \sin(om\ t) + \\
& - 4 \cdot \sin(bb_1)^2) \sin(om\ t) \cos(om\ t)^2) \cos(om\ t)^2) \\
& \cos(om\ t) aa_F m_b^2 JB \sin(bb_2)^2 + ((4. + (-4. \\
& - 4 \cdot \sin(bb_1)^2) \sin(om\ t)^2) \sin(om\ t) - 4 \cdot \cos(bb_1)^2 \sin(om\ t) + (-4. \\
& - 4 \cdot \sin(bb_1)^2) \sin(om\ t) \cos(om\ t)^2) \\
& \cos(om\ t) aa_F m_b^2 JB \cos(bb_2)^2 \cos(bb_2)^2 \\
& + (((12. \sin(om\ t)^5 \sin(bb_1)^2 + 12. \sin(om\ t)^3 \cos(bb_1)^2 \\
& + (24. \sin(om\ t)^3 \sin(bb_1)^2 + 12. \cos(bb_1)^2 \sin(om\ t) \\
& + 12. \sin(om\ t) \cos(om\ t)^2 \sin(bb_1)^2) \cos(om\ t)^2) m_b^2 JB + ((8. \\
& + 4 \cdot \sin(bb_1)^2) \sin(om\ t)^5 + 4 \cdot \sin(om\ t)^3 \cos(bb_1)^2 + ((8. \sin(bb_1)^2 \\
& + 16.) \sin(om\ t)^3 + 4 \cdot \cos(bb_1)^2 \sin(om\ t) + (8. \\
& + 4 \cdot \sin(bb_1)^2) \sin(om\ t) \cos(om\ t)^2) \cos(om\ t)^2) m_b^2 JB \sin(bb_2)^2) \\
& \sin(bb_2)^2 + (((8. \sin(bb_1)^2 - 4 \cdot \sin(om\ t)^2 \sin(bb_1)^2) \sin(om\ t)^3 \\
& + (8. - 4 \cdot \sin(om\ t)^2) \sin(om\ t) \cos(bb_1)^2 + ((8. \sin(bb_1)^2 \\
& - 8 \cdot \sin(om\ t)^2 \sin(bb_1)^2) \sin(om\ t) - 4 \cdot \cos(bb_1)^2 \sin(om\ t) \\
& - 4 \cdot \sin(om\ t) \cos(om\ t)^2 \sin(bb_1)^2) \cos(om\ t)^2) m_b^2 JB + ((12. \\
& + 4 \cdot \sin(bb_1)^2 + (-4. - 4 \cdot \sin(bb_1)^2) \sin(om\ t)^2) \sin(om\ t)^3 + \\
& - 4 \cdot \sin(om\ t)^2 + 4.) \sin(om\ t) \cos(bb_1)^2 + ((12. + 4 \cdot \sin(bb_1)^2 + (-8. \\
& - 8 \cdot \sin(bb_1)^2) \sin(om\ t)^2) \sin(om\ t) - 4 \cdot \cos(bb_1)^2 \sin(om\ t) + (-4. \\
& - 4 \cdot \sin(bb_1)^2) \sin(om\ t) \cos(om\ t)^2) \cos(om\ t)^2) m_b^2 JB \sin(bb_2)^2 \\
& + ((4. + (-4. - 4 \cdot \sin(bb_1)^2) \sin(om\ t)^2) \sin(om\ t) \\
& - 4 \cdot \cos(bb_1)^2 \sin(om\ t) + (-4. - 4 \cdot \sin(bb_1)^2) \sin(om\ t) \cos(om\ t)^2) \\
& m_b^2 JB \cos(bb_2)^2 \cos(bb_2)^2 bb_F_2) om \\
& + (((2. \sin(bb_1) \cos(aa) \sin(om\ t)^2 \cos(bb_1)^2 \\
& + 2 \cdot \sin(bb_1)^3 \cos(aa) \sin(om\ t)^4 + ((4. \sin(bb_1)^3 \cos(aa) \\
& - 2 \cdot \sin(bb_1)^3 \cos(aa) \sin(om\ t)^2) \sin(om\ t)^2 + (2. \sin(bb_1) \cos(aa) \\
& - 2 \cdot \sin(bb_1) \cos(aa) \sin(om\ t)^2) \cos(bb_1)^2 + (
\end{aligned}$$

$$\begin{aligned}
& -2 \cdot \sin(bb_1) \cos(aa) \cos(bb_1)^2 - 4 \cdot \sin(bb_1)^3 \cos(aa) \sin(om t)^2 \\
& + 2 \cdot \sin(bb_1)^3 \cos(aa) - 2 \cdot \sin(bb_1)^3 \cos(aa) \cos(om t)^2 \cos(om t)^2 \\
& \cos(om t)^2 g_m_b^3 + (2 \cdot \cos(aa) \sin(om t)^2 \cos(bb_1)^2 \\
& + 2 \cdot \cos(aa) \sin(om t)^4 \sin(bb_1)^2 + ((4 \cdot \cos(aa) \sin(bb_1)^2 \\
& - 2 \cdot \cos(aa) \sin(om t)^2 \sin(bb_1)^2) \sin(om t)^2 + (2 \cdot \cos(aa) \\
& - 2 \cdot \cos(aa) \sin(om t)^2) \cos(bb_1)^2 + (2 \cdot \cos(aa) \sin(bb_1)^2 \\
& - 4 \cdot \cos(aa) \sin(om t)^2 \sin(bb_1)^2 - 2 \cdot \cos(aa) \cos(bb_1)^2 \\
& - 2 \cdot \cos(aa) \cos(om t)^2 \sin(bb_1)^2) \cos(om t)^2) \cos(om t)^2) \\
& g_m_b^3 \sin(bb_2)) \sin(bb_2)^2 + ((2 \cdot \sin(bb_1) \cos(aa) \cos(bb_1)^2 \\
& + 2 \cdot \sin(bb_1)^3 \cos(aa) \sin(om t)^2 + (-2 \cdot \sin(bb_1)^3 \cos(aa) \sin(om t)^2 \\
& + 2 \cdot \sin(bb_1)^3 \cos(aa) - 2 \cdot \sin(bb_1) \cos(aa) \cos(bb_1)^2 \\
& - 2 \cdot \sin(bb_1)^3 \cos(aa) \cos(om t)^2) \cos(om t)^2) g_m_b^3 \\
& + (2 \cdot \cos(aa) \cos(bb_1)^2 + 2 \cdot \cos(aa) \sin(om t)^2 \sin(bb_1)^2 + \\
& - 2 \cdot \cos(aa) \cos(bb_1)^2 - 2 \cdot \cos(aa) \sin(om t)^2 \sin(bb_1)^2 \\
& + 2 \cdot \cos(aa) \sin(bb_1)^2 - 2 \cdot \cos(aa) \cos(om t)^2 \sin(bb_1)^2) \cos(om t)^2) \\
& g_m_b^3 \sin(bb_2)) \cos(bb_2)^2 + ((((-1 \cdot \sin(om t)^6 \sin(bb_1) \cos(bb_1)^2 \\
& + (\sin(om t)^4 \sin(bb_1)^3 + (2 \cdot \sin(bb_1) \\
& - 3 \cdot \sin(om t)^2 \sin(bb_1)) \sin(om t)^2 \cos(bb_1)^2 \\
& + (2 \cdot \sin(bb_1)^3 \sin(om t)^2 + (2 \cdot \sin(bb_1) \\
& - 3 \cdot \sin(om t)^2 \sin(bb_1)) \cos(bb_1)^2 + (\sin(bb_1)^3 \\
& - 1 \cdot \sin(bb_1) \cos(bb_1)^2) \cos(om t)^2) \cos(om t)^2) \cos(om t)^2) \\
& aa_F^2 m_b^3 + ((-2 \cdot \sin(om t)^2 \sin(bb_1) \cos(bb_1)^2 \\
& - 2 \cdot \sin(om t)^4 \sin(bb_1)^3 + (-4 \cdot \sin(bb_1)^3 \sin(om t)^2 \\
& - 2 \cdot \sin(bb_1) \cos(bb_1)^2 - 2 \cdot \sin(bb_1)^3 \cos(om t)^2) \cos(om t)^2) \\
& \cos(om t) aa_F m_b^3 + (\sin(om t)^4 \sin(bb_1) \cos(bb_1)^2 \\
& + \sin(om t)^4 \sin(bb_1)^3 + (2 \cdot \sin(om t)^2 \sin(bb_1) \cos(bb_1)^2 \\
& + 2 \cdot \sin(bb_1)^3 \sin(om t)^2 + (\sin(bb_1)^3 \\
& + \sin(bb_1) \cos(bb_1)^2) \cos(om t)^2) \cos(om t)^2) m_b^3 bb_F_1) bb_F_1 \\
& + (\cos(bb_1)^2 \sin(om t)^2 + \sin(om t)^4 \sin(bb_1)^2 + (\cos(bb_1)^2 \\
& + 2 \cdot \sin(om t)^2 \sin(bb_1)^2 + \sin(bb_1)^2 \cos(om t)^2) \cos(om t)^2) \\
& \cos(om t)^2 aa_F^2 m_b^3 \sin(bb_2)) \sin(bb_2)^2 + ((\\
& - 1 \cdot \sin(om t)^4 \sin(bb_1) \cos(bb_1)^2 + (\sin(bb_1)^3 \sin(om t)^2 + \\
& - 2 \cdot \sin(om t)^2 \sin(bb_1) + 2 \cdot \sin(bb_1)) \cos(bb_1)^2 + (\sin(bb_1)^3 \\
& - 1 \cdot \sin(bb_1) \cos(bb_1)^2) \cos(om t)^2) \cos(om t)^2) aa_F^2 m_b^3 + ((\\
& - 2 \cdot \sin(bb_1)^3 \sin(om t)^2 - 2 \cdot \sin(bb_1) \cos(bb_1)^2 \\
& - 2 \cdot \sin(bb_1)^3 \cos(om t)^2) \cos(om t) aa_F m_b^3 + (\sin(bb_1)^3 \sin(om t)^2
\end{aligned}$$

$$\begin{aligned}
& + \sin(\text{om t})^2 \sin(bb_1) \cos(bb_1)^2 + (\sin(bb_1)^3 \\
& + \sin(bb_1) \cos(bb_1)^2) \cos(\text{om t})^2 m_b^3 bb_F_1) bb_F_1 + (\\
& - 1. \sin(\text{om t})^4 \cos(bb_1)^2 - 1. \sin(\text{om t})^6 \sin(bb_1)^2 + ((2. \sin(bb_1)^2 \\
& - 3. \sin(\text{om t})^2 \sin(bb_1)^2) \sin(\text{om t})^2 + (2. - 2. \sin(\text{om t})^2) \cos(bb_1)^2 \\
& + (-3. \sin(\text{om t})^2 \sin(bb_1)^2 + 2. \sin(bb_1)^2 - 1. \cos(bb_1)^2 \\
& - 1. \sin(bb_1)^2 \cos(\text{om t})^2) \cos(\text{om t})^2) \\
& aa_F^2 m_b^3 \sin(bb_2)) \cos(bb_2)^2) l + (((2. \cos(bb_1)^2 \sin(\text{om t})^2 \\
& + 2. \sin(\text{om t})^4 \sin(bb_1)^2 + (4. \sin(\text{om t})^2 \sin(bb_1)^2 + 2. \cos(bb_1)^2 \\
& + 2. \sin(bb_1)^2 \cos(\text{om t})^2) \cos(\text{om t})^2) \cos(bb_1)^2 \\
& + 2. \sin(\text{om t})^2 \sin(bb_1)^2 + 2. \sin(\text{om t})^2 \sin(bb_1)^2 \\
& + 2. \sin(bb_1)^2 \cos(\text{om t})^2) \cos(\text{om t})^2) \cos(bb_1)^2 \\
& aa_F m_b^3 \sin(bb_2)^3 + (2. \cos(bb_1)^2 \sin(\text{om t})^2 + \sin(\text{om t})^4 \sin(bb_1)^2 \\
& + (\cos(bb_1)^2 + 2. \sin(\text{om t})^2 \sin(bb_1)^2 \\
& + \sin(bb_1)^2 \cos(\text{om t})^2) \cos(\text{om t})^2) m_b^3 \sin(bb_2) \cos(bb_2)^2) \\
& l bb_F_2) bb_F_2 + ((((-2. \sin(\text{om t})^5 \sin(bb_1)^2 + (-1. \\
& + \sin(\text{om t})^2) \sin(\text{om t})^3 \cos(bb_1)^2) \cos(bb_1) + ((\\
& - 4. \sin(\text{om t})^3 \sin(bb_1)^2 + (-1. + 2. \sin(\text{om t})^2) \sin(\text{om t}) \cos(bb_1)^2) \\
& \cos(bb_1) + (-2. \sin(\text{om t}) \sin(bb_1)^2 \\
& + \cos(bb_1)^2 \sin(\text{om t})) \cos(bb_1) \cos(\text{om t})^2) \cos(\text{om t})^2) \\
& aa_F m_b^3 \sin(bb_2)^2 + ((2. \sin(\text{om t})^5 \sin(bb_1)^2 \\
& + 2. \sin(\text{om t})^3 \cos(bb_1)^2 + (4. \sin(\text{om t})^3 \sin(bb_1)^2 \\
& + 2. \cos(bb_1)^2 \sin(\text{om t}) + 2. \sin(\text{om t}) \cos(\text{om t})^2 \sin(bb_1)^2) \\
& \cos(\text{om t})^2) aa_F m_b^3 \sin(bb_2)^2 + ((((-2. \sin(\text{om t})^3 \sin(bb_1)^2 + (-1. \\
& + \sin(\text{om t})^2) \sin(\text{om t}) \cos(bb_1)^2) \cos(bb_1) + (\\
& - 2. \sin(\text{om t}) \sin(bb_1)^2 + \cos(bb_1)^2 \sin(\text{om t})) \cos(bb_1) \cos(\text{om t})^2) \\
& aa_F m_b^3 + ((\sin(bb_1)^2 - 1. \sin(\text{om t})^2 \sin(bb_1)^2) \sin(\text{om t})^3 + (1 \\
& - 1. \sin(\text{om t})^2) \sin(\text{om t}) \cos(bb_1)^2 + ((\sin(bb_1)^2 \\
& - 2. \sin(\text{om t})^2 \sin(bb_1)^2) \sin(\text{om t}) - 1. \cos(bb_1)^2 \sin(\text{om t}) \\
& - 1. \sin(\text{om t}) \cos(\text{om t})^2 \sin(bb_1)^2) \cos(\text{om t})^2) aa_F m_b^3 \cos(bb_2)) \\
& \cos(bb_2)) \cos(bb_2)) l + ((\sin(\text{om t})^4 \sin(bb_1) \cos(bb_1)^2 \\
& + (2. \sin(\text{om t})^2 \sin(bb_1) \cos(bb_1)^2 \\
& + \sin(bb_1) \cos(\text{om t})^2 \cos(bb_1)^2) \cos(\text{om t})^2) m_b^3 \sin(bb_2)^2 \\
& + ((\sin(\text{om t})^2 \sin(bb_1) \cos(bb_1)^2 \\
& + \sin(bb_1) \cos(\text{om t})^2 \cos(bb_1)^2) m_b^3 + (\cos(bb_1)^2 \sin(\text{om t})^2
\end{aligned}$$

$$\begin{aligned}
& + \sin(\text{om t})^4 \sin(bb_1)^2 + (\cos(bb_1)^2 + 2. \sin(\text{om t})^2 \sin(bb_1)^2 \\
& + \sin(bb_1)^2 \cos(\text{om t})^2) \cos(\text{om t})^2 m_b^3 \sin(bb_2) \cos(bb_2)^2) l \text{om} \\
& \text{om} + (((((\sin(\text{om t})^8 \sin(bb_1)^3 \\
& + \sin(\text{om t})^6 \sin(bb_1) \cos(bb_1)^2) \cos(bb_1) + ((((-1. \sin(bb_1)^3 \\
& + 4. \sin(bb_1)^3 \sin(\text{om t})^2) \sin(\text{om t})^4 + (-1. \sin(bb_1) \\
& + 3. \sin(\text{om t})^2 \sin(bb_1)) \sin(\text{om t})^2 \cos(bb_1)^2) \cos(bb_1) + (((\\
& -2. \sin(bb_1)^3 + 6. \sin(bb_1)^3 \sin(\text{om t})^2) \sin(\text{om t})^2 + (-1. \sin(bb_1) \\
& + 3. \sin(\text{om t})^2 \sin(bb_1)) \cos(bb_1)^2) \cos(bb_1) + ((((-1. \sin(bb_1)^3 \\
& + 4. \sin(bb_1)^3 \sin(\text{om t})^2 + \sin(bb_1) \cos(bb_1)^2) \cos(bb_1) \\
& + \sin(bb_1)^3 \cos(bb_1) \cos(\text{om t})^2) \cos(\text{om t})^2 \cos(\text{om t})^2) \\
& \cos(\text{om t}) aa_F^2 m_b^3 + ((((-2. \sin(\text{om t})^8 \sin(bb_1)^3 \\
& - 2. \sin(\text{om t})^6 \sin(bb_1) \cos(bb_1)^2) \cos(bb_1) + (((2. \sin(bb_1)^3 \\
& - 8. \sin(bb_1)^3 \sin(\text{om t})^2) \sin(\text{om t})^4 + (2. \sin(bb_1) \\
& - 6. \sin(\text{om t})^2 \sin(bb_1)) \sin(\text{om t})^2 \cos(bb_1)^2) \cos(bb_1) \\
& + (((4. \sin(bb_1)^3 - 12. \sin(bb_1)^3 \sin(\text{om t})^2) \sin(\text{om t})^2 \\
& + (2. \sin(bb_1) - 6. \sin(\text{om t})^2 \sin(bb_1)) \cos(bb_1)^2) \cos(bb_1) \\
& + ((2. \sin(bb_1)^3 - 8. \sin(bb_1)^3 \sin(\text{om t})^2 \\
& - 2. \sin(bb_1) \cos(bb_1)^2) \cos(bb_1) \\
& - 2. \sin(bb_1)^3 \cos(bb_1) \cos(\text{om t})^2) \cos(\text{om t})^2) \\
& \cos(\text{om t})^2) aa_F m_b^3 + ((((-1. \sin(bb_1)^3 \\
& + \sin(bb_1)^3 \sin(\text{om t})^2) \sin(\text{om t})^4 + (-1. \sin(bb_1) \\
& + \sin(\text{om t})^2 \sin(bb_1)) \sin(\text{om t})^2 \cos(bb_1)^2) \cos(bb_1) + (((\\
& -2. \sin(bb_1)^3 + 3. \sin(bb_1)^3 \sin(\text{om t})^2) \sin(\text{om t})^2 + (-1. \sin(bb_1) \\
& + 2. \sin(\text{om t})^2 \sin(bb_1)) \cos(bb_1)^2) \cos(bb_1) \\
& + ((3. \sin(bb_1)^3 \sin(\text{om t})^2 - 1. \sin(bb_1)^3 \\
& + \sin(bb_1) \cos(bb_1)^2) \cos(bb_1) + \sin(bb_1)^3 \cos(bb_1) \cos(\text{om t})^2) \\
& \cos(\text{om t})^2) \cos(\text{om t})^2) \cos(\text{om t}) m_b^3 bb_F_1) bb_F_1) \sin(bb_2)^2 \\
& + ((-1. \sin(\text{om t})^6 \cos(bb_1)^2 - 1. \sin(\text{om t})^8 \sin(bb_1)^2 + ((\sin(bb_1)^2 \\
& - 4. \sin(\text{om t})^2 \sin(bb_1)^2) \sin(\text{om t})^4 + (1 \\
& - 3. \sin(\text{om t})^2) \sin(\text{om t})^2 \cos(bb_1)^2 + ((2. \sin(bb_1)^2 \\
& - 6. \sin(\text{om t})^2 \sin(bb_1)^2) \sin(\text{om t})^2 + (-3. \sin(\text{om t})^2 + 1.) \cos(bb_1)^2 \\
& + (-1. \cos(bb_1)^2 - 4. \sin(\text{om t})^2 \sin(bb_1)^2 + \sin(bb_1)^2 \\
& - 1. \sin(bb_1)^2 \cos(\text{om t})^2) \cos(\text{om t})^2) \cos(\text{om t})^2) \\
& \cos(\text{om t}) aa_F^2 m_b^3 \sin(bb_2)^3 + (((\sin(\text{om t})^6 \sin(bb_1)^3 \\
& + \sin(\text{om t})^4 \sin(bb_1) \cos(bb_1)^2) \cos(bb_1) \\
& + ((3. \sin(bb_1)^3 \sin(\text{om t})^2 - 1. \sin(bb_1)^3) \sin(\text{om t})^2 + (
\end{aligned}$$

$$\begin{aligned}
& -1 \cdot \sin(bb_1) + 2 \cdot \sin(om t)^2 \sin(bb_1) \cos(bb_1)^2 \cos(bb_1) \\
& + ((3 \cdot \sin(bb_1)^3 \sin(om t)^2 - 1 \cdot \sin(bb_1)^3 \\
& + \sin(bb_1) \cos(bb_1)^2) \cos(bb_1) + \sin(bb_1)^3 \cos(bb_1) \cos(om t)^2) \\
& \cos(om t)^2) \cos(om t) aa_F^2 m_b^3 + (((\\
& -2 \cdot \sin(om t)^6 \sin(bb_1)^3 - 2 \cdot \sin(om t)^4 \sin(bb_1) \cos(bb_1)^2) \cos(bb_1) \\
& + (((2 \cdot \sin(bb_1)^3 - 6 \cdot \sin(bb_1)^3 \sin(om t)^2) \sin(om t)^2 \\
& + (2 \cdot \sin(bb_1) - 4 \cdot \sin(om t)^2 \sin(bb_1)) \cos(bb_1)^2) \cos(bb_1) \\
& + ((2 \cdot \sin(bb_1)^3 - 6 \cdot \sin(bb_1)^3 \sin(om t)^2 \\
& - 2 \cdot \sin(bb_1) \cos(bb_1)^2) \cos(bb_1) \\
& - 2 \cdot \sin(bb_1)^3 \cos(bb_1) \cos(om t)^2) \cos(om t)^2) \cos(om t)^2) aa_F m_b^3 \\
& + ((((-1 \cdot \sin(bb_1)^3 + \sin(bb_1)^3 \sin(om t)^2) \sin(om t)^2 + (\\
& -1 \cdot \sin(bb_1) + \sin(om t)^2 \sin(bb_1)) \cos(bb_1)^2) \cos(bb_1) + ((\\
& -1 \cdot \sin(bb_1)^3 + 2 \cdot \sin(bb_1)^3 \sin(om t)^2 + \sin(bb_1) \cos(bb_1)^2) \\
& \cos(bb_1) + \sin(bb_1)^3 \cos(bb_1) \cos(om t)^2) \cos(om t)^2) \\
& \cos(om t) m_b^3 bb_F_1) bb_F_1 + (-1 \cdot \sin(om t)^4 \cos(bb_1)^2 \\
& - 1 \cdot \sin(om t)^6 \sin(bb_1)^2 + ((\sin(bb_1)^2 \\
& - 3 \cdot \sin(om t)^2 \sin(bb_1)^2) \sin(om t)^2 + (1 \cdot -2 \cdot \sin(om t)^2) \cos(bb_1)^2 \\
& + (\sin(bb_1)^2 - 1 \cdot \cos(bb_1)^2 - 3 \cdot \sin(om t)^2 \sin(bb_1)^2 \\
& - 1 \cdot \sin(bb_1)^2 \cos(om t)^2) \cos(om t)^2) \cos(om t)^2) \\
& \cos(om t) aa_F^2 m_b^3 \sin(bb_2) \cos(bb_2)) \cos(bb_2) + (((\\
& -2 \cdot \sin(om t)^8 \sin(bb_1)^2 - 2 \cdot \sin(om t)^6 \cos(bb_1)^2 + ((2 \cdot \sin(bb_1)^2 \\
& - 8 \cdot \sin(om t)^2 \sin(bb_1)^2) \sin(om t)^4 + (2 \cdot \\
& - 6 \cdot \sin(om t)^2) \sin(om t)^2 \cos(bb_1)^2 + ((4 \cdot \sin(bb_1)^2 \\
& - 12 \cdot \sin(om t)^2 \sin(bb_1)^2) \sin(om t)^2 + (2 \cdot -6 \cdot \sin(om t)^2) \cos(bb_1)^2 \\
& + (2 \cdot \sin(bb_1)^2 - 8 \cdot \sin(om t)^2 \sin(bb_1)^2 - 2 \cdot \cos(bb_1)^2 \\
& - 2 \cdot \sin(bb_1)^2 \cos(om t)^2) \cos(om t)^2) \cos(om t)^2) \\
& aa_F m_b^3 \sin(bb_2)^3 + (-2 \cdot \sin(om t)^4 \cos(bb_1)^2 \\
& - 2 \cdot \sin(om t)^6 \sin(bb_1)^2 + ((2 \cdot \sin(bb_1)^2 \\
& - 6 \cdot \sin(om t)^2 \sin(bb_1)^2) \sin(om t)^2 + (-4 \cdot \sin(om t)^2 + 2 \cdot) \cos(bb_1)^2 \\
& + (2 \cdot \sin(bb_1)^2 - 6 \cdot \sin(om t)^2 \sin(bb_1)^2 - 2 \cdot \cos(bb_1)^2 \\
& - 2 \cdot \sin(bb_1)^2 \cos(om t)^2) \cos(om t)^2) \cos(om t)^2) \\
& aa_F m_b^3 \sin(bb_2) \cos(bb_2)^2) \cos(bb_2) + (((\sin(bb_1)^2 \\
& - 1 \cdot \sin(om t)^2 \sin(bb_1)^2) \sin(om t)^4 + (1 \cdot \\
& - 1 \cdot \sin(om t)^2) \sin(om t)^2 \cos(bb_1)^2 + ((2 \cdot \sin(bb_1)^2 \\
& - 3 \cdot \sin(om t)^2 \sin(bb_1)^2) \sin(om t)^2 + (1 \cdot -2 \cdot \sin(om t)^2) \cos(bb_1)^2 \\
& + (\sin(bb_1)^2 - 1 \cdot \cos(bb_1)^2 - 3 \cdot \sin(om t)^2 \sin(bb_1)^2
\end{aligned}$$

$$\begin{aligned}
& -1 \cdot \sin(bb_1)^2 \cos(om t)^2) \cos(om t)^2) \cos(om t)^2 \\
& \cos(om t) m_b^3 \sin(bb_2)^3 + ((\sin(bb_1)^2 \\
& - 1 \cdot \sin(om t)^2 \sin(bb_1)^2) \sin(om t)^2 + (-1 \cdot \sin(om t)^2 + 1) \cos(bb_1)^2 \\
& + (-2 \cdot \sin(om t)^2 \sin(bb_1)^2 - 1 \cdot \cos(bb_1)^2 + \sin(bb_1)^2 \\
& - 1 \cdot \sin(bb_1)^2 \cos(om t)^2) \cos(om t)^2) \\
& \cos(om t) m_b^3 \sin(bb_2) \cos(bb_2)^2) \cos(bb_2) bb_F_2) bb_F_2 \\
& + (((((\sin(bb_1)^2 - 1 \cdot \sin(om t)^2 \sin(bb_1)^2) \sin(om t)^5 + (1 \\
& - 1 \cdot \sin(om t)^2) \sin(om t)^3 \cos(bb_1)^2) \cos(bb_1)^2 + (((2 \cdot \sin(bb_1)^2 \\
& - 3 \cdot \sin(om t)^2 \sin(bb_1)^2) \sin(om t)^3 + (1 \\
& - 2 \cdot \sin(om t)^2) \sin(om t) \cos(bb_1)^2) \cos(bb_1)^2 + (((\sin(bb_1)^2 \\
& - 3 \cdot \sin(om t)^2 \sin(bb_1)^2) \sin(om t) - 1 \cdot \cos(bb_1)^2 \sin(om t)) \\
& \cos(bb_1)^2 - 1 \cdot \sin(om t) \cos(bb_1)^2 \cos(om t)^2 \sin(bb_1)^2) \cos(om t)^2) \\
& \cos(om t)^2) \cos(om t) aa_F m_b^3 + (-2 \cdot \sin(om t)^7 \sin(bb_1)^4 + ((\\
& -3 \cdot \sin(bb_1)^2 + \sin(om t)^2 \sin(bb_1)^2) \sin(om t)^5 + (-1 \\
& + \sin(om t)^2) \sin(om t)^3 \cos(bb_1)^2) \cos(bb_1)^2 + (\\
& -6 \cdot \sin(om t)^5 \sin(bb_1)^4 + ((-6 \cdot \sin(bb_1)^2 \\
& + 3 \cdot \sin(om t)^2 \sin(bb_1)^2) \sin(om t)^3 + (-1 \\
& + 2 \cdot \sin(om t)^2) \sin(om t) \cos(bb_1)^2) \cos(bb_1)^2 + (\\
& -6 \cdot \sin(om t)^3 \sin(bb_1)^4 + ((-3 \cdot \sin(bb_1)^2 \\
& + 3 \cdot \sin(om t)^2 \sin(bb_1)^2) \sin(om t) + \cos(bb_1)^2 \sin(om t)) \cos(bb_1)^2 \\
& + (-2 \cdot \sin(om t) \sin(bb_1)^4 \\
& + \sin(om t) \sin(bb_1)^2 \cos(bb_1)^2) \cos(om t)^2) \cos(om t)^2) \cos(om t)^2) \\
& m_b^3 bb_F_1) \sin(bb_2)^2 + ((((\sin(bb_1)^2 \\
& - 1 \cdot \sin(om t)^2 \sin(bb_1)^2) \sin(om t)^3 + (1 \\
& - 1 \cdot \sin(om t)^2) \sin(om t) \cos(bb_1)^2) \cos(bb_1)^2 + (((\sin(bb_1)^2 \\
& - 2 \cdot \sin(om t)^2 \sin(bb_1)^2) \sin(om t) - 1 \cdot \cos(bb_1)^2 \sin(om t)) \\
& \cos(bb_1)^2 - 1 \cdot \sin(om t) \cos(bb_1)^2 \cos(om t)^2 \sin(bb_1)^2) \cos(om t)^2) \\
& \cos(om t) aa_F m_b^3 + (-2 \cdot \sin(om t)^5 \sin(bb_1)^4 + ((-3 \cdot \sin(bb_1)^2 \\
& + \sin(om t)^2 \sin(bb_1)^2) \sin(om t)^3 + (-1 \\
& + \sin(om t)^2) \sin(om t) \cos(bb_1)^2) \cos(bb_1)^2 + (\\
& -4 \cdot \sin(om t)^3 \sin(bb_1)^4 + ((-3 \cdot \sin(bb_1)^2 \\
& + 2 \cdot \sin(om t)^2 \sin(bb_1)^2) \sin(om t) + \cos(bb_1)^2 \sin(om t)) \cos(bb_1)^2 \\
& + (-2 \cdot \sin(om t) \sin(bb_1)^4 \\
& + \sin(om t) \sin(bb_1)^2 \cos(bb_1)^2) \cos(om t)^2) \cos(om t)^2) m_b^3 bb_F_1 \\
& + ((\sin(bb_1)^2 - 1 \cdot \sin(om t)^2 \sin(bb_1)^2) \sin(om t)^5 + (1 \\
& - 1 \cdot \sin(om t)^2) \sin(om t)^3 \cos(bb_1)^2 + ((2 \cdot \sin(bb_1)^2
\end{aligned}$$

$$\begin{aligned}
& -3 \cdot \sin(\omega t)^2 \sin(bb_1)^2) \sin(\omega t)^3 + (1 \\
& -2 \cdot \sin(\omega t)^2) \sin(\omega t) \cos(bb_1)^2 + ((\sin(bb_1)^2 \\
& -3 \cdot \sin(\omega t)^2 \sin(bb_1)^2) \sin(\omega t) - 1 \cdot \cos(bb_1)^2 \sin(\omega t) \\
& -1 \cdot \sin(\omega t) \cos(\omega t)^2 \sin(bb_1)^2) \cos(\omega t)^2) \cos(\omega t)^2) \\
& \cos(\omega t) aa_F m_b^3 \sin(bb_2)^2 + ((\sin(bb_1)^2 \\
& -1 \cdot \sin(\omega t)^2 \sin(bb_1)^2) \sin(\omega t)^3 + (1 \\
& -1 \cdot \sin(\omega t)^2) \sin(\omega t) \cos(bb_1)^2 + ((\sin(bb_1)^2 \\
& -2 \cdot \sin(\omega t)^2 \sin(bb_1)^2) \sin(\omega t) - 1 \cdot \cos(bb_1)^2 \sin(\omega t) \\
& -1 \cdot \sin(\omega t) \cos(\omega t)^2 \sin(bb_1)^2) \cos(\omega t)^2) \\
& \cos(\omega t) aa_F m_b^3 \cos(bb_2)^2) \cos(bb_2)^2 + ((2 \cdot \sin(\omega t)^5 \cos(bb_1)^2 \\
& + 2 \cdot \sin(\omega t)^7 \sin(bb_1)^2 + (4 \cdot \sin(\omega t)^3 \cos(bb_1)^2 \\
& + 6 \cdot \sin(\omega t)^5 \sin(bb_1)^2 + (2 \cdot \cos(bb_1)^2 \sin(\omega t) \\
& + 6 \cdot \sin(\omega t)^3 \sin(bb_1)^2 + 2 \cdot \sin(\omega t) \cos(\omega t)^2 \sin(bb_1)^2) \\
& \cos(\omega t)^2) \cos(\omega t)^2) m_b^3 \sin(bb_2)^4 + (((3 \cdot \sin(bb_1)^2 \\
& -1 \cdot \sin(\omega t)^2 \sin(bb_1)^2) \sin(\omega t)^5 + (3. \\
& -1 \cdot \sin(\omega t)^2) \sin(\omega t)^3 \cos(bb_1)^2 + ((6 \cdot \sin(bb_1)^2 \\
& -3 \cdot \sin(\omega t)^2 \sin(bb_1)^2) \sin(\omega t)^3 + (3. \\
& -2 \cdot \sin(\omega t)^2) \sin(\omega t) \cos(bb_1)^2 + ((3 \cdot \sin(bb_1)^2 \\
& -3 \cdot \sin(\omega t)^2 \sin(bb_1)^2) \sin(\omega t) - 1 \cdot \cos(bb_1)^2 \sin(\omega t) \\
& -1 \cdot \sin(\omega t) \cos(\omega t)^2 \sin(bb_1)^2) \cos(\omega t)^2) \cos(\omega t)^2) \\
& m_b^3 \sin(bb_2)^2 + ((\sin(bb_1)^2 - 1 \cdot \sin(\omega t)^2 \sin(bb_1)^2) \sin(\omega t)^3 \\
& + (1 - 1 \cdot \sin(\omega t)^2) \sin(\omega t) \cos(bb_1)^2 + ((\sin(bb_1)^2 \\
& -2 \cdot \sin(\omega t)^2 \sin(bb_1)^2) \sin(\omega t) - 1 \cdot \cos(bb_1)^2 \sin(\omega t) \\
& -1 \cdot \sin(\omega t) \cos(\omega t)^2 \sin(bb_1)^2) \cos(\omega t)^2) m_b^3 \cos(bb_2)^2) \\
& \cos(bb_2)^2) bb_F_2) om) R) R) R) R) R \\
& + (((32 \cdot \sin(\omega t)^2 \sin(bb_1) \cos(bb_1)^2 \\
& - 32 \cdot \sin(bb_1) \cos(\omega t)^2) \cos(\omega t) aa_F^2 m_b JB^2 \\
& + (64 \cdot m_b \sin(bb_1) aa_F \cos(\omega t)^2 JB^2 \\
& - 32 \cdot m_b \cos(\omega t) \sin(bb_1) JB^2 bb_F_1) bb_F_1 \\
& + 32 \cdot m_b \sin(bb_2) aa_F^2 \cos(\omega t)^3 JB^2 \\
& - 32 \cdot m_b \cos(\omega t) aa_F^2 \sin(\omega t)^2 \sin(bb_2) JB^2 \cos(bb_2)^2 \\
& - 32 \cdot m_b \cos(\omega t) \cos(bb_1) kb bb_1 JB \\
& + (64 \cdot m_b \sin(bb_2) aa_F \cos(\omega t)^2 JB^2 \\
& + 32 \cdot \cos(\omega t) m_b \sin(bb_2) JB^2 bb_F_2) bb_F_2 \\
& + 32 \cdot m_b \cos(\omega t) \cos(bb_2) kb bb_2 JB + (((((64. + 32 \cdot \sin(bb_1)^2 \\
& - 32 \cdot \sin(\omega t)^2) \sin(\omega t) - 32 \cdot \cos(bb_1)^2 \sin(\omega t)) \cos(bb_1)
\end{aligned}$$

$$\begin{aligned}
& -32 \cdot \cos(bb_1) \sin(om t) \cos(om t)^2 \cos(om t) aa_F m_b JB^2 + ((-32. \\
& + 32. \sin(om t)^2) \sin(om t) \cos(bb_1) \\
& + 32. \cos(bb_1) \sin(om t) \cos(om t)^2 m_b JB^2 bb_F_1 + (((64. \\
& - 32. \sin(om t)^2) \sin(om t) - 32. \sin(om t) \cos(om t)^2) \\
& \cos(om t) aa_F m_b JB^2 + 32. JB^2 \sin(om t) aa_F \cos(om t) \sin(bb_2)^2 m_b \\
& - 32. \cos(om t) m_b \sin(om t) aa_F \cos(bb_2)^2 JB^2) \cos(bb_2) + ((32. \\
& - 32. \sin(om t)^2) \sin(om t) - 32. \sin(om t) \cos(om t)^2) \\
& m_b JB^2 \cos(bb_2) bb_F_2 + \\
& - 32. m_b \cos(om t) JB^2 \cos(bb_1)^2 \sin(bb_1) \\
& + 32. m_b \cos(om t) JB^2 \cos(bb_2)^2 \sin(bb_2)) om) om \\
& + ((16. \sin(aa) \cos(bb_1)^2 \\
& - 16. \cos(bb_1) \sin(bb_1) \cos(om t) \cos(aa)) \cos(om t) g_m_b^2 JB + (\\
& - 16. m_b^2 g_ \sin(bb_2) \cos(om t)^2 \cos(aa) JB \\
& - 16. m_b^2 \cos(om t) g_ \sin(aa) JB \cos(bb_2)) \cos(bb_2) \\
& + (16. m_b^2 \cos(bb_1) \sin(bb_1) \cos(om t)^2 aa_F^2 JB \\
& + 16. m_b^2 \cos(bb_2) \sin(bb_2) \cos(om t)^2 aa_F^2 JB) l + ((((8. \\
& + 8. \sin(om t)^2) \sin(om t) \cos(bb_1)^2 \\
& + 8. \sin(om t) \cos(bb_1)^2 \cos(om t)^2) aa_F m_b^2 JB + ((-8. \\
& - 8. \sin(om t)^2) \sin(om t) - 8. \sin(om t) \cos(om t)^2) \\
& aa_F m_b^2 JB \cos(bb_2)^2) l + ((8. \sin(bb_1) \cos(bb_1) \cos(om t)^2 \\
& + 8. \sin(om t)^2 \sin(bb_1) \cos(bb_1)) m_b^2 JB + (8. \sin(om t)^2 \\
& + 8. \cos(om t)^2) m_b^2 JB \sin(bb_2) \cos(bb_2)) l om) om \\
& + ((8. \sin(om t)^4 \sin(bb_1) \cos(bb_1)^2 + (- 8. \sin(bb_1)^3 \sin(om t)^2 \\
& + (16. \sin(om t)^2 \sin(bb_1) - 16. \sin(bb_1)) \cos(bb_1)^2 \\
& + (8. \sin(bb_1) \cos(bb_1)^2 - 8. \sin(bb_1)^3) \cos(om t)^2) \cos(om t)^2) \\
& \cos(om t) aa_F^2 m_b^2 JB + ((16. \sin(bb_1) \cos(bb_1)^2 \\
& + 16. \sin(bb_1)^3 \sin(om t)^2 + 16. \sin(bb_1)^3 \cos(om t)^2) \\
& \cos(om t)^2 aa_F m_b^2 JB + (- 8. \sin(bb_1)^3 \sin(om t)^2 \\
& - 8. \sin(om t)^2 \sin(bb_1) \cos(bb_1)^2 + (- 8. \sin(bb_1) \cos(bb_1)^2 \\
& - 8. \sin(bb_1)^3) \cos(om t)^2) \cos(om t) m_b^2 JB bb_F_1) bb_F_1 \\
& + ((8. \sin(om t)^2 \sin(bb_1)^2 + 8. \cos(bb_1)^2 \\
& + 8. \sin(bb_1)^2 \cos(om t)^2) \cos(om t)^3 aa_F^2 m_b^2 JB \\
& + ((8. \sin(om t)^4 \sin(bb_1) \cos(bb_1)^2 + (- 8. \sin(om t)^2 \sin(bb_1) \\
& + 8. \sin(om t)^2 \sin(bb_1) \cos(bb_1)^2 - 8. \sin(bb_1) \cos(om t)^2) \\
& \cos(om t)^2) \cos(om t) aa_F^2 m_b^2 JB + ((16. \sin(om t)^2 \sin(bb_1) \\
& + 16. \sin(bb_1) \cos(om t)^2) \cos(om t)^2 aa_F m_b^2 JB +
\end{aligned}$$

$$\begin{aligned}
& -8 \cdot \sin(\omega m t)^2 \sin(bb_1) - 8 \cdot \sin(bb_1) \cos(\omega m t)^2 \\
& \cos(\omega m t) m_b^2 JB bb_F_1) bb_F_1 + (8 \cdot \sin(\omega m t)^2 \\
& + 8 \cdot \cos(\omega m t)^2) \cos(\omega m t)^3 aa_F^2 m_b^2 JB \sin(bb_2)) \sin(bb_2) \\
& \sin(bb_2) + ((8 \cdot \sin(\omega m t)^2 \sin(bb_1) \cos(bb_1)^2 \\
& - 8 \cdot \sin(bb_1) \cos(\omega m t)^2) \cos(\omega m t) aa_F^2 m_b^2 JB \\
& + (16 \cdot m_b^2 \sin(bb_1) aa_F \cos(\omega m t)^2 JB \\
& - 8 \cdot m_b^2 \cos(\omega m t) \sin(bb_1) JB bb_F_1) bb_F_1 + ((-8 \cdot \\
& - 8 \cdot \sin(bb_1)^2) \sin(\omega m t)^4 - 8 \cdot \cos(bb_1)^2 \sin(\omega m t)^2 + (16 \cdot + (-16 \cdot \\
& - 8 \cdot \sin(bb_1)^2) \sin(\omega m t)^2 - 8 \cdot \cos(\omega m t)^2) \cos(\omega m t)^2) \\
& \cos(\omega m t) aa_F^2 m_b^2 JB \sin(bb_2)) \cos(bb_2)^2 + ((\\
& - 8 \cdot \cos(bb_1) \sin(\omega m t)^2 - 8 \cdot \cos(\omega m t)^2 \cos(bb_1)) \\
& \cos(\omega m t) kb m_b^2 \sin(bb_2)^2 \\
& - 8 \cdot m_b^2 \cos(\omega m t) \cos(bb_1) kb \cos(bb_2)^2) bb_1 + (((16 \cdot \cos(bb_1)^2 \\
& + 16 \cdot \sin(\omega m t)^2 \sin(bb_1)^2 + 16 \cdot \sin(bb_1)^2 \cos(\omega m t)^2) \\
& \cos(\omega m t)^2 aa_F m_b^2 JB + (16 \cdot \sin(\omega m t)^2 \\
& + 16 \cdot \cos(\omega m t)^2) \cos(\omega m t)^2 aa_F m_b^2 JB \sin(bb_2)^2) \sin(bb_2) \\
& + 16 \cdot m_b^2 \sin(bb_2) aa_F \cos(\omega m t)^2 \cos(bb_2)^2 JB \\
& + (((8 \cdot \sin(\omega m t)^2 \sin(bb_1)^2 + 8 \cdot \cos(bb_1)^2 \\
& + 8 \cdot \sin(bb_1)^2 \cos(\omega m t)^2) \cos(\omega m t) m_b^2 JB + (8 \cdot \sin(\omega m t)^2 \\
& + 8 \cdot \cos(\omega m t)^2) \cos(\omega m t) m_b^2 JB \sin(bb_2)^2) \sin(bb_2) \\
& + (8 \cdot \sin(\omega m t)^2 \\
& + 8 \cdot \cos(\omega m t)^2) \cos(\omega m t) m_b^2 JB \sin(bb_2) \cos(bb_2)^2) bb_F_2 \\
& bb_F_2 + (8 \cdot \sin(\omega m t)^2 \sin(bb_1)^2 + 8 \cdot \cos(bb_1)^2 \\
& + 8 \cdot \sin(bb_1)^2 \cos(\omega m t)^2) \cos(\omega m t) kb m_b^2 \cos(bb_2) bb_2 \\
& + (((((24 \cdot \sin(bb_1)^2 - 8 \cdot \sin(\omega m t)^2 \sin(bb_1)^2) \sin(\omega m t)^3 + (\\
& - 16 \cdot \sin(\omega m t)^2 + 16 \cdot) \sin(\omega m t) \cos(bb_1)^2) \cos(bb_1) \\
& + (((24 \cdot \sin(bb_1)^2 - 16 \cdot \sin(\omega m t)^2 \sin(bb_1)^2) \sin(\omega m t) \\
& - 16 \cdot \cos(bb_1)^2 \sin(\omega m t)) \cos(bb_1) \\
& - 8 \cdot \sin(\omega m t) \cos(bb_1) \cos(\omega m t)^2 \sin(bb_1)^2) \cos(\omega m t)^2) \\
& \cos(\omega m t) aa_F m_b^2 JB + ((((-8 \cdot \sin(bb_1)^2 \\
& + 8 \cdot \sin(\omega m t)^2 \sin(bb_1)^2) \sin(\omega m t)^3 + (-8 \cdot \\
& + 8 \cdot \sin(\omega m t)^2) \sin(\omega m t) \cos(bb_1)^2) \cos(bb_1) + ((((-8 \cdot \sin(bb_1)^2 \\
& + 16 \cdot \sin(\omega m t)^2 \sin(bb_1)^2) \sin(\omega m t) + 8 \cdot \cos(bb_1)^2 \sin(\omega m t)) \\
& \cos(bb_1) + 8 \cdot \sin(\omega m t) \cos(bb_1) \cos(\omega m t)^2 \sin(bb_1)^2) \cos(\omega m t)^2) \\
& m_b^2 JB bb_F_1 + (((((8 \cdot \sin(bb_1)^2 + 16 \cdot - 8 \cdot \sin(\omega m t)^2) \sin(\omega m t)^3 \\
& - 8 \cdot \sin(\omega m t)^3 \cos(bb_1)^2) \cos(bb_1) + (((8 \cdot \sin(bb_1)^2 + 16 \cdot
\end{aligned}$$

$$\begin{aligned}
& -16 \cdot \sin(\text{om} t)^2) \sin(\text{om} t) - 8 \cdot \cos(bb_1)^2 \sin(\text{om} t) \cos(bb_1) \\
& - 8 \cdot \cos(bb_1) \sin(\text{om} t) \cos(\text{om} t)^2 \cos(\text{om} t)^2 \cos(\text{om} t) \text{aa_F m_b}^2 \text{JB} \\
& + ((-8 \cdot + 8 \cdot \sin(\text{om} t)^2) \sin(\text{om} t)^3 \cos(bb_1) + ((-8 \cdot \\
& + 16 \cdot \sin(\text{om} t)^2) \sin(\text{om} t) \cos(bb_1) \\
& + 8 \cdot \cos(bb_1) \sin(\text{om} t) \cos(\text{om} t)^2 \cos(\text{om} t)^2 \text{m_b}^2 \text{JB bb_F_1}) \\
& \sin(bb_2)^2 + (((16 \cdot \sin(bb_1)^2 - 8 \cdot \sin(\text{om} t)^2 \sin(bb_1)^2) \sin(\text{om} t)^3 \\
& + (16 \cdot - 8 \cdot \sin(\text{om} t)^2) \sin(\text{om} t) \cos(bb_1)^2 + ((16 \cdot \sin(bb_1)^2 \\
& - 16 \cdot \sin(\text{om} t)^2 \sin(bb_1)^2) \sin(\text{om} t) - 8 \cdot \cos(bb_1)^2 \sin(\text{om} t) \\
& - 8 \cdot \sin(\text{om} t) \cos(\text{om} t)^2 \sin(bb_1)^2) \cos(\text{om} t)^2 \cos(\text{om} t) \text{aa_F m_b}^2 \text{JB} \\
& + ((8 \cdot \sin(bb_1)^2 + 24 \cdot - 8 \cdot \sin(\text{om} t)^2) \sin(\text{om} t)^3 \\
& + 8 \cdot \cos(bb_1)^2 \sin(\text{om} t) + ((8 \cdot \sin(bb_1)^2 + 24 \cdot \\
& - 16 \cdot \sin(\text{om} t)^2) \sin(\text{om} t) - 8 \cdot \sin(\text{om} t) \cos(\text{om} t)^2) \cos(\text{om} t)^2) \\
& \cos(\text{om} t) \text{aa_F m_b}^2 \text{JB} \sin(bb_2)^2 + ((((8 \cdot \sin(bb_1)^2 + 16 \cdot \\
& - 8 \cdot \sin(\text{om} t)^2) \sin(\text{om} t) - 8 \cdot \cos(bb_1)^2 \sin(\text{om} t) \cos(bb_1) \\
& - 8 \cdot \cos(bb_1) \sin(\text{om} t) \cos(\text{om} t)^2) \cos(\text{om} t) \text{aa_F m_b}^2 \text{JB} + ((-8 \cdot \\
& + 8 \cdot \sin(\text{om} t)^2) \sin(\text{om} t) \cos(bb_1) + 8 \cdot \cos(bb_1) \sin(\text{om} t) \cos(\text{om} t)^2) \\
& \text{m_b}^2 \text{JB bb_F_1} + ((16 \cdot + (-16 \cdot - 8 \cdot \sin(bb_1)^2) \sin(\text{om} t)^2) \sin(\text{om} t) \\
& - 8 \cdot \cos(bb_1)^2 \sin(\text{om} t) + (-16 \cdot - 8 \cdot \sin(bb_1)^2) \sin(\text{om} t) \cos(\text{om} t)^2) \\
& \cos(\text{om} t) \text{aa_F m_b}^2 \text{JB} \cos(bb_2) \cos(bb_2) \cos(bb_2) \\
& + (((8 \cdot \sin(bb_1)^2 - 8 \cdot \sin(\text{om} t)^2 \sin(bb_1)^2) \sin(\text{om} t)^3 + (8 \cdot \\
& - 8 \cdot \sin(\text{om} t)^2) \sin(\text{om} t) \cos(bb_1)^2 + ((8 \cdot \sin(bb_1)^2 \\
& - 16 \cdot \sin(\text{om} t)^2 \sin(bb_1)^2) \sin(\text{om} t) - 8 \cdot \cos(bb_1)^2 \sin(\text{om} t) \\
& - 8 \cdot \sin(\text{om} t) \cos(\text{om} t)^2 \sin(bb_1)^2) \cos(\text{om} t)^2 \text{m_b}^2 \text{JB} + ((8 \cdot \\
& - 8 \cdot \sin(\text{om} t)^2) \sin(\text{om} t)^3 + ((-16 \cdot \sin(\text{om} t)^2 + 8 \cdot) \sin(\text{om} t) \\
& - 8 \cdot \sin(\text{om} t) \cos(\text{om} t)^2) \cos(\text{om} t)^2 \text{m_b}^2 \text{JB} \sin(bb_2)^2 + ((8 \cdot \\
& - 8 \cdot \sin(\text{om} t)^2) \sin(\text{om} t) - 8 \cdot \sin(\text{om} t) \cos(\text{om} t)^2) \text{m_b}^2 \text{JB} \cos(bb_2)^2) \\
& \cos(bb_2) \text{bb_F_2} + ((-8 \cdot \sin(\text{om} t)^2 \sin(bb_1) \cos(bb_1)^2 \\
& - 8 \cdot \sin(bb_1) \cos(\text{om} t)^2 \cos(bb_1)^2) \cos(\text{om} t) \text{m_b}^2 \text{JB} + (\\
& - 8 \cdot \sin(\text{om} t)^2 \sin(bb_1) \cos(bb_1)^2) \\
& - 8 \cdot \sin(bb_1) \cos(\text{om} t)^2 \cos(bb_1)^2) \cos(\text{om} t) \text{m_b}^2 \text{JB} \sin(bb_2)^2 + (\\
& - 8 \cdot \text{m_b}^2 \cos(\text{om} t) \text{JB} \cos(bb_1)^2 \sin(bb_1) + ((8 \cdot \\
& + 8 \cdot \sin(bb_1)^2) \sin(\text{om} t)^2 + 8 \cdot \cos(bb_1)^2 + (8 \cdot \\
& + 8 \cdot \sin(bb_1)^2) \cos(\text{om} t)^2) \cos(\text{om} t) \text{m_b}^2 \text{JB} \sin(bb_2) \cos(bb_2)^2) \\
& \text{om} \text{ om} + ((4 \cdot \sin(aa) \sin(\text{om} t)^2 \cos(bb_1)^2 + (\\
& - 4 \cdot \cos(bb_1) \sin(bb_1) \cos(aa) \sin(\text{om} t)^2 + (4 \cdot \sin(aa) \cos(bb_1)^2 \\
& - 4 \cdot \cos(bb_1) \sin(bb_1) \cos(\text{om} t) \cos(aa)) \cos(\text{om} t)) \cos(\text{om} t))
\end{aligned}$$

$$\begin{aligned}
& \cos(om t) g_m_b^3 \sin(bb_2)^2 + ((-4. \cos(aa) \cos(bb_1)^2 \\
& - 4. \cos(aa) \sin(om t)^2 \sin(bb_1)^2 - 4. \cos(aa) \cos(om t)^2 \sin(bb_1)^2) \\
& \cos(om t)^2 g_m_b^3 \sin(bb_2) + (-4. \sin(aa) \sin(om t)^2 \sin(bb_1)^2 + \\
& -4. \cos(bb_1) \sin(bb_1) \cos(aa) - 4. \sin(aa) \sin(bb_1)^2 \cos(om t)) \\
& \cos(om t) g_m_b^3 \cos(bb_2)) \cos(bb_2) \\
& + ((4. \sin(om t)^2 \sin(bb_1) \cos(bb_1) \\
& + 4. \sin(bb_1) \cos(bb_1) \cos(om t)^2) \cos(om t)^2 aa_F^2 m_b^3 \sin(bb_2)^2 \\
& + ((4. \cos(bb_1)^2 + 4. \sin(om t)^2 \sin(bb_1)^2 \\
& + 4. \sin(bb_1)^2 \cos(om t)^2) \cos(om t)^2 aa_F^2 m_b^3 \sin(bb_2) \\
& + 4. m_b^3 \cos(bb_1) \sin(bb_1) \cos(om t)^2 aa_F^2 \cos(bb_2)) \cos(bb_2)) l \\
& + (((((2. + 2. \sin(om t)^2) \sin(om t)^3 \cos(bb_1)^2 + ((2. \\
& + 4. \sin(om t)^2) \sin(om t) \cos(bb_1)^2 \\
& + 2. \sin(om t) \cos(bb_1)^2 \cos(om t)^2) \cos(om t)^2) aa_F m_b^3 \sin(bb_2)^2 \\
& + ((-2. \sin(bb_1)^2 - 2. \sin(om t)^2 \sin(bb_1)^2) \sin(om t)^3 + ((\\
& -2. \sin(bb_1)^2 - 4. \sin(om t)^2 \sin(bb_1)^2) \sin(om t) \\
& - 2. \sin(om t) \cos(om t)^2 \sin(bb_1)^2) \cos(om t)^2) aa_F m_b^3 \cos(bb_2)^2) \\
l + ((2. \sin(om t)^4 \sin(bb_1) \cos(bb_1) \\
& + (4. \sin(om t)^2 \sin(bb_1) \cos(bb_1) \\
& + 2. \sin(bb_1) \cos(bb_1) \cos(om t)^2) \cos(om t)^2) m_b^3 \sin(bb_2)^2 \\
& + ((2. \cos(bb_1)^2 \sin(om t)^2 + 2. \sin(om t)^4 \sin(bb_1)^2 \\
& + (4. \sin(om t)^2 \sin(bb_1)^2 + 2. \cos(bb_1)^2 \\
& + 2. \sin(bb_1)^2 \cos(om t)^2) \cos(om t)^2) m_b^3 \sin(bb_2) \\
& + (2. \sin(bb_1) \cos(bb_1) \cos(om t)^2 \\
& + 2. \sin(om t)^2 \sin(bb_1) \cos(bb_1) \cos(om t)^2) m_b^3 \cos(bb_2)) \cos(bb_2)) l om) \\
om + (((2. \sin(om t)^6 \sin(bb_1) \cos(bb_1)^2 + (-2. \sin(om t)^4 \sin(bb_1)^3 \\
& + (-4. \sin(bb_1) + 6. \sin(om t)^2 \sin(bb_1)) \sin(om t)^2 \cos(bb_1)^2 + (- \\
& -4. \sin(bb_1)^3 \sin(om t)^2 + (-4. \sin(bb_1) \\
& + 6. \sin(om t)^2 \sin(bb_1)) \cos(bb_1)^2 + (2. \sin(bb_1) \cos(bb_1)^2 \\
& - 2. \sin(bb_1)^3) \cos(om t)^2) \cos(om t)^2) \\
& \cos(om t) aa_F^2 m_b^3 + ((4. \sin(om t)^2 \sin(bb_1) \cos(bb_1)^2 \\
& + 4. \sin(om t)^4 \sin(bb_1)^3 + (4. \sin(bb_1) \cos(bb_1)^2 \\
& + 8. \sin(bb_1)^3 \sin(om t)^2 + 4. \sin(bb_1)^3 \cos(om t)^2) \cos(om t)^2) \\
& \cos(om t)^2 aa_F m_b^3 + (-2. \sin(om t)^4 \sin(bb_1)^3 \\
& - 2. \sin(om t)^4 \sin(bb_1) \cos(bb_1)^2 + (- \\
& -4. \sin(om t)^2 \sin(bb_1) \cos(bb_1)^2 - 4. \sin(bb_1)^3 \sin(om t)^2 + (- \\
& -2. \sin(bb_1) \cos(bb_1)^2 - 2. \sin(bb_1)^3) \cos(om t)^2) \cos(om t)^2)
\end{aligned}$$

$$\begin{aligned}
& \cos(om t) m_b^3 bb_F_1) bb_F_1 + (2. \cos(bb_1)^2 \sin(om t)^2 \\
& + 2. \sin(om t)^4 \sin(bb_1)^2 + (4. \sin(om t)^2 \sin(bb_1)^2 + 2. \cos(bb_1)^2 \\
& + 2. \sin(bb_1)^2 \cos(om t)^2) \cos(om t)^3 aa_F^2 m_b^3 \sin(bb_2)) \\
& \sin(bb_2)^2 + ((2. \sin(om t)^4 \sin(bb_1) \cos(bb_1)^2 + (\\
& - 2. \sin(bb_1)^3 \sin(om t)^2 + (4. \sin(om t)^2 \sin(bb_1) \\
& - 4. \sin(bb_1)) \cos(bb_1)^2 + (2. \sin(bb_1) \cos(bb_1)^2 \\
& - 2. \sin(bb_1)^3) \cos(om t)^2) \cos(om t) aa_F^2 m_b^3 \\
& + ((4. \sin(bb_1)^3 \sin(om t)^2 + 4. \sin(bb_1) \cos(bb_1)^2 \\
& + 4. \sin(bb_1)^3 \cos(om t)^2) \cos(om t)^2 aa_F m_b^3 + (\\
& - 2. \sin(bb_1)^3 \sin(om t)^2 - 2. \sin(om t)^2 \sin(bb_1) \cos(bb_1)^2 + (\\
& - 2. \sin(bb_1) \cos(bb_1)^2 - 2. \sin(bb_1)^3) \cos(om t)^2) \\
& \cos(om t) m_b^3 bb_F_1) bb_F_1 + (-2. \sin(om t)^4 \cos(bb_1)^2 \\
& - 2. \sin(om t)^6 \sin(bb_1)^2 + ((4. \sin(bb_1)^2 \\
& - 6. \sin(om t)^2 \sin(bb_1)^2) \sin(om t)^2 + (-4. \sin(om t)^2 + 4.) \cos(bb_1)^2 \\
& + (-2. \cos(bb_1)^2 + 4. \sin(bb_1)^2 - 6. \sin(om t)^2 \sin(bb_1)^2 \\
& - 2. \sin(bb_1)^2 \cos(om t)^2) \cos(om t)^2) \cos(om t)^2) \\
& \cos(om t) aa_F^2 m_b^3 \sin(bb_2)) \cos(bb_2)^2 + ((4. \sin(om t)^4 \sin(bb_1)^2 \\
& + 4. \cos(bb_1)^2 \sin(om t)^2 + (4. \cos(bb_1)^2 + 8. \sin(om t)^2 \sin(bb_1)^2 \\
& + 4. \sin(bb_1)^2 \cos(om t)^2) \cos(om t)^2) \cos(om t)^2 aa_F m_b^3 \sin(bb_2)^3 \\
& + (4. \cos(bb_1)^2 + 4. \sin(om t)^2 \sin(bb_1)^2 \\
& + 4. \sin(bb_1)^2 \cos(om t)^2) \cos(om t)^2 aa_F m_b^3 \sin(bb_2) \cos(bb_2)^2 \\
& + ((2. \cos(bb_1)^2 \sin(om t)^2 + 2. \sin(om t)^4 \sin(bb_1)^2 \\
& + (4. \sin(om t)^2 \sin(bb_1)^2 + 2. \cos(bb_1)^2 \\
& + 2. \sin(bb_1)^2 \cos(om t)^2) \cos(om t)^2) \cos(om t) m_b^3 \sin(bb_2)^3 \\
& + (2. \cos(bb_1)^2 \sin(om t)^2 + 2. \sin(om t)^4 \sin(bb_1)^2 \\
& + (4. \sin(om t)^2 \sin(bb_1)^2 + 2. \cos(bb_1)^2 \\
& + 2. \sin(bb_1)^2 \cos(om t)^2) \cos(om t)^2) \\
& \cos(om t) m_b^3 \sin(bb_2) \cos(bb_2)^2) bb_F_2) bb_F_2 \\
& + (((((6. \sin(bb_1)^2 - 2. \sin(om t)^2 \sin(bb_1)^2) \sin(om t)^5 + (\\
& - 4. \sin(om t)^2 + 4.) \sin(om t)^3 \cos(bb_1)^2) \cos(bb_1) \\
& + (((12. \sin(bb_1)^2 - 6. \sin(om t)^2 \sin(bb_1)^2) \sin(om t)^3 + (4. \\
& - 8. \sin(om t)^2) \sin(om t) \cos(bb_1)^2) \cos(bb_1) + (((6. \sin(bb_1)^2 \\
& - 6. \sin(om t)^2 \sin(bb_1)^2) \sin(om t) - 4. \cos(bb_1)^2 \sin(om t)) \\
& \cos(bb_1) - 2. \sin(om t) \cos(bb_1) \cos(om t)^2 \sin(bb_1)^2) \cos(om t)^2) \\
& \cos(om t)^2) \cos(om t) aa_F m_b^3 + ((((-2. \sin(bb_1)^2 \\
& + 2. \sin(om t)^2 \sin(bb_1)^2) \sin(om t)^5 + (-2.
\end{aligned}$$

$$\begin{aligned}
& + 2 \cdot \sin(\omega t)^2) \sin(\omega t)^3 \cos(bb_1)^2) \cos(bb_1) + (((-4 \cdot \sin(bb_1)^2 \\
& + 6 \cdot \sin(\omega t)^2 \sin(bb_1)^2) \sin(\omega t)^3 + (-2 \cdot \\
& + 4 \cdot \sin(\omega t)^2) \sin(\omega t) \cos(bb_1)^2) \cos(bb_1) + (((-2 \cdot \sin(bb_1)^2 \\
& + 6 \cdot \sin(\omega t)^2 \sin(bb_1)^2) \sin(\omega t) + 2 \cdot \cos(bb_1)^2 \sin(\omega t)) \\
& \cos(bb_1) + 2 \cdot \sin(\omega t) \cos(bb_1) \cos(\omega t)^2 \sin(bb_1)^2) \cos(\omega t)^2) \\
& \cos(\omega t)^2) m_b^3 bb_F_1) \sin(bb_2)^2 + (((6 \cdot \sin(bb_1)^2 \\
& - 2 \cdot \sin(\omega t)^2 \sin(bb_1)^2) \sin(\omega t)^5 + (6 \cdot \\
& - 2 \cdot \sin(\omega t)^2) \sin(\omega t)^3 \cos(bb_1)^2 + ((12 \cdot \sin(bb_1)^2 \\
& - 6 \cdot \sin(\omega t)^2 \sin(bb_1)^2) \sin(\omega t)^3 + (6 \cdot \\
& - 4 \cdot \sin(\omega t)^2) \sin(\omega t) \cos(bb_1)^2 + ((6 \cdot \sin(bb_1)^2 \\
& - 6 \cdot \sin(\omega t)^2 \sin(bb_1)^2) \sin(\omega t) - 2 \cdot \cos(bb_1)^2 \sin(\omega t) \\
& - 2 \cdot \sin(\omega t) \cos(\omega t)^2 \sin(bb_1)^2) \cos(\omega t)^2) \cos(\omega t)^2) \\
& \cos(\omega t) aa_F m_b^3 \sin(bb_2)^2 + ((((6 \cdot \sin(bb_1)^2 \\
& - 2 \cdot \sin(\omega t)^2 \sin(bb_1)^2) \sin(\omega t)^3 + (-4 \cdot \sin(\omega t)^2 \\
& + 4 \cdot) \sin(\omega t) \cos(bb_1)^2) \cos(bb_1) + ((((6 \cdot \sin(bb_1)^2 \\
& - 4 \cdot \sin(\omega t)^2 \sin(bb_1)^2) \sin(\omega t) - 4 \cdot \cos(bb_1)^2 \sin(\omega t)) \\
& \cos(bb_1) - 2 \cdot \sin(\omega t) \cos(bb_1) \cos(\omega t)^2 \sin(bb_1)^2) \cos(\omega t)^2) \\
& \cos(\omega t) aa_F m_b^3 + (((-2 \cdot \sin(bb_1)^2 \\
& + 2 \cdot \sin(\omega t)^2 \sin(bb_1)^2) \sin(\omega t)^3 + (-2 \cdot \\
& + 2 \cdot \sin(\omega t)^2) \sin(\omega t) \cos(bb_1)^2) \cos(bb_1) + ((((-2 \cdot \sin(bb_1)^2 \\
& + 4 \cdot \sin(\omega t)^2 \sin(bb_1)^2) \sin(\omega t) + 2 \cdot \cos(bb_1)^2 \sin(\omega t)) \\
& \cos(bb_1) + 2 \cdot \sin(\omega t) \cos(bb_1) \cos(\omega t)^2 \sin(bb_1)^2) \cos(\omega t)^2) \\
& m_b^3 bb_F_1 + (((4 \cdot \sin(bb_1)^2 - 4 \cdot \sin(\omega t)^2 \sin(bb_1)^2) \sin(\omega t)^3 \\
& + (-4 \cdot \sin(\omega t)^2 + 4 \cdot) \sin(\omega t) \cos(bb_1)^2 + (((4 \cdot \sin(bb_1)^2 \\
& - 8 \cdot \sin(\omega t)^2 \sin(bb_1)^2) \sin(\omega t) - 4 \cdot \cos(bb_1)^2 \sin(\omega t) \\
& - 4 \cdot \sin(\omega t) \cos(\omega t)^2 \sin(bb_1)^2) \cos(\omega t)^2) \\
& \cos(\omega t) aa_F m_b^3 \cos(bb_2)) \cos(bb_2) \cos(bb_2) \\
& + ((((2 \cdot \sin(bb_1)^2 - 2 \cdot \sin(\omega t)^2 \sin(bb_1)^2) \sin(\omega t)^5 + (2 \cdot \\
& - 2 \cdot \sin(\omega t)^2) \sin(\omega t)^3 \cos(bb_1)^2 + (((4 \cdot \sin(bb_1)^2 \\
& - 6 \cdot \sin(\omega t)^2 \sin(bb_1)^2) \sin(\omega t)^3 + (-4 \cdot \sin(\omega t)^2 \\
& + 2 \cdot) \sin(\omega t) \cos(bb_1)^2 + (((2 \cdot \sin(bb_1)^2 \\
& - 6 \cdot \sin(\omega t)^2 \sin(bb_1)^2) \sin(\omega t) - 2 \cdot \cos(bb_1)^2 \sin(\omega t) \\
& - 2 \cdot \sin(\omega t) \cos(\omega t)^2 \sin(bb_1)^2) \cos(\omega t)^2) \cos(\omega t)^2) \\
& m_b^3 \sin(bb_2)^2 + (((2 \cdot \sin(bb_1)^2 - 2 \cdot \sin(\omega t)^2 \sin(bb_1)^2) \sin(\omega t)^3 \\
& + (2 \cdot - 2 \cdot \sin(\omega t)^2) \sin(\omega t) \cos(bb_1)^2 + (((2 \cdot \sin(bb_1)^2 \\
& - 4 \cdot \sin(\omega t)^2 \sin(bb_1)^2) \sin(\omega t) - 2 \cdot \cos(bb_1)^2 \sin(\omega t)
\end{aligned}$$

$$\begin{aligned}
& -2 \cdot \sin(\text{om } t) \cos(\text{om } t)^2 \sin(bb_1)^2 \cos(\text{om } t)^2 m_b^3 \cos(bb_2)^2 \\
& \cos(bb_2) bb_F_2 + ((-2 \cdot \sin(\text{om } t)^4 \sin(bb_1) \cos(bb_1)^2 + \\
& -4 \cdot \sin(\text{om } t)^2 \sin(bb_1) \cos(bb_1)^2 \\
& -2 \cdot \sin(bb_1) \cos(\text{om } t)^2 \cos(bb_1)^2 \cos(\text{om } t)^2 \\
& \cos(\text{om } t) m_b^3 \sin(bb_2)^2 + ((-2 \cdot \sin(\text{om } t)^2 \sin(bb_1) \cos(bb_1)^2 \\
& -2 \cdot \sin(bb_1) \cos(\text{om } t)^2 \cos(bb_1)^2 \cos(\text{om } t) m_b^3 \\
& + (2 \cdot \cos(bb_1)^2 \sin(\text{om } t)^2 + 2 \cdot \sin(\text{om } t)^4 \sin(bb_1)^2 \\
& + (4 \cdot \sin(\text{om } t)^2 \sin(bb_1)^2 + 2 \cdot \cos(bb_1)^2 \\
& + 2 \cdot \sin(bb_1)^2 \cos(\text{om } t)^2 \cos(\text{om } t)^2 \cos(\text{om } t) m_b^3 \sin(bb_2)) \\
& \cos(bb_2)^2) \text{om}) \text{om}) R) R) R) R \\
& + (256 \cdot m_b \sin(\text{om } t) \text{om} aa_F \cos(\text{om } t) JB^2 + \\
& -16 \cdot JB m_b^2 \sin(bb_1) aa_F^2 \cos(\text{om } t)^3 \cos(bb_1) \\
& + 16 \cdot m_b^2 \cos(bb_2) \sin(bb_2) \cos(\text{om } t)^3 aa_F^2 JB \\
& + ((64 \cdot \sin(\text{om } t)^3 \sin(bb_1)^2 + (48. \\
& -16 \cdot \sin(\text{om } t)^2 \sin(\text{om } t) \cos(bb_1)^2 + (64 \cdot \sin(\text{om } t) \sin(bb_1)^2 \\
& -16 \cdot \cos(bb_1)^2 \sin(\text{om } t) \cos(\text{om } t)^2 \cos(\text{om } t) aa_F m_b^2 JB \\
& + (64 \cdot \sin(\text{om } t)^3 \\
& + 64 \cdot \sin(\text{om } t) \cos(\text{om } t)^2 \cos(\text{om } t) aa_F m_b^2 JB \sin(bb_2)^2 + ((48. \\
& -16 \cdot \sin(\text{om } t)^2 \sin(\text{om } t) - 16 \cdot \sin(\text{om } t) \cos(\text{om } t)^2 \\
& \cos(\text{om } t) aa_F m_b^2 JB \cos(bb_2)^2 + ((\\
& -16 \cdot \sin(\text{om } t)^2 \sin(bb_1) \cos(bb_1) \\
& -16 \cdot \sin(bb_1) \cos(bb_1) \cos(\text{om } t)^2 \cos(\text{om } t) m_b^2 JB \\
& + (16 \cdot \sin(\text{om } t)^2 \\
& + 16 \cdot \cos(\text{om } t)^2 \cos(\text{om } t) m_b^2 JB \sin(bb_2) \cos(bb_2)) \text{om}) \text{om} + ((\\
& -4 \cdot \sin(\text{om } t)^2 \sin(bb_1) \cos(bb_1) - 4 \cdot \sin(bb_1) \cos(bb_1) \cos(\text{om } t)^2 \\
& \cos(\text{om } t)^3 aa_F^2 m_b^3 \sin(bb_2)^2 + ((4 \cdot \cos(bb_1)^2 \\
& + 4 \cdot \sin(\text{om } t)^2 \sin(bb_1)^2 + 4 \cdot \sin(bb_1)^2 \cos(\text{om } t)^2 \\
& \cos(\text{om } t)^3 aa_F^2 m_b^3 \sin(bb_2) \\
& -4 \cdot m_b^3 \cos(bb_1) \sin(bb_1) aa_F^2 \cos(\text{om } t)^3 \cos(bb_2)) \cos(bb_2) \\
& + ((16 \cdot \sin(\text{om } t)^5 \sin(bb_1)^2 + (12. \\
& -4 \cdot \sin(\text{om } t)^2 \sin(\text{om } t)^3 \cos(bb_1)^2 + (32 \cdot \sin(\text{om } t)^3 \sin(bb_1)^2 \\
& + (12. - 8 \cdot \sin(\text{om } t)^2 \sin(\text{om } t) \cos(bb_1)^2 + (16 \cdot \sin(\text{om } t) \sin(bb_1)^2 \\
& -4 \cdot \cos(bb_1)^2 \sin(\text{om } t) \cos(\text{om } t)^2 \cos(\text{om } t)^2 \\
& \cos(\text{om } t) aa_F m_b^3 \sin(bb_2)^2 + ((12 \cdot \sin(bb_1)^2 \\
& -4 \cdot \sin(\text{om } t)^2 \sin(bb_1)^2 \sin(\text{om } t)^3 + (8. \\
& -8 \cdot \sin(\text{om } t)^2 \sin(\text{om } t) \cos(bb_1)^2 + ((12 \cdot \sin(bb_1)^2
\end{aligned}$$

$$\begin{aligned}
& -8 \cdot \sin(\omega_m t)^2 \sin(bb_1)^2 \sin(\omega_m t) - 8 \cdot \cos(bb_1)^2 \sin(\omega_m t) \\
& - 4 \cdot \sin(\omega_m t) \cos(\omega_m t)^2 \sin(bb_1)^2 \cos(\omega_m t)^2 \\
& \cos(\omega_m t) aa_F m_b^3 \cos(bb_2)^2 + ((-4 \cdot \sin(\omega_m t)^4 \sin(bb_1) \cos(bb_1) \\
& + (-8 \cdot \sin(\omega_m t)^2 \sin(bb_1) \cos(bb_1) \\
& - 4 \cdot \sin(bb_1) \cos(bb_1) \cos(\omega_m t)^2) \cos(\omega_m t)^2) \\
& \cos(\omega_m t) m_b^3 \sin(bb_2)^2 + ((4 \cdot \sin(\omega_m t)^4 \sin(bb_1)^2 \\
& + 4 \cdot \cos(bb_1)^2 \sin(\omega_m t)^2 + (4 \cdot \cos(bb_1)^2 + 8 \cdot \sin(\omega_m t)^2 \sin(bb_1)^2 \\
& + 4 \cdot \sin(bb_1)^2 \cos(\omega_m t)^2) \cos(\omega_m t) m_b^3 \sin(bb_2) + (\\
& -4 \cdot \sin(\omega_m t)^2 \sin(bb_1) \cos(bb_1) - 4 \cdot \sin(bb_1) \cos(bb_1) \cos(\omega_m t)^2) \\
& \cos(\omega_m t) m_b^3 \cos(bb_2)) \cos(bb_2)) om) om) R^2) R^2) e) e)) / \\
& ((256 \cdot JT + 256 \cdot JB \sin(bb_1)^2 \sin(\omega_m t)^2) JB^2 \\
& + 256 \cdot JB^3 \sin(\omega_m t)^2 \sin(bb_2)^2 + (128 \cdot m_b + 16 \cdot m_t) JB^2 l^2 \\
& + (((64 \cdot \sin(\omega_m t)^2 \sin(bb_1)^2 + 64 \cdot \sin(bb_1)^2 \cos(\omega_m t)^2 \\
& + 64 \cdot \cos(bb_1)^2) JT m_b + ((64 \cdot \\
& + 64 \cdot \sin(bb_1)^2) \sin(bb_1)^2 \sin(\omega_m t)^4 \\
& + 64 \cdot \cos(bb_1)^2 \sin(bb_1)^2 \sin(\omega_m t)^2 + (64 \cdot \\
& + 64 \cdot \sin(bb_1)^2) \sin(bb_1)^2 \sin(\omega_m t)^2 \cos(\omega_m t)^2) m_b JB) JB \\
& + (((64 \cdot \sin(\omega_m t)^2 + 64 \cdot \cos(\omega_m t)^2) JT m_b + ((64 \cdot \\
& + 128 \cdot \sin(bb_1)^2) \sin(\omega_m t)^4 + 64 \cdot \cos(bb_1)^2 \sin(\omega_m t)^2 + (64 \cdot \\
& + 128 \cdot \sin(bb_1)^2) \sin(\omega_m t)^2 \cos(\omega_m t)^2) m_b JB) JB + (64 \cdot \sin(\omega_m t)^4 \\
& + 64 \cdot \sin(\omega_m t)^2 \cos(\omega_m t)^2) m_b JB^2 \sin(bb_2)^2) \sin(bb_2)^2 \\
& + ((64 \cdot m_b JT + 64 \cdot m_b \sin(bb_1)^2 \sin(\omega_m t)^2) JB \\
& + 64 \cdot m_b JB^2 \sin(\omega_m t)^2 \sin(bb_2)^2) \cos(bb_2)^2 + (((4 \cdot \cos(bb_1)^2 \\
& + 4 \cdot \sin(\omega_m t)^2 \sin(bb_1)^2 + 4 \cdot \sin(bb_1)^2 \cos(\omega_m t)^2) m_t \\
& + (16 \cdot \cos(bb_1)^2 + 32 \cdot \sin(bb_1)^2 \cos(\omega_m t)^2 \\
& + 32 \cdot \sin(\omega_m t)^2 \sin(bb_1)^2) m_b) m_b JB + ((4 \cdot \sin(\omega_m t)^2 \\
& + 4 \cdot \cos(\omega_m t)^2) m_t + (32 \cdot \cos(\omega_m t)^2 + 32 \cdot \sin(\omega_m t)^2) m_b) \\
& m_b JB \sin(bb_2)^2 + (4 \cdot m_t + 16 \cdot m_b) m_b JB \cos(bb_2)^2) l^2 \\
& + ((16 \cdot \sin(\omega_m t)^6 \sin(bb_1)^4 + 16 \cdot \cos(bb_1)^2 \sin(bb_1)^2 \sin(\omega_m t)^4 \\
& + (16 \cdot \cos(bb_1)^2 \sin(bb_1)^2 \sin(\omega_m t)^2 + 32 \cdot \sin(\omega_m t)^4 \sin(bb_1)^4 \\
& + 16 \cdot \cos(\omega_m t)^2 \sin(bb_1)^4 \sin(\omega_m t)^2) \cos(\omega_m t)^2) m_b^2 JB \\
& + ((16 \cdot \cos(bb_1)^2 \sin(\omega_m t)^2 + 16 \cdot \sin(\omega_m t)^4 \sin(bb_1)^2 \\
& + (16 \cdot \cos(bb_1)^2 + 32 \cdot \sin(\omega_m t)^2 \sin(bb_1)^2 \\
& + 16 \cdot \sin(bb_1)^2 \cos(\omega_m t)^2) \cos(\omega_m t)^2) JT m_b^2 + ((32 \cdot \\
& + 16 \cdot \sin(bb_1)^2) \sin(bb_1)^2 \sin(\omega_m t)^6 + (16 \cdot \\
& + 16 \cdot \sin(bb_1)^2) \sin(\omega_m t)^4 \cos(bb_1)^2 + ((64 \cdot
\end{aligned}$$

$$\begin{aligned}
& + 32. \sin(bb_1)^2) \sin(bb_1)^2 \sin(om t)^4 + (16. \\
& + 16. \sin(bb_1)^2) \sin(om t)^2 \cos(bb_1)^2 + (32. \\
& + 16. \sin(bb_1)^2) \sin(bb_1)^2 \sin(om t)^2 \cos(om t)^2) \cos(om t)^2) m_b^2 JB \\
& + ((16. + 16. \sin(bb_1)^2) \sin(om t)^6 + 16. \sin(om t)^4 \cos(bb_1)^2 + ((32. \\
& + 32. \sin(bb_1)^2) \sin(om t)^4 + 16. \cos(bb_1)^2 \sin(om t)^2 + (16. \\
& + 16. \sin(bb_1)^2) \sin(om t)^2 \cos(om t)^2) \cos(om t)^2) m_b^2 JB \sin(bb_2)^2) \\
& \sin(bb_2)^2 + ((16. \cos(bb_1)^2 + 16. \sin(om t)^2 \sin(bb_1)^2 \\
& + 16. \sin(bb_1)^2 \cos(om t)^2) JT m_b^2 + ((16. \\
& + 16. \sin(bb_1)^2) \sin(bb_1)^2 \sin(om t)^4 \\
& + 16. \cos(bb_1)^2 \sin(bb_1)^2 \sin(om t)^2 + (16. \\
& + 16. \sin(bb_1)^2) \sin(bb_1)^2 \sin(om t)^2 \cos(om t)^2) m_b^2 JB + ((16. \\
& + 16. \sin(bb_1)^2) \sin(om t)^4 + 16. \cos(bb_1)^2 \sin(om t)^2 + (16. \\
& + 16. \sin(bb_1)^2) \sin(om t)^2 \cos(om t)^2) m_b^2 JB \sin(bb_2)^2) \cos(bb_2)^2 \\
& + (((\cos(bb_1)^2 \sin(om t)^2 + \sin(om t)^4 \sin(bb_1)^2 + (\cos(bb_1)^2 \\
& + 2. \sin(om t)^2 \sin(bb_1)^2 + \sin(bb_1)^2 \cos(om t)^2) \cos(om t)^2) m_t \\
& + (8. \sin(om t)^4 \sin(bb_1)^2 + 4. \cos(bb_1)^2 \sin(om t)^2 + (4. \cos(bb_1)^2 \\
& + 16. \sin(om t)^2 \sin(bb_1)^2 + 8. \sin(bb_1)^2 \cos(om t)^2) \cos(om t)^2) m_b) \\
& m_b^2 \sin(bb_2)^2 + ((\sin(om t)^2 \sin(bb_1)^2 + \cos(bb_1)^2 \\
& + \sin(bb_1)^2 \cos(om t)^2) m_t + (4. \sin(om t)^2 \sin(bb_1)^2 \\
& + 4. \sin(bb_1)^2 \cos(om t)^2) m_b) m_b^2 \cos(bb_2)^2) l^2 \\
& + (((4. \sin(om t)^6 \cos(bb_1)^2 \sin(bb_1)^2 + 4. \sin(om t)^8 \sin(bb_1)^4 \\
& + (8. \cos(bb_1)^2 \sin(bb_1)^2 \sin(om t)^4 + 12. \sin(om t)^6 \sin(bb_1)^4 \\
& + (4. \cos(bb_1)^2 \sin(bb_1)^2 \sin(om t)^2 + 12. \sin(om t)^4 \sin(bb_1)^4 \\
& + 4. \cos(om t)^2 \sin(bb_1)^4 \sin(om t)^2) \cos(om t)^2) m_b^3 \\
& + (4. \sin(om t)^8 \sin(bb_1)^2 + 4. \sin(om t)^6 \cos(bb_1)^2 \\
& + (8. \sin(om t)^4 \cos(bb_1)^2 + 12. \sin(om t)^6 \sin(bb_1)^2 \\
& + (4. \cos(bb_1)^2 \sin(om t)^2 + 12. \sin(om t)^4 \sin(bb_1)^2 \\
& + 4. \sin(om t)^2 \sin(bb_1)^2 \cos(om t)^2) \cos(om t)^2) \cos(om t)^2) \\
& m_b^3 \sin(bb_2)^2) \sin(bb_2)^2 + ((4. \sin(om t)^6 \sin(bb_1)^4 \\
& + 4. \cos(bb_1)^2 \sin(bb_1)^2 \sin(om t)^4 \\
& + (4. \cos(bb_1)^2 \sin(bb_1)^2 \sin(om t)^2 + 8. \sin(om t)^4 \sin(bb_1)^4 \\
& + 4. \cos(om t)^2 \sin(bb_1)^4 \sin(om t)^2) \cos(om t)^2) m_b^3 \\
& + (4. \sin(om t)^6 \sin(bb_1)^2 + 4. \sin(om t)^4 \cos(bb_1)^2 \\
& + (8. \sin(om t)^4 \sin(bb_1)^2 + 4. \cos(bb_1)^2 \sin(om t)^2 \\
& + 4. \sin(om t)^2 \sin(bb_1)^2 \cos(om t)^2) \cos(om t)^2) m_b^3 \sin(bb_2)^2) \\
& \cos(bb_2)^2) R^2) R^2 + (((- 64. m_b^2 \cos(om t) \cos(bb_2)^2) JB
\end{aligned}$$

```

+ 64. JB cos(om t) m_b2 cos(bb_1)2) l + (( 16. cos(bb_1)2 sin(om t)2
+ 16. cos(bb_1)2 cos(om t)2) cos(om t) m_b3 sin(bb_2)2 +
- 16. sin(om t)2 sin(bb_1)2 - 16. sin(bb_1)2 cos(om t)2)
cos(om t) m_b3 cos(bb_2)2) l R2 + (512. JB2 m_b cos(om t)2
+ (( 64. cos(bb_1)2 + 128. sin(om t)2 sin(bb_1)2
+ 128. sin(bb_1)2 cos(om t)2) cos(om t)2 m_b2 JB + (128. sin(om t)2
+ 128. cos(om t)2) cos(om t)2 m_b2 JB sin(bb_2)2
+ 64. m_b2 cos(bb_2)2 JB cos(om t)2 + (( 16. cos(bb_1)2 sin(om t)2
+ 32. sin(om t)4 sin(bb_1)2 + (16. cos(bb_1)2 + 64. sin(om t)2 sin(bb_1)2
+ 32. sin(bb_1)2 cos(om t)2) cos(om t)2) cos(om t)2 m_b3 sin(bb_2)2
+ (16. sin(om t)2 sin(bb_1)2
+ 16. sin(bb_1)2 cos(om t)2) cos(om t)2 m_b3 cos(bb_2)2) R2) R2) e) e)

```

> **length(%);**

89306

(14.3.3.11)

[>

Linearized equations of motion using the Lagrangian

lin eq of motion for beta_1

```

> eq_mo_beta1_FF_lin := subs({sin(bb_1)=bb_1, sin(bb_2)=bb_2,
cos(bb_1)=1, cos(bb_2)=1, cos(aa)=1,sin(aa)=aa},bb_FF_1);
eq_mo_beta1_FF_lin := - (1. (- 4. JB aa_FF cos(om t) + R m_b l aa_FF + 4. kb bb_1 (15.1.1)
- 1. m_b R2 aa_FF cos(om t) + 8. JB aa_F sin(om t) om
- 2. m_b R2 aa_F2 sin(om t)2 bb_1 cos(om t)2 + m_b R2 sin(om t)3 om aa_F
+ 2. m_b g_R bb_1 cos(om t) - 1. m_b R2 aa_F2 sin(om t)4 bb_1
- 4. JB aa_F sin(om t) bb_12 om - 4. aa_F2 sin(om t)2 bb_1 JB
+ 2. m_b R e sin(om t)3 om aa_F - 2. m_b aa_FF cos(om t) R e
- 1. m_b R2 cos(om t)3 bb_12 aa_FF - 1. m_b R2 bb_1 bb_F_I2
+ 2. m_b R e sin(om t)2 om2 bb_1 + m_b R2 bb_1 aa_F2 cos(om t)2
+ 2. m_b aa_F sin(om t) om R e + m_b R2 cos(om t)2 bb_1 bb_F_I2
- 1. m_b R2 cos(om t)4 bb_1 aa_F2 + m_b R2 bb_1 sin(om t)2 bb_F_I2
+ 2. m_b R e cos(om t)2 om2 bb_1 - 1. m_b R bb_1 l aa_F2 cos(om t)
+ m_b R2 sin(om t)2 om2 bb_1 + 2. m_b R e sin(om t) om cos(om t)2 aa_F

```

```

- 2. m_b g_R aa + m_b R2 sin(om t) om cos(om t)2 aa_F
+ 2. m_b R bb_I e cos(om t)2 aa_F2 + 4. JB om2 bb_I
- 1. m_b R2 bb_I2 sin(om t)2 aa_FF cos(om t) + m_b R2 cos(om t)2 om2 bb_I
+ m_b R2 aa_F sin(om t) om ) / (4. JB + R2 m_b sin(om t)2 bb_I2 + R2 m_b
+ R2 m_b cos(om t)2 bb_I2)

> `starting length` = length(%), `converting to horner`=length
(convert(% ,horner)), factoring=length(factor(%)), `simplify
length` = length(simplify(%));
starting length = 1696, converting to horner = 1445, factoring = 1693, simplify length      (15.1.2)
= 1709

```

▼ lin eq of motion for beta_2

```

> eq_mo_beta2_FF_lin := subs({sin(bb_1)=bb_1, sin(bb_2)=bb_2,
cos(bb_1)=1, cos(bb_2)=1, cos(aa)=1,sin(aa)=aa},bb_FF_2);
eq_mo_beta2_FF_lin := - (1. (4. JB aa_FF cos(om t) + R m_b l aa_FF
+ m_b R2 aa_FF cos(om t) - 8. JB aa_F sin(om t) om
- 1. m_b R2 sin(om t)3 om aa_F - 2. m_b R e sin(om t)3 om aa_F
+ 2. m_b aa_FF cos(om t) R e - 1. m_b R2 bb_2 bb_F_22
+ m_b R2 bb_2 aa_F2 cos(om t)2 - 1. m_b R2 aa_F2 sin(om t)4 bb_2
- 4. aa_F2 sin(om t)2 bb_2 JB + 2. m_b R e cos(om t)2 om2 bb_2
+ m_b R2 sin(om t)2 om2 bb_2 + 2. m_b R e sin(om t)2 om2 bb_2
- 2. m_b g_R bb_2 cos(om t) + m_b R2 aa_FF bb_22 cos(om t)3
+ m_b R bb_2 l aa_F2 cos(om t) + 2. m_b R bb_2 e cos(om t)2 aa_F2
+ m_b R2 sin(om t)2 bb_2 bb_F_22 + m_b R2 cos(om t)2 bb_2 bb_F_22
+ m_b R2 cos(om t)2 om2 bb_2 + 4. JB aa_F sin(om t) bb_22 om
- 1. m_b R2 aa_F2 cos(om t)4 bb_2 + 4. kb bb_2 - 2. m_b aa_F sin(om t) om R e
- 2. m_b R e sin(om t) om cos(om t)2 aa_F - 2. m_b g_R aa
- 1. m_b R2 sin(om t) om cos(om t)2 aa_F
+ m_b R2 aa_FF bb_22 cos(om t) sin(om t)2 + 4. JB om2 bb_2
- 1. m_b R2 aa_F sin(om t) om - 2. m_b R2 aa_F2 sin(om t)2 bb_2 cos(om t)2 ) )
(4. JB + R2 m_b cos(om t)2 bb_22 + R2 m_b sin(om t)2 bb_22 + R2 m_b)

> `starting length` = length(%), `converting to horner`=length
(convert(% ,horner)), factoring=length(factor(%));
starting length = 1693, converting to horner = 1439, factoring = 1690      (15.2.2)

```

▼ lin eq of motion for rho

```
> eq_mo_rho_FF_lin := subs({sin(bb_1)=bb_1, sin(bb_2)=bb_2, cos
```

```

(bb_1)=1, cos(bb_2)=1, cos(aa)=1,sin(aa)=aa},T5_eq_rho[full])
;
eq_mo_rho_FF_lin:= (4. (( -64. ka aa + 64. cos(om t) aa_F^2 sin(om t)^2 bb_1 JB) JB^2 (15.3.1)
- 128. sin(om t)^2 bb_1 aa_F bb_F_1 JB^3
- 64. cos(om t) aa_F^2 sin(om t)^2 bb_2 JB^3 - 64. cos(om t) kb bb_1 JB^2
+ (64. m_b g_aa + 16. m_t g_aa) JB^2 l - 128. sin(om t)^2 bb_2 aa_F bb_F_2 JB^3
+ 64. cos(om t) kb bb_2 JB^2 + (((128. - 64. bb_1^2) sin(om t)
- 64. sin(om t)) cos(om t) aa_F JB^3 + ((-64. bb_1^2 - 64.) sin(om t)
+ 64. sin(om t)) JB^3 bb_F_1 - 64. cos(om t) JB^3 aa_F sin(om t) bb_2^2
- 64. cos(om t) JB^3 sin(om t) aa_F + 64. JB^3 sin(om t) bb_2^2 bb_F_2) om + (((-32. bb_1 cos(om t)^2 + 32. bb_1) g_m_b JB^2 + (32.
- 32. cos(om t)^2) g_m_b JB^2 bb_2 + ((16. bb_1 cos(om t)^2
- 16. sin(om t)^2 bb_1) aa_F^2 m_b JB^2 + (-32. m_b bb_1 aa_F cos(om t) JB^2
+ 16. m_b bb_1 JB^2 bb_F_1) bb_F_1 + 16. m_b bb_2 aa_F^2 cos(om t)^2 JB^2
- 16. m_b aa_F^2 sin(om t)^2 bb_2 JB^2 + 16. m_b kb bb_1 JB) l
+ (32. m_b l bb_2 aa_F cos(om t) JB^2 + 16. m_b l bb_2 JB^2 bb_F_2) bb_F_2
+ 16. m_b l kb bb_2 JB + ((((-16. - 16. bb_1^2) sin(om t)
+ 16. sin(om t)) aa_F m_b JB^2 + 16. m_b JB^2 aa_F sin(om t) bb_2^2) l
+ (16. m_b JB^2 bb_1 + 16. m_b JB^2 bb_2) l om) om + ((((-16. aa
- 16. aa cos(om t)^2 bb_1^2 - 16. aa sin(om t)^2 bb_1^2) ka m_b + ((16.
+ 16. bb_1^2) bb_1 sin(om t)^4 + 16. sin(om t)^2 bb_1 + (-16. bb_1 + (32.
+ 16. bb_1^2) bb_1 sin(om t)^2 + 16. bb_1 cos(om t)^2) cos(om t)^2)
cos(om t) aa_F^2 m_b JB) JB + ((((-32. - 32. bb_1^2) bb_1 sin(om t)^4
- 32. sin(om t)^2 bb_1 + (32. bb_1 + (-64. - 32. bb_1^2) bb_1 sin(om t)^2
- 32. bb_1 cos(om t)^2) cos(om t)^2) aa_F m_b JB^2 + (16. sin(om t)^2 bb_1
- 16. bb_1 + 16. bb_1 cos(om t)^2) cos(om t) m_b JB^2 bb_F_1) bb_F_1 + ((((-16. aa sin(om t)^2 - 16. aa cos(om t)^2) ka m_b + (16. sin(om t)^4 bb_1
+ 16. sin(om t)^2 cos(om t)^2 bb_1) cos(om t) aa_F^2 m_b JB) JB + (
-32. sin(om t)^2 cos(om t)^2 bb_1 - 32. sin(om t)^4 bb_1) aa_F m_b JB^2 bb_F_1)
bb_2^2 + ((((-16. - 16. bb_1^2) sin(om t)^4 - 16. sin(om t)^2 + (16. + (-32.
- 16. bb_1^2) sin(om t)^2 - 16. cos(om t)^2) cos(om t)^2) cos(om t) aa_F^2 m_b JB^2
+ (-16. sin(om t)^4 - 16. sin(om t)^2 cos(om t)^2) cos(om t) aa_F^2 m_b JB^2 bb_2^2)
bb_2 + (-16. ka aa m_b + 16. cos(om t) aa_F^2 sin(om t)^2 bb_1 m_b JB) JB
- 32. sin(om t)^2 bb_1 aa_F bb_F_1 m_b JB^2
- 16. m_b cos(om t) aa_F^2 sin(om t)^2 bb_2 JB^2 + ((-16. sin(om t)^2 bb_1^2 - 16.
- 16. bb_1^2 cos(om t)^2) cos(om t) kb m_b JB + (-16. sin(om t)^2

```

$$\begin{aligned}
& -16 \cdot \cos(om t)^2) \cos(om t) kb m_b JB bb_2^2 - 16 \cdot m_b \cos(om t) kb JB) bb_1 \\
& + ((4 \cdot aa \cos(om t)^2 bb_1^2 + 4 \cdot aa + 4 \cdot aa \sin(om t)^2 bb_1^2) g_m_t + (8 \cdot aa \\
& + 16 \cdot aa \sin(om t)^2 bb_1^2 + (8 \cdot bb_1 + 16 \cdot aa bb_1^2 \cos(om t)) \cos(om t)) \\
& g_m_b) m_b JB + ((4 \cdot aa \cos(om t)^2 + 4 \cdot aa \sin(om t)^2) g_m_t \\
& + (16 \cdot aa \cos(om t)^2 + 16 \cdot aa \sin(om t)^2) g_m_b) m_b JB bb_2^2 \\
& - 8 \cdot m_b^2 g_bb_2 \cos(om t) JB + (4 \cdot m_t g_aa + 8 \cdot m_b g_aa) m_b JB \\
& + (4 \cdot m_b^2 bb_2 aa_F^2 \cos(om t) JB - 4 \cdot m_b^2 bb_1 aa_F^2 \cos(om t) JB) l) l \\
& + ((((-32 \cdot -32 \cdot bb_1^2) \sin(om t)^4 - 32 \cdot \sin(om t)^2 + (32 \cdot + (-64 \cdot \\
& - 32 \cdot bb_1^2) \sin(om t)^2 - 32 \cdot \cos(om t)^2) \cos(om t)^2) aa_F m_b JB^2 + (\\
& - 32 \cdot \sin(om t)^2 \cos(om t)^2 - 32 \cdot \sin(om t)^4) aa_F m_b JB^2 bb_2^2) bb_2 \\
& - 32 \cdot \sin(om t)^2 bb_2 aa_F m_b JB^2 + (-16 \cdot \sin(om t)^2 + 16 \cdot \\
& - 16 \cdot \cos(om t)^2) \cos(om t) m_b JB^2 bb_2 bb_F_2) bb_F_2 + ((16 \cdot \\
& + 16 \cdot \sin(om t)^2 bb_1^2 + 16 \cdot bb_1^2 \cos(om t)^2) \cos(om t) kb m_b JB \\
& + (16 \cdot \sin(om t)^2 + 16 \cdot \cos(om t)^2) \cos(om t) kb m_b JB bb_2^2 \\
& + 16 \cdot m_b \cos(om t) kb JB) bb_2 + (((32 \cdot -16 \cdot bb_1^2) bb_1^2 \sin(om t)^3 + (\\
& - 16 \cdot bb_1^2 + 48 \cdot + (-16 \cdot -16 \cdot bb_1^2) \sin(om t)^2) \sin(om t) - 16 \cdot \sin(om t) \\
& + ((32 \cdot -16 \cdot bb_1^2) bb_1^2 \sin(om t) + (-16 \cdot \\
& - 16 \cdot bb_1^2) \sin(om t)) \cos(om t)^2) \cos(om t) aa_F m_b JB^2 + ((-48 \cdot \\
& - 16 \cdot bb_1^2) bb_1^2 \sin(om t)^3 + (-32 \cdot -16 \cdot bb_1^2 + (16 \cdot \\
& + 16 \cdot bb_1^2) \sin(om t)^2) \sin(om t) + 16 \cdot \sin(om t) + ((-48 \cdot \\
& - 16 \cdot bb_1^2) bb_1^2 \sin(om t) + (16 \cdot + 16 \cdot bb_1^2) \sin(om t)) \cos(om t)^2) \\
& m_b JB^2 bb_F_1 + (((32 \cdot -32 \cdot bb_1^2) \sin(om t)^3 + (-16 \cdot \\
& - 16 \cdot \sin(om t)^2) \sin(om t) + ((32 \cdot -32 \cdot bb_1^2) \sin(om t) \\
& - 16 \cdot \sin(om t)) \cos(om t)^2) \cos(om t) aa_F m_b JB^2 + ((-16 \cdot \\
& - 16 \cdot bb_1^2) \sin(om t)^3 + 16 \cdot \sin(om t)^3 + ((-16 \cdot -16 \cdot bb_1^2) \sin(om t) \\
& + 16 \cdot \sin(om t)) \cos(om t)^2) m_b JB^2 bb_F_1 + (-16 \cdot \sin(om t)^3 \\
& - 16 \cdot \sin(om t) \cos(om t)^2) \cos(om t) aa_F m_b JB^2 bb_2^2 + ((\\
& - 16 \cdot bb_1^2 + 48 \cdot + (-16 \cdot -16 \cdot bb_1^2) \sin(om t)^2) \sin(om t) - 32 \cdot \sin(om t) + (\\
& - 16 \cdot -16 \cdot bb_1^2) \sin(om t) \cos(om t)^2) \cos(om t) aa_F m_b JB^2 + ((-16 \cdot \\
& - 16 \cdot bb_1^2) \sin(om t) + 16 \cdot \sin(om t)) m_b JB^2 bb_F_1 + ((-16 \cdot \\
& - 16 \cdot \sin(om t)^2) \sin(om t) - 16 \cdot \sin(om t) \cos(om t)^2) \\
& \cos(om t) aa_F m_b JB^2 bb_2^2 - 16 \cdot \cos(om t) m_b \sin(om t) aa_F JB^2 \\
& + ((16 \cdot \sin(om t) \cos(om t)^2 bb_1^2 + 16 \cdot \sin(om t) \\
& + 16 \cdot \sin(om t)^3 bb_1^2) m_b JB^2 + (((16 \cdot bb_1^2 + 48 \cdot) \sin(om t)^3 \\
& + 16 \cdot \sin(om t) + (16 \cdot bb_1^2 + 48 \cdot) \sin(om t) \cos(om t)^2) m_b JB^2 \\
& + (16 \cdot \sin(om t)^3 + 16 \cdot \sin(om t) \cos(om t)^2) m_b JB^2 bb_2^2 + ((32 \cdot +
\end{aligned}$$

$$\begin{aligned}
& -16. - 16. bb_I^2) \sin(om t)^2) \sin(om t) - 16. \sin(om t) + (-16. \\
& - 16. bb_I^2) \sin(om t) \cos(om t)^2) m_b JB^2 + ((-16. \sin(om t)^2 \\
& + 16.) \sin(om t) - 16. \sin(om t) \cos(om t)^2) m_b JB^2 bb_2^2 \\
& - 16. JB^2 \sin(om t) m_b) bb_F_2) om + ((8. bb_I^3 \sin(om t)^2 + 8. bb_I + (\\
& - 8. bb_I - 8. bb_I^3 \sin(om t)^2 + 8. bb_I^3 - 8. bb_I^3 \cos(om t)^2) \cos(om t)^2) \\
& g_m_b^2 JB + ((8. \sin(om t)^2 bb_I^2 + 8. + (-8. + 8. bb_I^2 - 8. \sin(om t)^2 bb_I^2 \\
& - 8. bb_I^2 \cos(om t)^2) \cos(om t)^2) g_m_b^2 JB + ((8. \sin(om t)^2 bb_I \\
& + (8. bb_I - 8. \sin(om t)^2 bb_I - 8. bb_I \cos(om t)^2) \cos(om t)^2) g_m_b^2 JB \\
& + (8. \sin(om t)^2 + (8. - 8. \sin(om t)^2 \\
& - 8. \cos(om t)^2) \cos(om t)^2) g_m_b^2 JB bb_2) bb_2 + (8. bb_I \\
& - 8. bb_I \cos(om t)^2) g_m_b^2 JB + (8. - 8. \cos(om t)^2) g_m_b^2 JB bb_2 + ((\\
& - 4. \sin(om t)^4 bb_I + (4. bb_I^3 \sin(om t)^2 - 8. \sin(om t)^2 bb_I + 8. bb_I + (\\
& - 4. bb_I + 4. bb_I^3) \cos(om t)^2) \cos(om t)^2) aa_F^2 m_b^2 JB + ((-8. bb_I \\
& - 8. bb_I^3 \sin(om t)^2 - 8. bb_I^3 \cos(om t)^2) \cos(om t) aa_F m_b^2 JB \\
& + (4. bb_I^3 \sin(om t)^2 + 4. \sin(om t)^2 bb_I + (4. bb_I \\
& + 4. bb_I^3) \cos(om t)^2) m_b^2 JB bb_F_1) bb_F_1 + ((4. + 4. \sin(om t)^2 bb_I^2 \\
& + 4. bb_I^2 \cos(om t)^2) \cos(om t)^2 aa_F^2 m_b^2 JB + ((-4. \sin(om t)^4 bb_I \\
& + 4. bb_I \cos(om t)^4) aa_F^2 m_b^2 JB + ((-8. \sin(om t)^2 bb_I \\
& - 8. bb_I \cos(om t)^2) \cos(om t) aa_F m_b^2 JB + (4. \sin(om t)^2 bb_I \\
& + 4. bb_I \cos(om t)^2) m_b^2 JB bb_F_1) bb_F_1 + (4. \sin(om t)^2 \\
& + 4. \cos(om t)^2) \cos(om t)^2 aa_F^2 m_b^2 JB bb_2) bb_2 \\
& + (4. bb_I \cos(om t)^2 - 4. \sin(om t)^2 bb_I) aa_F^2 m_b^2 JB + (\\
& - 8. m_b^2 bb_I aa_F \cos(om t) JB + 4. m_b^2 bb_I JB bb_F_1) bb_F_1 + ((-4. \\
& - 4. bb_I^2) \sin(om t)^4 - 4. \sin(om t)^2 + (8. + (-8. - 4. bb_I^2) \sin(om t)^2 \\
& - 4. \cos(om t)^2) \cos(om t)^2) aa_F^2 m_b^2 JB bb_2 + ((4. \sin(om t)^2 \\
& + 4. \cos(om t)^2) kb m_b^2 bb_2^2 + 4. m_b^2 kb) bb_1) l + (((((8. \sin(om t)^2 bb_I^2 \\
& + 8. + 8. bb_I^2 \cos(om t)^2) \cos(om t) aa_F m_b^2 JB + (8. \sin(om t)^2 \\
& + 8. \cos(om t)^2) \cos(om t) aa_F m_b^2 JB bb_2^2) bb_2 \\
& + 8. m_b^2 bb_2 aa_F \cos(om t) JB) l + (((4. + 4. \sin(om t)^2 bb_I^2 \\
& + 4. bb_I^2 \cos(om t)^2) m_b^2 JB + (4. \sin(om t)^2 + 4. \cos(om t)^2) m_b^2 JB bb_2^2) \\
& bb_2 + (4. \sin(om t)^2 + 4. \cos(om t)^2) m_b^2 JB bb_2) l bb_F_2) bb_F_2 + (4. \\
& + 4. \sin(om t)^2 bb_I^2 + 4. bb_I^2 \cos(om t)^2) kb m_b^2 l bb_2 + (((\\
& - 8. \sin(om t)^3 bb_I^2 + (-4. + 4. \sin(om t)^2) \sin(om t) + (-8. \sin(om t) bb_I^2 \\
& + 4. \sin(om t) \cos(om t)^2) aa_F m_b^2 JB + ((-4. - 4. bb_I^2) \sin(om t)^3 \\
& + 4. \sin(om t)^3 + ((-4. - 4. bb_I^2) \sin(om t) + 4. \sin(om t)) \cos(om t)^2) \\
& aa_F m_b^2 JB bb_2^2 + (4. \sin(om t) \cos(om t)^2 bb_I^2 + 4. \sin(om t)^3 bb_I^2
\end{aligned}$$

$$\begin{aligned}
& + 4. \sin(om t)) aa_F m_b^2 JB + ((8. + 4. bb_I^2) \sin(om t)^3 + 4. \sin(om t) + (8. \\
& + 4. bb_I^2) \sin(om t) \cos(om t)^2) aa_F m_b^2 JB bb_2^2 + ((-4. \\
& - 4. bb_I^2) \sin(om t) + 4. \sin(om t)) aa_F m_b^2 JB + ((4. + (-4. \\
& - 4. bb_I^2) \sin(om t)^2) \sin(om t) - 4. \sin(om t) + (-4. \\
& - 4. bb_I^2) \sin(om t) \cos(om t)^2) aa_F m_b^2 JB) l + ((4. \sin(om t)^2 bb_I \\
& + 4. bb_I \cos(om t)^2) m_b^2 JB + (4. \sin(om t)^2 bb_I \\
& + 4. bb_I \cos(om t)^2) m_b^2 JB bb_2^2 + 4. m_b^2 JB bb_I + ((4. \\
& + 4. bb_I^2) \sin(om t)^2 + 4. + (4. + 4. bb_I^2) \cos(om t)^2) m_b^2 JB bb_2) l om \\
& om + ((4. \sin(om t)^6 bb_I^3 + 4. \sin(om t)^4 bb_I + ((-4. bb_I^3 \\
& + 12. bb_I^3 \sin(om t)^2) \sin(om t)^2 - 4. bb_I + 8. \sin(om t)^2 bb_I + (-4. bb_I^3 \\
& + 12. bb_I^3 \sin(om t)^2 + 4. bb_I + 4. bb_I^3 \cos(om t)^2) \cos(om t)^2) \cos(om t)^2 \\
& \cos(om t) aa_F^2 m_b^2 JB + ((-8. \sin(om t)^6 bb_I^3 - 8. \sin(om t)^4 bb_I \\
& + ((8. bb_I^3 - 24. bb_I^3 \sin(om t)^2) \sin(om t)^2 - 16. \sin(om t)^2 bb_I + 8. bb_I \\
& + (8. bb_I^3 - 24. bb_I^3 \sin(om t)^2 - 8. bb_I - 8. bb_I^3 \cos(om t)^2) \cos(om t)^2 \\
& \cos(om t)^2) aa_F m_b^2 JB + ((-4. bb_I^3 + 4. bb_I^3 \sin(om t)^2) \sin(om t)^2 \\
& + 4. \sin(om t)^2 bb_I - 4. bb_I + (8. bb_I^3 \sin(om t)^2 - 4. bb_I^3 + 4. bb_I \\
& + 4. bb_I^3 \cos(om t)^2) \cos(om t) m_b^2 JB bb_F_1) bb_F_1 + (\\
& -4. aa \sin(om t)^4 bb_I^2 - 4. aa \sin(om t)^2 + (-8. aa \sin(om t)^2 bb_I^2 - 4. aa \\
& - 4. aa \cos(om t)^2 bb_I^2) \cos(om t)^2) ka m_b^2 + ((4. \\
& + 4. bb_I^2) bb_I \sin(om t)^6 + 4. \sin(om t)^4 bb_I + ((-4. bb_I + (12. \\
& + 8. bb_I^2) bb_I \sin(om t)^2) \sin(om t)^2 + 4. \sin(om t)^2 bb_I + (-4. bb_I \\
& + (12. + 4. bb_I^2) bb_I \sin(om t)^2 + 4. bb_I \cos(om t)^2) \cos(om t)^2 \\
& \cos(om t) aa_F^2 m_b^2 JB + (((-8. - 8. bb_I^2) bb_I \sin(om t)^6 \\
& - 8. \sin(om t)^4 bb_I + ((8. bb_I + (-24. \\
& - 16. bb_I^2) bb_I \sin(om t)^2) \sin(om t)^2 - 8. \sin(om t)^2 bb_I + (8. bb_I + (\\
& - 24. - 8. bb_I^2) bb_I \sin(om t)^2 - 8. bb_I \cos(om t)^2) \cos(om t)^2) \cos(om t)^2 \\
& aa_F m_b^2 JB + ((4. \sin(om t)^2 bb_I - 4. bb_I) \sin(om t)^2 + (-4. bb_I \\
& + 8. \sin(om t)^2 bb_I + 4. bb_I \cos(om t)^2) \cos(om t)^2 \\
& \cos(om t) m_b^2 JB bb_F_1) bb_F_1) bb_2^2 + ((-4. \sin(om t)^6 bb_I^2 \\
& - 4. \sin(om t)^4 + ((4. bb_I^2 - 12. \sin(om t)^2 bb_I^2) \sin(om t)^2 + 4. \\
& - 8. \sin(om t)^2 + (-12. \sin(om t)^2 bb_I^2 - 4. + 4. bb_I^2 \\
& - 4. bb_I^2 \cos(om t)^2) \cos(om t)^2) \cos(om t) aa_F^2 m_b^2 JB + ((-4. \\
& - 4. bb_I^2) \sin(om t)^6 - 4. \sin(om t)^4 + ((4. + (-12. \\
& - 8. bb_I^2) \sin(om t)^2) \sin(om t)^2 - 4. \sin(om t)^2 + (4. + (-4. bb_I^2 \\
& - 12.) \sin(om t)^2 - 4. \cos(om t)^2) \cos(om t)^2) \cos(om t)^2 \\
& \cos(om t) aa_F^2 m_b^2 JB bb_2^2 + (-4. aa \sin(om t)^2 bb_I^2
\end{aligned}$$

$$\begin{aligned}
& -4.aa \cos(om t)^2 bb_I^2 - 4.aa) ka m_b^2 + ((4. + 4.bb_I^2) bb_I \sin(om t)^4 \\
& + 4.\sin(om t)^2 bb_I + (-4.bb_I + (8. + 4.bb_I^2) bb_I \sin(om t)^2 \\
& + 4.bb_I \cos(om t)^2) \cos(om t) aa_F^2 m_b^2 JB + ((((-8. \\
& - 8.bb_I^2) bb_I \sin(om t)^4 - 8.\sin(om t)^2 bb_I + (8.bb_I + (-16. \\
& - 8.bb_I^2) bb_I \sin(om t)^2 - 8.bb_I \cos(om t)^2) \cos(om t)^2) aa_F m_b^2 JB \\
& + (4.\sin(om t)^2 bb_I - 4.bb_I \\
& + 4.bb_I \cos(om t)^2) \cos(om t) m_b^2 JB bb_F_1) bb_F_1 + ((-4. \\
& - 4.bb_I^2) \sin(om t)^4 - 4.\sin(om t)^2 + (4. + (-8. - 4.bb_I^2) \sin(om t)^2 \\
& - 4.\cos(om t)^2) \cos(om t)^2) \cos(om t) aa_F^2 m_b^2 JB bb_2 + ((\\
& - 4.\sin(om t)^4 bb_I^2 - 4.\sin(om t)^2 + (-4. - 8.\sin(om t)^2 bb_I^2 \\
& - 4.bb_I^2 \cos(om t)^2) \cos(om t)^2) \cos(om t) kb m_b^2 bb_2^2 + (-4. \\
& - 4.\sin(om t)^2 bb_I^2 - 4.bb_I^2 \cos(om t)^2) \cos(om t) kb m_b^2) bb_1 \\
& + (((aa \sin(om t)^2 + aa \sin(om t)^4 bb_I^2 + (2.aa \sin(om t)^2 bb_I^2 + aa \\
& + aa \cos(om t)^2 bb_I^2) \cos(om t)^2) g_m_t + (2.aa \sin(om t)^2 \\
& + 4.aa \sin(om t)^4 bb_I^2 + (2.\sin(om t)^2 bb_I + (2.aa + 8.aa \sin(om t)^2 bb_I^2 \\
& + (2.bb_I + 4.aa bb_I^2 \cos(om t)) \cos(om t)) \cos(om t)) \cos(om t)) g_m_b) \\
& m_b^2 bb_2^2 + (-2. - 2.\sin(om t)^2 bb_I^2 \\
& - 2.bb_I^2 \cos(om t)^2) \cos(om t) g_m_b^3 bb_2 + ((aa + aa \cos(om t)^2 bb_I^2 \\
& + aa \sin(om t)^2 bb_I^2) g_m_t + (2.aa \sin(om t)^2 bb_I^2 + (2.bb_I \\
& + 2.aa bb_I^2 \cos(om t)) \cos(om t)) g_m_b) m_b^2 + ((-1.\sin(om t)^2 bb_I \\
& - 1.bb_I \cos(om t)^2) \cos(om t) aa_F^2 m_b^3 bb_2^2 + (\sin(om t)^2 bb_I^2 + 1 \\
& + bb_I^2 \cos(om t)^2) \cos(om t) aa_F^2 m_b^3 bb_2 - 1.m_b^3 bb_I aa_F^2 \cos(om t)) \\
& l) l + ((((-8.\sin(om t)^4 - 8.\sin(om t)^6 bb_I^2 + ((8.bb_I^2 \\
& - 24.\sin(om t)^2 bb_I^2) \sin(om t)^2 - 16.\sin(om t)^2 + 8. + (-8. + 8.bb_I^2 \\
& - 24.\sin(om t)^2 bb_I^2 - 8.bb_I^2 \cos(om t)^2) \cos(om t)^2) \\
& aa_F m_b^2 JB + ((-8. - 8.bb_I^2) \sin(om t)^6 - 8.\sin(om t)^4 + ((8. + (-24. \\
& - 16.bb_I^2) \sin(om t)^2) \sin(om t)^2 - 8.\sin(om t)^2 + (8. + (-24. \\
& - 8.bb_I^2) \sin(om t)^2 - 8.\cos(om t)^2) \cos(om t)^2) \\
& aa_F m_b^2 JB bb_2^2) bb_2 + ((-8. - 8.bb_I^2) \sin(om t)^4 - 8.\sin(om t)^2 + (8. \\
& + (-16. - 8.bb_I^2) \sin(om t)^2 - 8.\cos(om t)^2) \cos(om t)^2) aa_F m_b^2 JB bb_2 \\
& + (((((4.bb_I^2 - 4.\sin(om t)^2 bb_I^2) \sin(om t)^2 - 4.\sin(om t)^2 + 4. + (-4. \\
& + 4.bb_I^2 - 8.\sin(om t)^2 bb_I^2 - 4.bb_I^2 \cos(om t)^2) \cos(om t)^2) \\
& \cos(om t) m_b^2 JB + ((-4.\sin(om t)^2 + 4.) \sin(om t)^2 + (4. - 8.\sin(om t)^2 \\
& - 4.\cos(om t)^2) \cos(om t) m_b^2 JB bb_2^2) bb_2 + (-4.\sin(om t)^2 \\
& + 4. - 4.\cos(om t)^2) \cos(om t) m_b^2 JB bb_2) bb_F_2) bb_F_2 \\
& + ((4.\sin(om t)^4 bb_I^2 + 4.\sin(om t)^2 + (4. + 8.\sin(om t)^2 bb_I^2
\end{aligned}$$

$$\begin{aligned}
& + 4 \cdot bb_I^2 \cos(om t)^2) \cos(om t)^2) \cos(om t) kb m_b^2 bb_2^2 + (4. \\
& + 4 \cdot \sin(om t)^2 bb_I^2 + 4 \cdot bb_I^2 \cos(om t)^2) \cos(om t) kb m_b^2) bb_2 \\
& + ((4 \cdot bb_I^2 - 4 \cdot \sin(om t)^2 bb_I^2) \sin(om t)^3 + (-4 \cdot \sin(om t)^2 \\
& + 4) \sin(om t) + ((4 \cdot bb_I^2 - 8 \cdot \sin(om t)^2 bb_I^2) \sin(om t) - 4 \cdot \sin(om t) \\
& - 4 \cdot \sin(om t) \cos(om t)^2 bb_I^2) \cos(om t)^2) \cos(om t) aa_F m_b^2 JB + (\\
& - 8 \cdot \sin(om t)^5 bb_I^4 + (-12 \cdot bb_I^2 + 4 \cdot \sin(om t)^2 bb_I^2) \sin(om t)^3 + (-4 \cdot \\
& + 4 \cdot \sin(om t)^2) \sin(om t) + (-16 \cdot \sin(om t)^3 bb_I^4 + (-12 \cdot bb_I^2 \\
& + 8 \cdot \sin(om t)^2 bb_I^2) \sin(om t) + 4 \cdot \sin(om t) + (4 \cdot \sin(om t) bb_I^2 \\
& - 8 \cdot \sin(om t) bb_I^4) \cos(om t)^2) \cos(om t)^2) m_b^2 JB bb_F_I + (((8. \\
& - 4 \cdot bb_I^2) bb_I^2 \sin(om t)^5 + (12 \cdot -4 \cdot bb_I^2 + (-4 \cdot \\
& - 4 \cdot bb_I^2) \sin(om t)^2) \sin(om t)^3 - 4 \cdot \sin(om t)^3 + ((16. \\
& - 8 \cdot bb_I^2) bb_I^2 \sin(om t)^3 + (12 \cdot -4 \cdot bb_I^2 + (-8 \cdot \\
& - 8 \cdot bb_I^2) \sin(om t)^2) \sin(om t) - 4 \cdot \sin(om t) + ((8. \\
& - 4 \cdot bb_I^2) bb_I^2 \sin(om t) + (-4 \cdot -4 \cdot bb_I^2) \sin(om t)) \cos(om t)^2) \\
& \cos(om t)^2) \cos(om t) aa_F m_b^2 JB + ((-4 \cdot bb_I^2 - 12.) bb_I^2 \sin(om t)^5 + (\\
& - 8 \cdot -4 \cdot bb_I^2 + (4 \cdot +4 \cdot bb_I^2) \sin(om t)^2) \sin(om t)^3 + 4 \cdot \sin(om t)^3 + ((-24. \\
& - 8 \cdot bb_I^2) bb_I^2 \sin(om t)^3 + (-8 \cdot -4 \cdot bb_I^2 + (8. \\
& + 8 \cdot bb_I^2) \sin(om t)^2) \sin(om t) + 4 \cdot \sin(om t) + ((-4 \cdot bb_I^2 \\
& - 12.) bb_I^2 \sin(om t) + (4 \cdot +4 \cdot bb_I^2) \sin(om t)) \cos(om t)^2) \cos(om t)^2) \\
& m_b^2 JB bb_F_I + (-4 \cdot \sin(om t)^5 bb_I^2 - 4 \cdot \sin(om t)^3 + (-4 \cdot \sin(om t) \\
& - 8 \cdot \sin(om t)^3 bb_I^2 - 4 \cdot \sin(om t) \cos(om t)^2 bb_I^2) \cos(om t)^2) \\
& \cos(om t) aa_F m_b^2 JB bb_2^2) bb_2^2 + (((12 \cdot -4 \cdot bb_I^2) bb_I^2 \\
& - 4 \cdot \sin(om t)^2 bb_I^2) \sin(om t)^3 + (16 \cdot -4 \cdot bb_I^2 + (-8 \cdot \\
& - 4 \cdot bb_I^2) \sin(om t)^2) \sin(om t) - 4 \cdot \sin(om t) + (((12 \cdot -4 \cdot bb_I^2) bb_I^2 \\
& - 8 \cdot \sin(om t)^2 bb_I^2) \sin(om t) + (-8 \cdot -4 \cdot bb_I^2) \sin(om t) \\
& - 4 \cdot \sin(om t) \cos(om t)^2 bb_I^2) \cos(om t)^2) \cos(om t) aa_F m_b^2 JB + ((\\
& -4 \cdot bb_I^2 - 12.) bb_I^2 \sin(om t)^3 + (-8 \cdot -4 \cdot bb_I^2 + (4. \\
& + 4 \cdot bb_I^2) \sin(om t)^2) \sin(om t) + 4 \cdot \sin(om t) + ((-4 \cdot bb_I^2 \\
& - 12.) bb_I^2 \sin(om t) + (4 \cdot +4 \cdot bb_I^2) \sin(om t)) \cos(om t)^2) \\
& m_b^2 JB bb_F_I + ((4 \cdot -4 \cdot bb_I^2 + (-4 \cdot -4 \cdot bb_I^2) \sin(om t)^2) \sin(om t)^3 \\
& + (-4 \cdot -4 \cdot \sin(om t)^2) \sin(om t) + ((4 \cdot -4 \cdot bb_I^2 + (-8 \cdot \\
& - 8 \cdot bb_I^2) \sin(om t)^2) \sin(om t) - 4 \cdot \sin(om t) + (-4 \cdot \\
& - 4 \cdot bb_I^2) \sin(om t) \cos(om t)^2) \cos(om t)^2) \cos(om t) aa_F m_b^2 JB bb_2^2 \\
& + ((4 \cdot +(-4 \cdot -4 \cdot bb_I^2) \sin(om t)^2) \sin(om t) - 4 \cdot \sin(om t) + (-4 \cdot \\
& - 4 \cdot bb_I^2) \sin(om t) \cos(om t)^2) \cos(om t) aa_F m_b^2 JB \\
& + (((12 \cdot \sin(om t)^5 bb_I^2 + 12 \cdot \sin(om t)^3 + (24 \cdot \sin(om t)^3 bb_I^2
\end{aligned}$$

$$\begin{aligned}
& + 12 \cdot \sin(\omega m t) + 12 \cdot \sin(\omega m t) \cos(\omega m t)^2 bb_I^2 \cos(\omega m t)^2 m_b^2 JB + ((8. \\
& + 4. bb_I^2) \sin(\omega m t)^5 + 4. \sin(\omega m t)^3 + ((8. bb_I^2 + 16.) \sin(\omega m t)^3 \\
& + 4. \sin(\omega m t) + (8. + 4. bb_I^2) \sin(\omega m t) \cos(\omega m t)^2) \cos(\omega m t)^2 \\
& m_b^2 JB bb_2^2) bb_2^2 + ((8. bb_I^2 - 4. \sin(\omega m t)^2 bb_I^2) \sin(\omega m t)^3 + (8. \\
& - 4. \sin(\omega m t)^2) \sin(\omega m t) + ((8. bb_I^2 - 8. \sin(\omega m t)^2 bb_I^2) \sin(\omega m t) \\
& - 4. \sin(\omega m t) - 4. \sin(\omega m t) \cos(\omega m t)^2 bb_I^2) \cos(\omega m t)^2 m_b^2 JB + ((12. \\
& + 4. bb_I^2 + (-4. - 4. bb_I^2) \sin(\omega m t)^2) \sin(\omega m t)^3 + (-4. \sin(\omega m t)^2 \\
& + 4.) \sin(\omega m t) + ((12. + 4. bb_I^2 + (-8. - 8. bb_I^2) \sin(\omega m t)^2) \sin(\omega m t) \\
& - 4. \sin(\omega m t) + (-4. - 4. bb_I^2) \sin(\omega m t) \cos(\omega m t)^2) \cos(\omega m t)^2) \\
& m_b^2 JB bb_2^2 + ((4. + (-4. - 4. bb_I^2) \sin(\omega m t)^2) \sin(\omega m t) - 4. \sin(\omega m t) \\
& + (-4. - 4. bb_I^2) \sin(\omega m t) \cos(\omega m t)^2 m_b^2 JB) bb_F_2) om \\
& + ((2. \sin(\omega m t)^2 bb_I + 2. bb_I^3 \sin(\omega m t)^4 + ((4. bb_I^3 \\
& - 2. bb_I^3 \sin(\omega m t)^2) \sin(\omega m t)^2 + 2. bb_I - 2. \sin(\omega m t)^2 bb_I + (-2. bb_I \\
& - 4. bb_I^3 \sin(\omega m t)^2 + 2. bb_I^3 - 2. bb_I^3 \cos(\omega m t)^2) \cos(\omega m t)^2) \cos(\omega m t)^2) \\
& g_m_b^3 + (2. \sin(\omega m t)^2 + 2. \sin(\omega m t)^4 bb_I^2 + ((4. bb_I^2 \\
& - 2. \sin(\omega m t)^2 bb_I^2) \sin(\omega m t)^2 + 2. - 2. \sin(\omega m t)^2 + (2. bb_I^2 \\
& - 4. \sin(\omega m t)^2 bb_I^2 - 2. - 2. bb_I^2 \cos(\omega m t)^2) \cos(\omega m t)^2) \cos(\omega m t)^2) \\
& g_m_b^3 bb_2) bb_2^2 + (2. bb_I + 2. bb_I^3 \sin(\omega m t)^2 + (-2. bb_I^3 \sin(\omega m t)^2 \\
& + 2. bb_I^3 - 2. bb_I - 2. bb_I^3 \cos(\omega m t)^2) \cos(\omega m t)^2) g_m_b^3 + (2. \\
& + 2. \sin(\omega m t)^2 bb_I^2 + (-2. - 2. \sin(\omega m t)^2 bb_I^2 + 2. bb_I^2 \\
& - 2. bb_I^2 \cos(\omega m t)^2) \cos(\omega m t)^2) g_m_b^3 bb_2 + ((((-1. \sin(\omega m t)^6 bb_I \\
& + (bb_I^3 \sin(\omega m t)^4 + (2. bb_I - 3. \sin(\omega m t)^2 bb_I) \sin(\omega m t)^2 \\
& + (2. bb_I^3 \sin(\omega m t)^2 + 2. bb_I - 3. \sin(\omega m t)^2 bb_I + (bb_I^3 \\
& - 1. bb_I) \cos(\omega m t)^2) \cos(\omega m t)^2) aa_F^2 m_b^3 + ((\\
& - 2. \sin(\omega m t)^2 bb_I - 2. bb_I^3 \sin(\omega m t)^4 + (-4. bb_I^3 \sin(\omega m t)^2 - 2. bb_I \\
& - 2. bb_I^3 \cos(\omega m t)^2) \cos(\omega m t)^2) \cos(\omega m t) aa_F m_b^3 + (\sin(\omega m t)^4 bb_I \\
& + bb_I^3 \sin(\omega m t)^4 + (2. \sin(\omega m t)^2 bb_I + 2. bb_I^3 \sin(\omega m t)^2 + (bb_I^3 \\
& + bb_I) \cos(\omega m t)^2) \cos(\omega m t)^2) m_b^3 bb_F_1) bb_F_1 + (\sin(\omega m t)^2 \\
& + \sin(\omega m t)^4 bb_I^2 + (1 + 2. \sin(\omega m t)^2 bb_I^2 + bb_I^2 \cos(\omega m t)^2) \cos(\omega m t)^2) \\
& \cos(\omega m t)^2 aa_F^2 m_b^3 bb_2) bb_2^2 + (-1. \sin(\omega m t)^4 bb_I + (bb_I^3 \sin(\omega m t)^2 \\
& + 2. bb_I - 2. \sin(\omega m t)^2 bb_I + (bb_I^3 - 1. bb_I) \cos(\omega m t)^2) \cos(\omega m t)^2) \\
& aa_F^2 m_b^3 + ((-2. bb_I^3 \sin(\omega m t)^2 - 2. bb_I \\
& - 2. bb_I^3 \cos(\omega m t)^2) \cos(\omega m t) aa_F m_b^3 + (bb_I^3 \sin(\omega m t)^2 \\
& + \sin(\omega m t)^2 bb_I + (bb_I^3 + bb_I) \cos(\omega m t)^2) m_b^3 bb_F_1) bb_F_1 + (\\
& - 1. \sin(\omega m t)^4 - 1. \sin(\omega m t)^6 bb_I^2 + ((2. bb_I^2 \\
& - 3. \sin(\omega m t)^2 bb_I^2) \sin(\omega m t)^2 + 2. - 2. \sin(\omega m t)^2 + (-3. \sin(\omega m t)^2 bb_I^2
\end{aligned}$$

$$\begin{aligned}
& + 2 \cdot bb_I^2 - 1 \cdot -1 \cdot bb_I^2 \cos(om t)^2) \cos(om t)^2) \cos(om t)^2 \\
& aa_F^2 m_b^3 bb_2) l + (((2 \cdot \sin(om t)^2 + 2 \cdot \sin(om t)^4 bb_I^2 \\
& + (4 \cdot \sin(om t)^2 bb_I^2 + 2 \cdot + 2 \cdot bb_I^2 \cos(om t)^2) \cos(om t)^2) \\
& \cos(om t) aa_F m_b^3 bb_2^3 + (2 \cdot + 2 \cdot \sin(om t)^2 bb_I^2 \\
& + 2 \cdot bb_I^2 \cos(om t)^2) \cos(om t) aa_F m_b^3 bb_2) l + ((\sin(om t)^2 \\
& + \sin(om t)^4 bb_I^2 + (1 + 2 \cdot \sin(om t)^2 bb_I^2 + bb_I^2 \cos(om t)^2) \cos(om t)^2) \\
& m_b^3 bb_2^3 + (\sin(om t)^2 + \sin(om t)^4 bb_I^2 + (1 + 2 \cdot \sin(om t)^2 bb_I^2 \\
& + bb_I^2 \cos(om t)^2) \cos(om t)^2) m_b^3 bb_2) l bb_F_2 + (((\\
& -2 \cdot \sin(om t)^5 bb_I^2 + (-1 \cdot + \sin(om t)^2) \sin(om t)^3 + (-4 \cdot \sin(om t)^3 bb_I^2 \\
& + (-1 \cdot + 2 \cdot \sin(om t)^2) \sin(om t) + (-2 \cdot \sin(om t) bb_I^2 \\
& + \sin(om t) \cos(om t)^2 bb_I^2) \cos(om t)^2) aa_F m_b^3 bb_2^2 + (2 \cdot \sin(om t)^5 bb_I^2 \\
& + 2 \cdot \sin(om t)^3 + (4 \cdot \sin(om t)^3 bb_I^2 + 2 \cdot \sin(om t) \\
& + 2 \cdot \sin(om t) \cos(om t)^2 bb_I^2) \cos(om t)^2) aa_F m_b^3 bb_2^2 + (\\
& -2 \cdot \sin(om t)^3 bb_I^2 + (-1 \cdot + \sin(om t)^2) \sin(om t) + (-2 \cdot \sin(om t) bb_I^2 \\
& + \sin(om t) \cos(om t)^2) aa_F m_b^3 + ((bb_I^2 \\
& - 1 \cdot \sin(om t)^2 bb_I^2) \sin(om t)^3 + (1 - 1 \cdot \sin(om t)^2) \sin(om t) + ((bb_I^2 \\
& - 2 \cdot \sin(om t)^2 bb_I^2) \sin(om t) - 1 \cdot \sin(om t) - 1 \cdot \sin(om t) \cos(om t)^2 bb_I^2) \\
& \cos(om t)^2) aa_F m_b^3) l + ((\sin(om t)^4 bb_I + (2 \cdot \sin(om t)^2 bb_I \\
& + bb_I \cos(om t)^2) \cos(om t)^2) m_b^3 bb_2^2 + (\sin(om t)^2 bb_I \\
& + bb_I \cos(om t)^2) m_b^3 + (\sin(om t)^2 + \sin(om t)^4 bb_I^2 + (1 \\
& + 2 \cdot \sin(om t)^2 bb_I^2 + bb_I^2 \cos(om t)^2) \cos(om t)^2) m_b^3 bb_2) l om) om \\
& + (((\sin(om t)^8 bb_I^3 + \sin(om t)^6 bb_I + ((-1 \cdot bb_I^3 \\
& + 4 \cdot bb_I^3 \sin(om t)^2 + bb_I + bb_I^3 \cos(om t)^2) \cos(om t)^2) \\
& \cos(om t)^2) \cos(om t) aa_F^2 m_b^3 + ((-2 \cdot \sin(om t)^8 bb_I^3 \\
& - 2 \cdot \sin(om t)^6 bb_I + ((2 \cdot bb_I^3 - 8 \cdot bb_I^3 \sin(om t)^2) \sin(om t)^4 + (2 \cdot bb_I \\
& - 6 \cdot \sin(om t)^2 bb_I) \sin(om t)^2 + ((4 \cdot bb_I^3 - 12 \cdot bb_I^3 \sin(om t)^2) \sin(om t)^2 \\
& + 2 \cdot bb_I - 6 \cdot \sin(om t)^2 bb_I + (2 \cdot bb_I^3 - 8 \cdot bb_I^3 \sin(om t)^2 - 2 \cdot bb_I \\
& - 2 \cdot bb_I^3 \cos(om t)^2) \cos(om t)^2) \cos(om t)^2) aa_F m_b^3 + ((\\
& -1 \cdot bb_I^3 + bb_I^3 \sin(om t)^2) \sin(om t)^4 + (-1 \cdot bb_I \\
& + \sin(om t)^2 bb_I) \sin(om t)^2 + ((-2 \cdot bb_I^3 + 3 \cdot bb_I^3 \sin(om t)^2) \sin(om t)^2 \\
& - 1 \cdot bb_I + 2 \cdot \sin(om t)^2 bb_I + (3 \cdot bb_I^3 \sin(om t)^2 - 1 \cdot bb_I^3 + bb_I \\
& + bb_I^3 \cos(om t)^2) \cos(om t)^2) \cos(om t)^2) \cos(om t) m_b^3 bb_F_1) bb_F_1) \\
& bb_2^2 + (-1 \cdot \sin(om t)^6 - 1 \cdot \sin(om t)^8 bb_I^2 + ((bb_I^2 \\
& - 4 \cdot \sin(om t)^2 bb_I^2) \sin(om t)^4 + (1 - 3 \cdot \sin(om t)^2) \sin(om t)^2 + ((2 \cdot bb_I^2
\end{aligned}$$

$$\begin{aligned}
& -6 \cdot \sin(\omega m t)^2 bb_I^2) \sin(\omega m t)^2 - 3 \cdot \sin(\omega m t)^2 + 1. + (-1. \\
& -4 \cdot \sin(\omega m t)^2 bb_I^2 + bb_I^2 - 1. bb_I^2 \cos(\omega m t)^2) \cos(\omega m t)^2 \cos(\omega m t)^2 \\
& \cos(\omega m t)^2) \cos(\omega m t) aa_F^2 m_b^3 bb_2^3 + (\sin(\omega m t)^6 bb_I^3 + \sin(\omega m t)^4 bb_I \\
& + ((3. bb_I^3 \sin(\omega m t)^2 - 1. bb_I^3) \sin(\omega m t)^2 - 1. bb_I + 2. \sin(\omega m t)^2 bb_I \\
& + (3. bb_I^3 \sin(\omega m t)^2 - 1. bb_I^3 + bb_I + bb_I^3 \cos(\omega m t)^2) \cos(\omega m t)^2) \\
& \cos(\omega m t)^2) \cos(\omega m t) aa_F^2 m_b^3 + ((-2. \sin(\omega m t)^6 bb_I^3 - 2. \sin(\omega m t)^4 bb_I \\
& + ((2. bb_I^3 - 6. bb_I^3 \sin(\omega m t)^2) \sin(\omega m t)^2 + 2. bb_I - 4. \sin(\omega m t)^2 bb_I \\
& + (2. bb_I^3 - 6. bb_I^3 \sin(\omega m t)^2 - 2. bb_I - 2. bb_I^3 \cos(\omega m t)^2) \cos(\omega m t)^2) \\
& \cos(\omega m t)^2) aa_F m_b^3 + ((-1. bb_I^3 + bb_I^3 \sin(\omega m t)^2) \sin(\omega m t)^2 - 1. bb_I \\
& + \sin(\omega m t)^2 bb_I + (-1. bb_I^3 + 2. bb_I^3 \sin(\omega m t)^2 + bb_I \\
& + bb_I^3 \cos(\omega m t)^2) \cos(\omega m t) m_b^3 bb_F_I) bb_F_I + \\
& -1. \sin(\omega m t)^4 - 1. \sin(\omega m t)^6 bb_I^2 + ((bb_I^2 - 3. \sin(\omega m t)^2 bb_I^2) \sin(\omega m t)^2 \\
& + 1. - 2. \sin(\omega m t)^2 + (bb_I^2 - 1. - 3. \sin(\omega m t)^2 bb_I^2 \\
& - 1. bb_I^2 \cos(\omega m t)^2) \cos(\omega m t)^2) \cos(\omega m t) aa_F^2 m_b^3 bb_2 + ((\\
& -2. \sin(\omega m t)^8 bb_I^2 - 2. \sin(\omega m t)^6 + ((2. bb_I^2 \\
& - 8. \sin(\omega m t)^2 bb_I^2) \sin(\omega m t)^4 + (2. - 6. \sin(\omega m t)^2) \sin(\omega m t)^2 + ((4. bb_I^2 \\
& - 12. \sin(\omega m t)^2 bb_I^2) \sin(\omega m t)^2 + 2. - 6. \sin(\omega m t)^2 + (2. bb_I^2 \\
& - 8. \sin(\omega m t)^2 bb_I^2 - 2. - 2. bb_I^2 \cos(\omega m t)^2) \cos(\omega m t)^2) \cos(\omega m t)^2) \\
& \cos(\omega m t)^2) aa_F m_b^3 bb_2^3 + (-2. \sin(\omega m t)^4 - 2. \sin(\omega m t)^6 bb_I^2 \\
& + ((2. bb_I^2 - 6. \sin(\omega m t)^2 bb_I^2) \sin(\omega m t)^2 - 4. \sin(\omega m t)^2 + 2. + (2. bb_I^2 \\
& - 6. \sin(\omega m t)^2 bb_I^2 - 2. - 2. bb_I^2 \cos(\omega m t)^2) \cos(\omega m t)^2) \\
& aa_F m_b^3 bb_2 + (((bb_I^2 - 1. \sin(\omega m t)^2 bb_I^2) \sin(\omega m t)^4 + (1 \\
& - 1. \sin(\omega m t)^2) \sin(\omega m t)^2 + ((2. bb_I^2 - 3. \sin(\omega m t)^2 bb_I^2) \sin(\omega m t)^2 + 1. \\
& - 2. \sin(\omega m t)^2 + (bb_I^2 - 1. - 3. \sin(\omega m t)^2 bb_I^2 \\
& - 1. bb_I^2 \cos(\omega m t)^2) \cos(\omega m t)^2) \cos(\omega m t) m_b^3 bb_2^3 + ((bb_I^2 \\
& - 1. \sin(\omega m t)^2 bb_I^2) \sin(\omega m t)^2 - 1. \sin(\omega m t)^2 + 1. + (-2. \sin(\omega m t)^2 bb_I^2 \\
& - 1. + bb_I^2 - 1. bb_I^2 \cos(\omega m t)^2) \cos(\omega m t)^2) \cos(\omega m t) m_b^3 bb_2) bb_F_2) \\
& bb_F_2 + (((bb_I^2 - 1. \sin(\omega m t)^2 bb_I^2) \sin(\omega m t)^5 + (1 \\
& - 1. \sin(\omega m t)^2) \sin(\omega m t)^3 + ((2. bb_I^2 - 3. \sin(\omega m t)^2 bb_I^2) \sin(\omega m t)^3 + (1 \\
& - 2. \sin(\omega m t)^2) \sin(\omega m t) + ((bb_I^2 - 3. \sin(\omega m t)^2 bb_I^2) \sin(\omega m t) \\
& - 1. \sin(\omega m t) - 1. \sin(\omega m t) \cos(\omega m t)^2 bb_I^2) \cos(\omega m t)^2) \cos(\omega m t)^2) \\
& \cos(\omega m t) aa_F m_b^3 + (-2. \sin(\omega m t)^7 bb_I^4 + (-3. bb_I^2 \\
& + \sin(\omega m t)^2 bb_I^2) \sin(\omega m t)^5 + (-1. + \sin(\omega m t)^2) \sin(\omega m t)^3 + (\\
& -6. \sin(\omega m t)^5 bb_I^4 + (-6. bb_I^2 + 3. \sin(\omega m t)^2 bb_I^2) \sin(\omega m t)^3 + (-1. \\
& + 2. \sin(\omega m t)^2) \sin(\omega m t) + (-6. \sin(\omega m t)^3 bb_I^4 + (-3. bb_I^2 \\
& + 3. \sin(\omega m t)^2 bb_I^2) \sin(\omega m t) + \sin(\omega m t) + (-2. \sin(\omega m t) bb_I^4
\end{aligned}$$

$$\begin{aligned}
& + \sin(\omega m t) bb_I^2 \cos(\omega m t)^2 \cos(\omega m t)^2 \cos(\omega m t)^2 m_b^3 bb_F_1) bb_2^2 \\
& + 2 ((bb_I^2 - 1. \sin(\omega m t)^2 bb_I^2) \sin(\omega m t)^3 + (1 - 1. \sin(\omega m t)^2) \sin(\omega m t) \\
& + ((bb_I^2 - 2. \sin(\omega m t)^2 bb_I^2) \sin(\omega m t) - 1. \sin(\omega m t) \\
& - 1. \sin(\omega m t) \cos(\omega m t)^2 bb_I^2) \cos(\omega m t)^2) \cos(\omega m t) aa_F m_b^3 + (\\
& - 2. \sin(\omega m t)^5 bb_I^4 + (-3. bb_I^2 + \sin(\omega m t)^2 bb_I^2) \sin(\omega m t)^3 + (-1. \\
& + \sin(\omega m t)^2) \sin(\omega m t) + (-4. \sin(\omega m t)^3 bb_I^4 + (-3. bb_I^2 \\
& + 2. \sin(\omega m t)^2 bb_I^2) \sin(\omega m t) + \sin(\omega m t) + (-2. \sin(\omega m t) bb_I^4 \\
& + \sin(\omega m t) bb_I^2) \cos(\omega m t)^2) \cos(\omega m t)^2 m_b^3 bb_F_1 + ((bb_I^2 \\
& - 1. \sin(\omega m t)^2 bb_I^2) \sin(\omega m t)^5 + (1 - 1. \sin(\omega m t)^2) \sin(\omega m t)^3 + ((2. bb_I^2 \\
& - 3. \sin(\omega m t)^2 bb_I^2) \sin(\omega m t)^3 + (1 - 2. \sin(\omega m t)^2) \sin(\omega m t) + ((bb_I^2 \\
& - 3. \sin(\omega m t)^2 bb_I^2) \sin(\omega m t) - 1. \sin(\omega m t) - 1. \sin(\omega m t) \cos(\omega m t)^2 bb_I^2) \\
& \cos(\omega m t)^2) \cos(\omega m t) aa_F m_b^3 bb_2^2 + ((2. \sin(\omega m t)^5 \\
& + 2. \sin(\omega m t)^7 bb_I^2 + (4. \sin(\omega m t)^3 + 6. \sin(\omega m t)^5 bb_I^2 + (2. \sin(\omega m t) \\
& + 6. \sin(\omega m t)^3 bb_I^2 + 2. \sin(\omega m t) \cos(\omega m t)^2 bb_I^2) \cos(\omega m t)^2) \cos(\omega m t)^2) \\
& m_b^3 bb_2^4 + ((3. bb_I^2 - 1. \sin(\omega m t)^2 bb_I^2) \sin(\omega m t)^5 + (3. \\
& - 1. \sin(\omega m t)^2) \sin(\omega m t)^3 + ((6. bb_I^2 - 3. \sin(\omega m t)^2 bb_I^2) \sin(\omega m t)^3 + (3. \\
& - 2. \sin(\omega m t)^2) \sin(\omega m t) + ((3. bb_I^2 - 3. \sin(\omega m t)^2 bb_I^2) \sin(\omega m t) \\
& - 1. \sin(\omega m t) - 1. \sin(\omega m t) \cos(\omega m t)^2 bb_I^2) \cos(\omega m t)^2) \cos(\omega m t)^2) \\
& m_b^3 bb_2^2 + ((bb_I^2 - 1. \sin(\omega m t)^2 bb_I^2) \sin(\omega m t)^3 + (1 \\
& - 1. \sin(\omega m t)^2) \sin(\omega m t) + ((bb_I^2 - 2. \sin(\omega m t)^2 bb_I^2) \sin(\omega m t) \\
& - 1. \sin(\omega m t) - 1. \sin(\omega m t) \cos(\omega m t)^2 bb_I^2) \cos(\omega m t)^2) m_b^3) bb_F_2) om) \\
R) R) R) R + ((32. \sin(\omega m t)^2 bb_1 \\
& - 32. bb_1 \cos(\omega m t)^2) \cos(\omega m t) aa_F^2 m_b JB^2 \\
& + (64. m_b bb_1 aa_F \cos(\omega m t)^2 JB^2 \\
& - 32. m_b \cos(\omega m t) bb_1 JB^2 bb_F_1) bb_F_1 \\
& + 32. m_b bb_2 aa_F^2 \cos(\omega m t)^3 JB^2 \\
& - 32. m_b \cos(\omega m t) aa_F^2 \sin(\omega m t)^2 bb_2 JB^2 - 32. m_b \cos(\omega m t) kb bb_1 JB \\
& + (64. m_b bb_2 aa_F \cos(\omega m t)^2 JB^2 \\
& + 32. \cos(\omega m t) m_b bb_2 JB^2 bb_F_2) bb_F_2 + 32. m_b \cos(\omega m t) kb bb_2 JB \\
& + ((64. + 32. bb_1^2 - 32. \sin(\omega m t)^2) \sin(\omega m t) - 32. \sin(\omega m t) \\
& - 32. \sin(\omega m t) \cos(\omega m t)^2) \cos(\omega m t) aa_F m_b JB^2 + ((-32. \\
& + 32. \sin(\omega m t)^2) \sin(\omega m t) + 32. \sin(\omega m t) \cos(\omega m t)^2) m_b JB^2 bb_F_1 + ((64. \\
& - 32. \sin(\omega m t)^2) \sin(\omega m t) - 32. \sin(\omega m t) \cos(\omega m t)^2) \cos(\omega m t) aa_F m_b JB^2 \\
& + 32. JB^2 \sin(\omega m t) aa_F \cos(\omega m t) bb_2^2 m_b \\
& - 32. \cos(\omega m t) m_b \sin(\omega m t) aa_F JB^2 + ((32. - 32. \sin(\omega m t)^2) \sin(\omega m t) \\
& - 32. \sin(\omega m t) \cos(\omega m t)^2) m_b JB^2 bb_F_2 + (-32. m_b \cos(\omega m t) JB^2 bb_1
\end{aligned}$$

$$\begin{aligned}
& + 32. m_b \cos(\omega m t) J B^2 b b_2) \omega m + ((16. a a \\
& - 16. b b_1 \cos(\omega m t) \cos(\omega m t) g_m_b^2 J B - 16. m_b^2 g_b b_2 \cos(\omega m t)^2 J B \\
& - 16. m_b^2 \cos(\omega m t) g_a a J B + (16. m_b^2 b b_1 \cos(\omega m t)^2 a a_F^2 J B \\
& + 16. m_b^2 b b_2 \cos(\omega m t)^2 a a_F^2 J B) l + (((((8. + 8. \sin(\omega m t)^2) \sin(\omega m t) \\
& + 8. \sin(\omega m t) \cos(\omega m t)^2) a a_F m_b^2 J B + ((-8. - 8. \sin(\omega m t)^2) \sin(\omega m t) \\
& - 8. \sin(\omega m t) \cos(\omega m t)^2) a a_F m_b^2 J B) l + ((8. b b_1 \cos(\omega m t)^2 \\
& + 8. \sin(\omega m t)^2 b b_1) m_b^2 J B + (8. \sin(\omega m t)^2 + 8. \cos(\omega m t)^2) m_b^2 J B b b_2) \\
& l \omega m + ((8. \sin(\omega m t)^4 b b_1 + (-8. b b_1^3 \sin(\omega m t)^2 + 16. \sin(\omega m t)^2 b b_1 \\
& - 16. b b_1 + (8. b b_1 - 8. b b_1^3) \cos(\omega m t)^2) \cos(\omega m t)^2 \\
& \cos(\omega m t) a a_F^2 m_b^2 J B + ((16. b b_1 + 16. b b_1^3 \sin(\omega m t)^2 \\
& + 16. b b_1^3 \cos(\omega m t)^2) \cos(\omega m t)^2 a a_F m_b^2 J B + (-8. b b_1^3 \sin(\omega m t)^2 \\
& - 8. \sin(\omega m t)^2 b b_1 + (-8. b b_1 - 8. b b_1^3) \cos(\omega m t)^2) \\
& \cos(\omega m t) m_b^2 J B b b_F_1) b b_F_1 + ((8. \sin(\omega m t)^2 b b_1^2 + 8. \\
& + 8. b b_1^2 \cos(\omega m t)^2) \cos(\omega m t)^3 a a_F^2 m_b^2 J B + ((8. \sin(\omega m t)^4 b b_1 \\
& - 8. b b_1 \cos(\omega m t)^4) \cos(\omega m t) a a_F^2 m_b^2 J B + ((16. \sin(\omega m t)^2 b b_1 \\
& + 16. b b_1 \cos(\omega m t)^2) \cos(\omega m t)^2 a a_F m_b^2 J B + (-8. \sin(\omega m t)^2 b b_1 \\
& - 8. b b_1 \cos(\omega m t)^2) \cos(\omega m t) m_b^2 J B b b_F_1) b b_F_1 + (8. \sin(\omega m t)^2 \\
& + 8. \cos(\omega m t)^2) \cos(\omega m t)^3 a a_F^2 m_b^2 J B b b_2) b b_2 \\
& + (8. \sin(\omega m t)^2 b b_1 - 8. b b_1 \cos(\omega m t)^2) \cos(\omega m t) a a_F^2 m_b^2 J B \\
& + (16. m_b^2 b b_1 a a_F \cos(\omega m t)^2 J B \\
& - 8. m_b^2 \cos(\omega m t) b b_1 J B b b_F_1) b b_F_1 + ((-8. - 8. b b_1^2) \sin(\omega m t)^4 \\
& - 8. \sin(\omega m t)^2 + (16. + (-16. - 8. b b_1^2) \sin(\omega m t)^2 \\
& - 8. \cos(\omega m t)^2) \cos(\omega m t)^2 \cos(\omega m t) a a_F^2 m_b^2 J B b b_2 + ((-8. \sin(\omega m t)^2 \\
& - 8. \cos(\omega m t)^2) \cos(\omega m t) k b m_b^2 b b_2^2 - 8. m_b^2 \cos(\omega m t) k b) b b_1 + (((16. \\
& + 16. \sin(\omega m t)^2 b b_1^2 + 16. b b_1^2 \cos(\omega m t)^2) \cos(\omega m t)^2 a a_F m_b^2 J B \\
& + (16. \sin(\omega m t)^2 + 16. \cos(\omega m t)^2) \cos(\omega m t)^2 a a_F m_b^2 J B b b_2^2) b b_2 \\
& + 16. m_b^2 b b_2 a a_F \cos(\omega m t)^2 J B + (((8. \sin(\omega m t)^2 b b_1^2 + 8. \\
& + 8. b b_1^2 \cos(\omega m t)^2) \cos(\omega m t) m_b^2 J B + (8. \sin(\omega m t)^2 \\
& + 8. \cos(\omega m t)^2) \cos(\omega m t) m_b^2 J B b b_2^2) b b_2 + (8. \sin(\omega m t)^2 \\
& + 8. \cos(\omega m t)^2) \cos(\omega m t) m_b^2 J B b b_2) b b_F_2 \\
& + (8. \sin(\omega m t)^2 b b_1^2 + 8. + 8. b b_1^2 \cos(\omega m t)^2) \cos(\omega m t) k b m_b^2 b b_2 \\
& + (((24. b b_1^2 - 8. \sin(\omega m t)^2 b b_1^2) \sin(\omega m t)^3 + (-16. \sin(\omega m t)^2 \\
& + 16.) \sin(\omega m t) + ((24. b b_1^2 - 16. \sin(\omega m t)^2 b b_1^2) \sin(\omega m t) \\
& - 16. \sin(\omega m t) - 8. \sin(\omega m t) \cos(\omega m t)^2 b b_1^2) \cos(\omega m t)^2) \\
& \cos(\omega m t) a a_F m_b^2 J B + ((-8. b b_1^2 + 8. \sin(\omega m t)^2 b b_1^2) \sin(\omega m t)^3 + (-8. \\
& + 8. \sin(\omega m t)^2) \sin(\omega m t) + ((-8. b b_1^2 + 16. \sin(\omega m t)^2 b b_1^2) \sin(\omega m t)
\end{aligned}$$

$$\begin{aligned}
& + 8 \cdot \sin(\omega m t) + 8 \cdot \sin(\omega m t) \cos(\omega m t)^2 bb_I^2 \cos(\omega m t)^2 m_b^2 JB bb_F_I \\
& + ((8 \cdot bb_I^2 + 16 \cdot -8 \cdot \sin(\omega m t)^2) \sin(\omega m t)^3 - 8 \cdot \sin(\omega m t)^3 + ((8 \cdot bb_I^2 \\
& + 16 \cdot -16 \cdot \sin(\omega m t)^2) \sin(\omega m t) - 8 \cdot \sin(\omega m t) - 8 \cdot \sin(\omega m t) \cos(\omega m t)^2) \\
& \cos(\omega m t)^2 \cos(\omega m t) aa_F m_b^2 JB + ((-8 \cdot +8 \cdot \sin(\omega m t)^2) \sin(\omega m t)^3 + ((\\
& -8 \cdot +16 \cdot \sin(\omega m t)^2) \sin(\omega m t) + 8 \cdot \sin(\omega m t) \cos(\omega m t)^2) \cos(\omega m t)^2) \\
& m_b^2 JB bb_F_I) bb_2^2 + ((16 \cdot bb_I^2 - 8 \cdot \sin(\omega m t)^2 bb_I^2) \sin(\omega m t)^3 + (16 \cdot \\
& -8 \cdot \sin(\omega m t)^2) \sin(\omega m t) + ((16 \cdot bb_I^2 - 16 \cdot \sin(\omega m t)^2 bb_I^2) \sin(\omega m t) \\
& - 8 \cdot \sin(\omega m t) - 8 \cdot \sin(\omega m t) \cos(\omega m t)^2 bb_I^2) \cos(\omega m t)^2) \\
& \cos(\omega m t) aa_F m_b^2 JB + ((8 \cdot bb_I^2 + 24 \cdot -8 \cdot \sin(\omega m t)^2) \sin(\omega m t)^3 \\
& + 8 \cdot \sin(\omega m t) + ((8 \cdot bb_I^2 + 24 \cdot -16 \cdot \sin(\omega m t)^2) \sin(\omega m t) \\
& - 8 \cdot \sin(\omega m t) \cos(\omega m t)^2) \cos(\omega m t)^2 \cos(\omega m t) aa_F m_b^2 JB bb_2^2 \\
& + ((8 \cdot bb_I^2 + 16 \cdot -8 \cdot \sin(\omega m t)^2) \sin(\omega m t) - 8 \cdot \sin(\omega m t) \\
& - 8 \cdot \sin(\omega m t) \cos(\omega m t)^2) \cos(\omega m t) aa_F m_b^2 JB + ((-8 \cdot \\
& + 8 \cdot \sin(\omega m t)^2) \sin(\omega m t) + 8 \cdot \sin(\omega m t) \cos(\omega m t)^2) m_b^2 JB bb_F_I + ((16 \cdot \\
& + (-16 \cdot -8 \cdot bb_I^2) \sin(\omega m t)^2) \sin(\omega m t) - 8 \cdot \sin(\omega m t) + (-16 \cdot \\
& - 8 \cdot bb_I^2) \sin(\omega m t) \cos(\omega m t)^2) \cos(\omega m t) aa_F m_b^2 JB + (((8 \cdot bb_I^2 \\
& - 8 \cdot \sin(\omega m t)^2 bb_I^2) \sin(\omega m t)^3 + (8 \cdot -8 \cdot \sin(\omega m t)^2) \sin(\omega m t) + ((8 \cdot bb_I^2 \\
& - 16 \cdot \sin(\omega m t)^2 bb_I^2) \sin(\omega m t) - 8 \cdot \sin(\omega m t) \\
& - 8 \cdot \sin(\omega m t) \cos(\omega m t)^2 bb_I^2) \cos(\omega m t)^2) m_b^2 JB + ((8 \cdot \\
& - 8 \cdot \sin(\omega m t)^2) \sin(\omega m t)^3 + ((-16 \cdot \sin(\omega m t)^2 + 8 \cdot) \sin(\omega m t) \\
& - 8 \cdot \sin(\omega m t) \cos(\omega m t)^2) \cos(\omega m t)^2) m_b^2 JB bb_2^2 + ((8 \cdot \\
& - 8 \cdot \sin(\omega m t)^2) \sin(\omega m t) - 8 \cdot \sin(\omega m t) \cos(\omega m t)^2) m_b^2 JB) bb_F_2 + ((\\
& - 8 \cdot \sin(\omega m t)^2 bb_I - 8 \cdot bb_I \cos(\omega m t)^2) \cos(\omega m t) m_b^2 JB + (\\
& - 8 \cdot \sin(\omega m t)^2 bb_I - 8 \cdot bb_I \cos(\omega m t)^2) \cos(\omega m t) m_b^2 JB bb_2^2 \\
& - 8 \cdot m_b^2 \cos(\omega m t) JB bb_I + ((8 \cdot +8 \cdot bb_I^2) \sin(\omega m t)^2 + 8 \cdot + (8 \cdot \\
& + 8 \cdot bb_I^2) \cos(\omega m t)^2) \cos(\omega m t) m_b^2 JB bb_2) om) om + ((4 \cdot aa \sin(\omega m t)^2 \\
& + (-4 \cdot \sin(\omega m t)^2 bb_I + (4 \cdot aa - 4 \cdot bb_I \cos(\omega m t)) \cos(\omega m t)) \cos(\omega m t)) \\
& \cos(\omega m t) g_m_b^3 bb_2^2 + (-4 \cdot -4 \cdot \sin(\omega m t)^2 bb_I^2 \\
& - 4 \cdot bb_I^2 \cos(\omega m t)^2) \cos(\omega m t)^2 g_m_b^3 bb_2 + (-4 \cdot aa \sin(\omega m t)^2 bb_I^2 + (\\
& -4 \cdot bb_I - 4 \cdot aa bb_I^2 \cos(\omega m t)) \cos(\omega m t)) \cos(\omega m t) g_m_b^3 \\
& + ((4 \cdot \sin(\omega m t)^2 bb_I + 4 \cdot bb_I \cos(\omega m t)^2) \cos(\omega m t)^2 aa_F^2 m_b^3 bb_2^2 + (4 \cdot \\
& + 4 \cdot \sin(\omega m t)^2 bb_I^2 + 4 \cdot bb_I^2 \cos(\omega m t)^2) \cos(\omega m t)^2 aa_F^2 m_b^3 bb_2 \\
& + 4 \cdot m_b^3 bb_I \cos(\omega m t)^2 aa_F^2) l + (((((2 \cdot + 2 \cdot \sin(\omega m t)^2) \sin(\omega m t)^3 + ((2 \cdot \\
& + 4 \cdot \sin(\omega m t)^2) \sin(\omega m t) + 2 \cdot \sin(\omega m t) \cos(\omega m t)^2) \cos(\omega m t)^2) \\
& aa_F m_b^3 bb_2^2 + ((-2 \cdot bb_I^2 - 2 \cdot \sin(\omega m t)^2 bb_I^2) \sin(\omega m t)^3 + ((-2 \cdot bb_I^2 \\
& - 4 \cdot \sin(\omega m t)^2 bb_I^2) \sin(\omega m t) - 2 \cdot \sin(\omega m t) \cos(\omega m t)^2 bb_I^2) \cos(\omega m t)^2)
\end{aligned}$$

$$\begin{aligned}
& aa_F m_b^3 \) l + ((2. \sin(om t)^4 bb_I + (4. \sin(om t)^2 bb_I \\
& + 2. bb_I \cos(om t)^2) \cos(om t)^2) m_b^3 bb_2^2 + (2. \sin(om t)^2 \\
& + 2. \sin(om t)^4 bb_I^2 + (4. \sin(om t)^2 bb_I^2 + 2. \\
& + 2. bb_I^2 \cos(om t)^2) \cos(om t)^2) m_b^3 bb_2 + (2. bb_I \cos(om t)^2 \\
& + 2. \sin(om t)^2 bb_I) m_b^3) l om + (((2. \sin(om t)^6 bb_I + (\\
& - 2. bb_I^3 \sin(om t)^4 + (-4. bb_I + 6. \sin(om t)^2 bb_I) \sin(om t)^2 + (\\
& - 4. bb_I^3 \sin(om t)^2 - 4. bb_I + 6. \sin(om t)^2 bb_I + (2. bb_I \\
& - 2. bb_I^3) \cos(om t)^2) \cos(om t)^2) \cos(om t) aa_F^2 m_b^3 \\
& + ((4. \sin(om t)^2 bb_I + 4. bb_I^3 \sin(om t)^4 + (4. bb_I + 8. bb_I^3 \sin(om t)^2 \\
& + 4. bb_I^3 \cos(om t)^2) \cos(om t)^2) \cos(om t)^2 aa_F m_b^3 + (\\
& - 2. bb_I^3 \sin(om t)^4 - 2. \sin(om t)^4 bb_I + (-4. \sin(om t)^2 bb_I \\
& - 4. bb_I^3 \sin(om t)^2 + (-2. bb_I - 2. bb_I^3) \cos(om t)^2) \cos(om t)^2) \\
& \cos(om t) m_b^3 bb_F_1) bb_F_1 + (2. \sin(om t)^2 + 2. \sin(om t)^4 bb_I^2 \\
& + (4. \sin(om t)^2 bb_I^2 + 2. + 2. bb_I^2 \cos(om t)^2) \cos(om t)^2) \\
& \cos(om t)^3 aa_F^2 m_b^3 bb_2) bb_2^2 + (2. \sin(om t)^4 bb_I + (\\
& - 2. bb_I^3 \sin(om t)^2 + 4. \sin(om t)^2 bb_I - 4. bb_I + (2. bb_I \\
& - 2. bb_I^3) \cos(om t)^2) \cos(om t) aa_F^2 m_b^3 \\
& + ((4. bb_I^3 \sin(om t)^2 + 4. bb_I + 4. bb_I^3 \cos(om t)^2) \cos(om t)^2 aa_F m_b^3 \\
& + (-2. bb_I^3 \sin(om t)^2 - 2. \sin(om t)^2 bb_I + (-2. bb_I \\
& - 2. bb_I^3) \cos(om t)^2) \cos(om t) m_b^3 bb_F_1) bb_F_1 + (-2. \sin(om t)^4 \\
& - 2. \sin(om t)^6 bb_I^2 + ((4. bb_I^2 - 6. \sin(om t)^2 bb_I^2) \sin(om t)^2 \\
& - 4. \sin(om t)^2 + 4. + (-2. + 4. bb_I^2 - 6. \sin(om t)^2 bb_I^2 \\
& - 2. bb_I^2 \cos(om t)^2) \cos(om t)^2) \cos(om t) aa_F^2 m_b^3 bb_2 \\
& + ((4. \sin(om t)^4 bb_I^2 + 4. \sin(om t)^2 + (4. + 8. \sin(om t)^2 bb_I^2 \\
& + 4. bb_I^2 \cos(om t)^2) \cos(om t)^2) \cos(om t)^2 aa_F m_b^3 bb_2^3 + (4. \\
& + 4. \sin(om t)^2 bb_I^2 + 4. bb_I^2 \cos(om t)^2) \cos(om t)^2 aa_F m_b^3 bb_2 \\
& + ((2. \sin(om t)^2 + 2. \sin(om t)^4 bb_I^2 + (4. \sin(om t)^2 bb_I^2 + 2. \\
& + 2. bb_I^2 \cos(om t)^2) \cos(om t)^2) \cos(om t) m_b^3 bb_2^3 + (2. \sin(om t)^2 \\
& + 2. \sin(om t)^4 bb_I^2 + (4. \sin(om t)^2 bb_I^2 + 2. \\
& + 2. bb_I^2 \cos(om t)^2) \cos(om t)^2) \cos(om t) m_b^3 bb_2) bb_F_2 \\
& + (((((6. bb_I^2 - 2. \sin(om t)^2 bb_I^2) \sin(om t)^5 + (-4. \sin(om t)^2 \\
& + 4.) \sin(om t)^3 + ((12. bb_I^2 - 6. \sin(om t)^2 bb_I^2) \sin(om t)^3 + (4. \\
& - 8. \sin(om t)^2) \sin(om t) + ((6. bb_I^2 - 6. \sin(om t)^2 bb_I^2) \sin(om t) \\
& - 4. \sin(om t) - 2. \sin(om t) \cos(om t)^2 bb_I^2) \cos(om t)^2) \cos(om t)^2) \\
& \cos(om t) aa_F m_b^3 + ((-2. bb_I^2 + 2. \sin(om t)^2 bb_I^2) \sin(om t)^5 + (-2. \\
& + 2. \sin(om t)^2) \sin(om t)^3 + ((-4. bb_I^2 + 6. \sin(om t)^2 bb_I^2) \sin(om t)^3 + (
\end{aligned}$$

$$\begin{aligned}
& -2. + 4. \sin(\omega m t)^2) \sin(\omega m t) + ((-2. b b_I^2 + 6. \sin(\omega m t)^2 b b_I^2) \sin(\omega m t) \\
& + 2. \sin(\omega m t) + 2. \sin(\omega m t) \cos(\omega m t)^2 b b_I^2) \cos(\omega m t)^2) \cos(\omega m t)^2) \\
& m_b^3 b b_F_I) b b_2^2 + ((6. b b_I^2 - 2. \sin(\omega m t)^2 b b_I^2) \sin(\omega m t)^5 + (6. \\
& - 2. \sin(\omega m t)^2) \sin(\omega m t)^3 + ((12. b b_I^2 - 6. \sin(\omega m t)^2 b b_I^2) \sin(\omega m t)^3 \\
& + (6. - 4. \sin(\omega m t)^2) \sin(\omega m t) + ((6. b b_I^2 - 6. \sin(\omega m t)^2 b b_I^2) \sin(\omega m t) \\
& - 2. \sin(\omega m t) - 2. \sin(\omega m t) \cos(\omega m t)^2 b b_I^2) \cos(\omega m t)^2) \cos(\omega m t)^2) \\
& \cos(\omega m t) a a_F m_b^3 b b_2^2 + ((6. b b_I^2 - 2. \sin(\omega m t)^2 b b_I^2) \sin(\omega m t)^3 + (\\
& - 4. \sin(\omega m t)^2 + 4.) \sin(\omega m t) + ((6. b b_I^2 - 4. \sin(\omega m t)^2 b b_I^2) \sin(\omega m t) \\
& - 4. \sin(\omega m t) - 2. \sin(\omega m t) \cos(\omega m t)^2 b b_I^2) \cos(\omega m t)^2) \cos(\omega m t) a a_F m_b^3 \\
& + ((-2. b b_I^2 + 2. \sin(\omega m t)^2 b b_I^2) \sin(\omega m t)^3 + (-2. \\
& + 2. \sin(\omega m t)^2) \sin(\omega m t) + ((-2. b b_I^2 + 4. \sin(\omega m t)^2 b b_I^2) \sin(\omega m t) \\
& + 2. \sin(\omega m t) + 2. \sin(\omega m t) \cos(\omega m t)^2 b b_I^2) \cos(\omega m t)^2) m_b^3 b b_F_I \\
& + ((4. b b_I^2 - 4. \sin(\omega m t)^2 b b_I^2) \sin(\omega m t)^3 + (-4. \sin(\omega m t)^2 \\
& + 4.) \sin(\omega m t) + ((4. b b_I^2 - 8. \sin(\omega m t)^2 b b_I^2) \sin(\omega m t) - 4. \sin(\omega m t) \\
& - 4. \sin(\omega m t) \cos(\omega m t)^2 b b_I^2) \cos(\omega m t)^2) \cos(\omega m t) a a_F m_b^3 + (((2. b b_I^2 \\
& - 2. \sin(\omega m t)^2 b b_I^2) \sin(\omega m t)^5 + (2. - 2. \sin(\omega m t)^2) \sin(\omega m t)^3 + ((4. b b_I^2 \\
& - 6. \sin(\omega m t)^2 b b_I^2) \sin(\omega m t)^3 + (-4. \sin(\omega m t)^2 + 2.) \sin(\omega m t) \\
& + ((2. b b_I^2 - 6. \sin(\omega m t)^2 b b_I^2) \sin(\omega m t) - 2. \sin(\omega m t) \\
& - 2. \sin(\omega m t) \cos(\omega m t)^2 b b_I^2) \cos(\omega m t)^2) \cos(\omega m t)^2) m_b^3 b b_2^2 \\
& + ((2. b b_I^2 - 2. \sin(\omega m t)^2 b b_I^2) \sin(\omega m t)^3 + (2. - 2. \sin(\omega m t)^2) \sin(\omega m t) \\
& + ((2. b b_I^2 - 4. \sin(\omega m t)^2 b b_I^2) \sin(\omega m t) - 2. \sin(\omega m t) \\
& - 2. \sin(\omega m t) \cos(\omega m t)^2 b b_I^2) \cos(\omega m t)^2) m_b^3) b b_F_2 + ((\\
& - 2. \sin(\omega m t)^4 b b_I + (-4. \sin(\omega m t)^2 b b_I - 2. b b_I \cos(\omega m t)^2) \cos(\omega m t)^2) \\
& \cos(\omega m t) m_b^3 b b_2^2 + (-2. \sin(\omega m t)^2 b b_I \\
& - 2. b b_I \cos(\omega m t)^2) \cos(\omega m t) m_b^3 + (2. \sin(\omega m t)^2 + 2. \sin(\omega m t)^4 b b_I^2 \\
& + (4. \sin(\omega m t)^2 b b_I^2 + 2. + 2. b b_I^2 \cos(\omega m t)^2) \cos(\omega m t)^2) \\
& \cos(\omega m t) m_b^3 b b_2) o m) o m) R) R) R) R) R \\
& + (256. m_b \sin(\omega m t) o m a a_F \cos(\omega m t) J B^2 + (\\
& - 16. J B m_b^2 b b_I a a_F^2 \cos(\omega m t)^3 + 16. m_b^2 b b_2 \cos(\omega m t)^3 a a_F^2 J B \\
& + ((64. \sin(\omega m t)^3 b b_I^2 + (48. - 16. \sin(\omega m t)^2) \sin(\omega m t) \\
& + (64. \sin(\omega m t) b b_I^2 - 16. \sin(\omega m t)) \cos(\omega m t)^2) \cos(\omega m t) a a_F m_b^2 J B \\
& + (64. \sin(\omega m t)^3 + 64. \sin(\omega m t) \cos(\omega m t)^2) \cos(\omega m t) a a_F m_b^2 J B b b_2^2 \\
& + ((48. - 16. \sin(\omega m t)^2) \sin(\omega m t) \\
& - 16. \sin(\omega m t) \cos(\omega m t)^2) \cos(\omega m t) a a_F m_b^2 J B + ((-16. \sin(\omega m t)^2 b b_I \\
& - 16. b b_I \cos(\omega m t)^2) \cos(\omega m t) m_b^2 J B + (16. \sin(\omega m t)^2 \\
& + 16. \cos(\omega m t)^2) \cos(\omega m t) m_b^2 J B b b_2) o m) o m + ((-4. \sin(\omega m t)^2 b b_I
\end{aligned}$$

$$\begin{aligned}
& -4. bb_1 \cos(om t)^2) \cos(om t)^3 aa_F^2 m_b^3 bb_2^2 + (4. + 4. \sin(om t)^2 bb_1^2 \\
& + 4. bb_1^2 \cos(om t)^2) \cos(om t)^3 aa_F^2 m_b^3 bb_2 \\
& -4. m_b^3 bb_1 aa_F^2 \cos(om t)^3 + ((16. \sin(om t)^5 bb_1^2 + (12. \\
& -4. \sin(om t)^2) \sin(om t)^3 + (32. \sin(om t)^3 bb_1^2 + (12. \\
& -8. \sin(om t)^2) \sin(om t) + (16. \sin(om t) bb_1^2 - 4. \sin(om t)) \cos(om t)^2 \\
& \cos(om t)^2) \cos(om t) aa_F m_b^3 bb_2^2 + ((12. bb_1^2 \\
& -4. \sin(om t)^2 bb_1^2) \sin(om t)^3 + (8. - 8. \sin(om t)^2) \sin(om t) + ((12. bb_1^2 \\
& -8. \sin(om t)^2 bb_1^2) \sin(om t) - 8. \sin(om t) - 4. \sin(om t) \cos(om t)^2 bb_1^2) \\
& \cos(om t)^2) \cos(om t) aa_F m_b^3 + ((-4. \sin(om t)^4 bb_1 + (\\
& -8. \sin(om t)^2 bb_1 - 4. bb_1 \cos(om t)^2) \cos(om t)^2) \cos(om t) m_b^3 bb_2^2 \\
& + (4. \sin(om t)^4 bb_1^2 + 4. \sin(om t)^2 + (4. + 8. \sin(om t)^2 bb_1^2 \\
& + 4. bb_1^2 \cos(om t)^2) \cos(om t)^2) \cos(om t) m_b^3 bb_2 + (-4. \sin(om t)^2 bb_1 \\
& -4. bb_1 \cos(om t)^2) \cos(om t) m_b^3) om) om) R^2) R^2) e) e)) / ((256. JT \\
& + 256. JB bb_1^2 \sin(om t)^2) JB^2 + 256. JB^3 \sin(om t)^2 bb_2^2 + (128. m_b \\
& + 16. m_t) JB^2 l^2 + (((64. \sin(om t)^2 bb_1^2 + 64. bb_1^2 \cos(om t)^2 \\
& + 64.) JT m_b + ((64. + 64. bb_1^2) bb_1^2 \sin(om t)^4 + 64. \sin(om t)^2 bb_1^2 \\
& + (64. + 64. bb_1^2) bb_1^2 \sin(om t)^2 \cos(om t)^2) m_b JB) JB \\
& + (((64. \sin(om t)^2 + 64. \cos(om t)^2) JT m_b + ((64. + 128. bb_1^2) \sin(om t)^4 \\
& + 64. \sin(om t)^2 + (64. + 128. bb_1^2) \sin(om t)^2 \cos(om t)^2) m_b JB) JB \\
& + (64. \sin(om t)^4 + 64. \sin(om t)^2 \cos(om t)^2) m_b JB^2 bb_2^2) bb_2^2 \\
& + (64. m_b JT + 64. m_b bb_1^2 \sin(om t)^2 JB) JB + 64. m_b JB^2 \sin(om t)^2 bb_2^2 \\
& + (((4. + 4. \sin(om t)^2 bb_1^2 + 4. bb_1^2 \cos(om t)^2) m_t + (16. \\
& + 32. bb_1^2 \cos(om t)^2 + 32. \sin(om t)^2 bb_1^2) m_b) m_b JB + ((4. \sin(om t)^2 \\
& + 4. \cos(om t)^2) m_t + (32. \cos(om t)^2 + 32. \sin(om t)^2) m_b) m_b JB bb_2^2 \\
& + (4. m_t + 16. m_b) m_b JB) l^2 + ((16. \sin(om t)^6 bb_1^4 + 16. \sin(om t)^4 bb_1^2 \\
& + (16. \sin(om t)^2 bb_1^2 + 32. \sin(om t)^4 bb_1^2 \\
& + 16. \cos(om t)^2 bb_1^4 \sin(om t)^2) \cos(om t)^2) m_b^2 JB + ((16. \sin(om t)^2 \\
& + 16. \sin(om t)^4 bb_1^2 + (16. + 32. \sin(om t)^2 bb_1^2 \\
& + 16. bb_1^2 \cos(om t)^2) \cos(om t)^2) JT m_b^2 + ((32. \\
& + 16. bb_1^2) bb_1^2 \sin(om t)^6 + (16. + 16. bb_1^2) \sin(om t)^4 + ((64. \\
& + 32. bb_1^2) bb_1^2 \sin(om t)^4 + (16. + 16. bb_1^2) \sin(om t)^2 + (32. \\
& + 16. bb_1^2) bb_1^2 \sin(om t)^2 \cos(om t)^2) \cos(om t)^2) m_b^2 JB + ((16. \\
& + 16. bb_1^2) \sin(om t)^6 + 16. \sin(om t)^4 + ((32. + 32. bb_1^2) \sin(om t)^4 \\
& + 16. \sin(om t)^2 + (16. + 16. bb_1^2) \sin(om t)^2 \cos(om t)^2) \cos(om t)^2) \\
& m_b^2 JB bb_2^2) bb_2^2 + (16. + 16. \sin(om t)^2 bb_1^2 \\
& + 16. bb_1^2 \cos(om t)^2) JT m_b^2 + ((16. + 16. bb_1^2) bb_1^2 \sin(om t)^4
\end{aligned}$$

$$\begin{aligned}
& + 16 \cdot \sin(\omega m t)^2 b b_1^2 + (16 + 16 \cdot b b_1^2) b b_1^2 \sin(\omega m t)^2 \cos(\omega m t)^2) m_b^2 J B \\
& + ((16 + 16 \cdot b b_1^2) \sin(\omega m t)^4 + 16 \cdot \sin(\omega m t)^2 + (16 \\
& + 16 \cdot b b_1^2) \sin(\omega m t)^2 \cos(\omega m t)^2) m_b^2 J B b b_2^2 + (((\sin(\omega m t)^2 \\
& + \sin(\omega m t)^4 b b_1^2 + (1 + 2 \cdot \sin(\omega m t)^2 b b_1^2 + b b_1^2 \cos(\omega m t)^2) \cos(\omega m t)^2) \\
& m_t + (8 \cdot \sin(\omega m t)^4 b b_1^2 + 4 \cdot \sin(\omega m t)^2 + (4 + 16 \cdot \sin(\omega m t)^2 b b_1^2 \\
& + 8 \cdot b b_1^2 \cos(\omega m t)^2) \cos(\omega m t)^2) m_b) m_b^2 b b_2^2 + ((\sin(\omega m t)^2 b b_1^2 + 1 \\
& + b b_1^2 \cos(\omega m t)^2) m_t + (4 \cdot \sin(\omega m t)^2 b b_1^2 + 4 \cdot b b_1^2 \cos(\omega m t)^2) m_b) \\
& m_b^2) l^2 + (((4 \cdot \sin(\omega m t)^6 b b_1^2 + 4 \cdot \sin(\omega m t)^8 b b_1^4 + (8 \cdot \sin(\omega m t)^4 b b_1^2 \\
& + 12 \cdot \sin(\omega m t)^6 b b_1^4 + (4 \cdot \sin(\omega m t)^2 b b_1^2 + 12 \cdot \sin(\omega m t)^4 b b_1^4 \\
& + 4 \cdot \cos(\omega m t)^2 b b_1^4 \sin(\omega m t)^2) \cos(\omega m t)^2) m_b^3 \\
& + (4 \cdot \sin(\omega m t)^8 b b_1^2 + 4 \cdot \sin(\omega m t)^6 + (8 \cdot \sin(\omega m t)^4 + 12 \cdot \sin(\omega m t)^6 b b_1^2 \\
& + (4 \cdot \sin(\omega m t)^2 + 12 \cdot \sin(\omega m t)^4 b b_1^2 \\
& + 4 \cdot \sin(\omega m t)^2 b b_1^2 \cos(\omega m t)^2) \cos(\omega m t)^2) m_b^3 b b_2^2) b b_2^2 \\
& + (4 \cdot \sin(\omega m t)^6 b b_1^4 + 4 \cdot \sin(\omega m t)^4 b b_1^2 + (4 \cdot \sin(\omega m t)^2 b b_1^2 \\
& + 8 \cdot \sin(\omega m t)^4 b b_1^4 + 4 \cdot \cos(\omega m t)^2 b b_1^4 \sin(\omega m t)^2) \cos(\omega m t)^2) m_b^3 \\
& + (4 \cdot \sin(\omega m t)^6 b b_1^2 + 4 \cdot \sin(\omega m t)^4 + (8 \cdot \sin(\omega m t)^4 b b_1^2 + 4 \cdot \sin(\omega m t)^2 \\
& + 4 \cdot \sin(\omega m t)^2 b b_1^2 \cos(\omega m t)^2) \cos(\omega m t)^2) m_b^3 b b_2^2) R^2) R^2 \\
& + (((16 \cdot \sin(\omega m t)^2 + 16 \cdot \cos(\omega m t)^2) \cos(\omega m t) m_b^3 b b_2^2 + (-16 \cdot \sin(\omega m t)^2 b b_1^2 - 16 \cdot b b_1^2 \cos(\omega m t)^2) \cos(\omega m t) m_b^3) l R^4 \\
& + (512 \cdot J B^2 m_b \cos(\omega m t)^2 + ((64 + 128 \cdot \sin(\omega m t)^2 b b_1^2 \\
& + 128 \cdot b b_1^2 \cos(\omega m t)^2) \cos(\omega m t)^2 m_b^2 J B + (128 \cdot \sin(\omega m t)^2 \\
& + 128 \cdot \cos(\omega m t)^2) \cos(\omega m t)^2 m_b^2 J B b b_2^2 + 64 \cdot m_b^2 J B \cos(\omega m t)^2 \\
& + ((16 \cdot \sin(\omega m t)^2 + 32 \cdot \sin(\omega m t)^4 b b_1^2 + (16 + 64 \cdot \sin(\omega m t)^2 b b_1^2 \\
& + 32 \cdot b b_1^2 \cos(\omega m t)^2) \cos(\omega m t)^2) \cos(\omega m t)^2 m_b^3 b b_2^2 \\
& + (16 \cdot \sin(\omega m t)^2 b b_1^2 + 16 \cdot b b_1^2 \cos(\omega m t)^2) \cos(\omega m t)^2 m_b^3) R^2) R^2) e) e)
\end{aligned}$$

Matlab code

rho

```

> Matlab(T5_eq_rho[full], resultname="aa_FF");
aa_FF = 0.4e1 * ((-0.64e2 * ka * aa + 0.64e2 * cos(om * t) *
aa_F ^ 2 * sin(om * t) ^ 2 * sin(bb_1) * cos(bb_1) * JB) *
JB ^ 2 - 0.128e3 * sin(om * t) ^ 2 * sin(bb_1) * aa_F * cos
(bb_1) * bb_F_1 * JB ^ 3 - 0.64e2 * cos(om * t) * aa_F ^ 2 *
sin(om * t) ^ 2 * sin(bb_2) * JB ^ 3 * cos(bb_2) - 0.64e2 *
cos(om * t) * kb * bb_1 * JB ^ 2 + (0.64e2 * m_b * g_ * sin
(aa) + 0.16e2 * m_t * g_ * sin(aa)) * JB ^ 2 * l - 0.128e3 *

```

```

sin(om * t) ^ 2 * sin(bb_2) * aa_F * cos(bb_2) * bb_F_2 * JB
^ 3 + 0.64e2 * cos(om * t) * kb * bb_2 * JB ^ 2 + (((0.128e3
- 0.64e2 * sin(bb_1) ^ 2) * sin(om * t) - 0.64e2 * cos(bb_1)
^ 2 * sin(om * t)) * cos(om * t) * aa_F * JB ^ 3 + ((-0.64e2
* sin(bb_1) ^ 2 - 0.64e2) * sin(om * t) + 0.64e2 * cos(bb_1)
^ 2 * sin(om * t)) * JB ^ 3 * bb_F_1 - 0.64e2 * cos(om * t)
* JB ^ 3 * aa_F * sin(om * t) * sin(bb_2) ^ 2 - 0.64e2 * cos
(om * t) * JB ^ 3 * sin(om * t) * aa_F * cos(bb_2) ^ 2 +
(0.64e2 * JB ^ 3 * sin(om * t) * sin(bb_2) ^ 2 - 0.64e2 * JB
^ 3 * sin(om * t) * cos(bb_2) ^ 2 + 0.64e2 * JB ^ 3 * sin(om
* t)) * bb_F_2 * om + ((-0.32e2 * sin(bb_1) * cos(om * t) ^
2 * cos(aa) + 0.32e2 * sin(bb_1) * cos(aa)) * g_ * m_b * JB
^ 2 + (0.32e2 * cos(aa) - 0.32e2 * cos(om * t) ^ 2 * cos(aa)
) * g_ * m_b * JB ^ 2 * sin(bb_2) + ((0.16e2 * sin(bb_1) *
cos(om * t) ^ 2 - 0.16e2 * sin(om * t) ^ 2 * sin(bb_1) * cos
(bb_1) ^ 2) * aa_F ^ 2 * m_b * JB ^ 2 + (-0.32e2 * m_b * sin
(bb_1) * aa_F * cos(om * t) * JB ^ 2 + 0.16e2 * m_b * sin
(bb_1) * JB ^ 2 * bb_F_1) * bb_F_1 + 0.16e2 * m_b * sin
(bb_2) * aa_F ^ 2 * cos(om * t) ^ 2 * JB ^ 2 - 0.16e2 * m_b
* aa_F ^ 2 * sin(om * t) ^ 2 * sin(bb_2) * JB ^ 2 * cos
(bb_2) ^ 2 + 0.16e2 * m_b * cos(bb_1) * kb * bb_1 * JB) * l
+ (0.32e2 * m_b * l * sin(bb_2) * aa_F * cos(om * t) * JB ^
2 + 0.16e2 * m_b * l * sin(bb_2) * JB ^ 2 * bb_F_2) * bb_F_2
+ 0.16e2 * m_b * l * cos(bb_2) * kb * bb_2 * JB + ((((
(-0.16e2 - 0.16e2 * sin(bb_1) ^ 2) * sin(om * t) + 0.16e2 *
cos(bb_1) ^ 2 * sin(om * t)) * cos(bb_1) * aa_F * m_b * JB ^
2 + (0.16e2 * m_b * JB ^ 2 * aa_F * sin(om * t) + 0.16e2 *
m_b * JB ^ 2 * aa_F * sin(om * t) * sin(bb_2) ^ 2 - 0.16e2 *
m_b * JB ^ 2 * aa_F * sin(om * t) * cos(bb_2) ^ 2) * cos
(bb_2)) * l + (0.16e2 * m_b * JB ^ 2 * cos(bb_1) ^ 2 * sin
(bb_1) + 0.16e2 * m_b * JB ^ 2 * cos(bb_2) ^ 2 * sin(bb_2))
* l * om) * om + ((((-0.16e2 * aa * cos(bb_1) ^ 2 - 0.16e2 *
aa * cos(om * t) ^ 2 * sin(bb_1) ^ 2 - 0.16e2 * aa * sin(om
* t) ^ 2 * sin(bb_1) ^ 2) * ka * m_b + (((0.16e2 + 0.16e2 *
sin(bb_1) ^ 2) * sin(bb_1) * sin(om * t) ^ 4 + 0.16e2 * sin
(om * t) ^ 2 * sin(bb_1) * cos(bb_1) ^ 2) * cos(bb_1) + (
(-0.16e2 * sin(bb_1) + (0.32e2 + 0.16e2 * sin(bb_1) ^ 2) *
sin(bb_1) * sin(om * t) ^ 2) * cos(bb_1) + 0.16e2 * sin
(bb_1) * cos(bb_1) * cos(om * t) ^ 2) * cos(om * t) ^ 2) *
cos(om * t) * aa_F ^ 2 * m_b * JB) * JB + ((((-0.32e2 -
0.32e2 * sin(bb_1) ^ 2) * sin(bb_1) * sin(om * t) ^ 4 -
0.32e2 * sin(om * t) ^ 2 * sin(bb_1) * cos(bb_1) ^ 2) * cos

```

$$\begin{aligned}
& (\text{bb_1}) + ((0.32e2 * \sin(\text{bb_1}) + (-0.64e2 - 0.32e2 * \sin(\text{bb_1})^2) * \sin(\text{bb_1}) * \sin(\text{om} * t)^2 * \cos(\text{bb_1}) - \\
& 0.32e2 * \sin(\text{bb_1}) * \cos(\text{bb_1}) * \cos(\text{om} * t)^2 * \cos(\text{om} * t)^2) * \text{aa_F} * \text{m_b} * \text{JB}^2 + ((0.16e2 * \sin(\text{om} * t)^2 * \sin(\text{bb_1}) - \\
& 0.16e2 * \sin(\text{bb_1})) * \cos(\text{bb_1}) + 0.16e2 * \sin(\text{bb_1}) * \cos(\text{bb_1}) * \cos(\text{om} * t)^2 * \cos(\text{om} * t) * \text{m_b} * \\
& \text{JB}^2 * \text{bb_F_1}) * \text{bb_F_1} + (((-0.16e2 * \text{aa} * \sin(\text{om} * t)^2 - 0.16e2 * \text{aa} * \cos(\text{om} * t)^2) * \text{ka} * \text{m_b} + (0.16e2 * \\
& \sin(\text{om} * t)^2 * \sin(\text{bb_1}) * \cos(\text{bb_1}) + 0.16e2 * \sin(\text{om} * t)^2 * \cos(\text{om} * t)^2 * \sin(\text{bb_1}) * \cos(\text{bb_1})) * \cos(\text{om} * t) * \\
& \text{aa_F}^2 * \text{m_b} * \text{JB}) * \text{JB} + (-0.32e2 * \sin(\text{om} * t)^2 * \cos(\text{om} * t)^2 * \sin(\text{bb_1}) * \cos(\text{bb_1}) - 0.32e2 * \sin(\text{om} * t)^4 * \\
& \sin(\text{bb_1}) * \cos(\text{bb_1}) + 0.32e2 * \sin(\text{om} * t)^4 * \sin(\text{bb_1}) * \cos(\text{bb_1})) * \text{aa_F} * \text{m_b} * \text{JB}^2 * \text{bb_F_1}) * \sin(\text{bb_2})^2 + ((((-0.16e2 - 0.16e2 * \sin(\text{bb_1})^2) * \sin(\text{om} * t)^4 - \\
& 0.16e2 * \cos(\text{bb_1})^2 * \sin(\text{om} * t)^4 - 0.16e2 * \cos(\text{om} * t)^2 * \sin(\text{om} * t)^2) * \cos(\text{om} * t)^2 * \cos(\text{om} * t)^2 * \\
& \text{aa_F}^2 * \text{m_b} * \text{JB}^2 + (-0.16e2 * \sin(\text{om} * t)^4 - 0.16e2 * \sin(\text{om} * t)^2 * \cos(\text{om} * t)^2) * \sin(\text{bb_2})^2 * \sin(\text{bb_2}) * \\
& \cos(\text{bb_2}) + ((-0.16e2 * \text{ka} * \text{aa} * \text{m_b} + 0.16e2 * \cos(\text{om} * t) * \text{aa_F}^2 * \sin(\text{om} * t)^2 * \sin(\text{bb_1}) * \cos(\text{bb_1}) * \text{m_b} * \\
& \text{JB}) * \text{JB} - 0.32e2 * \sin(\text{om} * t)^2 * \sin(\text{bb_1}) * \text{aa_F} * \cos(\text{bb_1}) * \text{m_b} * \text{bb_F_1} * \text{m_b} * \text{JB}^2 - 0.16e2 * \text{m_b} * \cos(\text{om} * t) * \\
& \text{aa_F}^2 * \sin(\text{om} * t)^2 * \sin(\text{bb_2}) * \text{JB}^2 * \cos(\text{bb_2})) * \cos(\text{bb_2}) + (((-0.16e2 * \sin(\text{om} * t)^2 * \sin(\text{bb_1})^2 - \\
& 0.16e2 * \cos(\text{bb_1})^2 * \sin(\text{om} * t)^2 - 0.16e2 * \sin(\text{om} * t)^2 * \cos(\text{om} * t)^2) * \cos(\text{om} * t)^2 * \cos(\text{om} * t)^2 * \\
& \text{kb} * \text{m_b} * \text{JB} + (-0.16e2 * \sin(\text{om} * t)^2 * \cos(\text{om} * t)^2 - 0.16e2 * \cos(\text{om} * t)^2 * \cos(\text{om} * t)^2) * \\
& \cos(\text{om} * t) * \text{kb} * \text{m_b} * \text{JB} * \sin(\text{bb_2})^2 - 0.16e2 * \text{m_b} * \cos(\text{om} * t) * \text{kb} * \cos(\text{bb_2})^2 * \text{JB} * \text{bb_1} + (((0.4e1 * \\
& \sin(\text{aa}) * \cos(\text{om} * t)^2 * \sin(\text{bb_1})^2 + 0.4e1 * \sin(\text{aa}) * \cos(\text{bb_1})^2 + 0.4e1 * \sin(\text{aa}) * \cos(\text{bb_1})^2 * \\
& \sin(\text{aa}) * \sin(\text{om} * t)^2 * \sin(\text{bb_1})^2 + 0.4e1 * \sin(\text{aa}) * \cos(\text{bb_1})^2 * \sin(\text{aa}) * \sin(\text{om} * t)^2 * \\
& \sin(\text{bb_1})^2 + 0.8e1 * \sin(\text{aa}) * \cos(\text{bb_1})^2 + 0.16e2 * \sin(\text{aa}) * \sin(\text{om} * t)^2 * \sin(\text{bb_1})^2 + (0.8e1 * \\
& \cos(\text{bb_1}) * \sin(\text{bb_1}) * \cos(\text{aa}) + 0.16e2 * \sin(\text{aa}) * \sin(\text{bb_1})^2 * \cos(\text{aa}) + 0.16e2 * \sin(\text{aa}) * \sin(\text{bb_1})^2 * \\
& \cos(\text{aa}) * \cos(\text{om} * t)) * \cos(\text{om} * t) * \text{g_} * \text{m_b} * \text{m_b} * \text{JB} + ((0.4e1 * \sin(\text{aa}) * \cos(\text{om} * t)^2 * \sin(\text{aa}) * \\
& \sin(\text{om} * t)^2 * \text{g_} * \text{m_t} + (0.16e2 * \sin(\text{aa}) * \cos(\text{om} * t)^2 * \text{g_} * \text{m_b} * \text{m_b} * \text{JB} + \\
& (0.4e1 * \sin(\text{aa}) * \cos(\text{om} * t)^2 * \sin(\text{aa}) * \cos(\text{om} * t)^2 * \text{g_} * \text{m_b}) * \sin(\text{om} * t)^2 * \text{g_} * \text{m_t} * \text{g_} * \\
& \text{m_b} * \text{JB} * \sin(\text{bb_2})^2 + (-0.8e1 * \text{m_b}^2 * \text{g_} * \sin(\text{bb_2})^2 * \cos(\text{aa}) * \cos(\text{om} * t) * \text{JB} + (0.4e1 * \text{m_t} * \text{g_} * \\
& \text{m_b} * \text{JB} * \sin(\text{bb_2})^2 + (-0.8e1 * \text{m_b}^2 * \text{g_} * \sin(\text{bb_2})^2 * \cos(\text{aa}) * \cos(\text{om} * t) * \text{JB} + (0.4e1 * \text{m_t} * \text{g_} *
\end{aligned}$$

```

sin(aa) + 0.8e1 * m_b * g_ * sin(aa)) * m_b * JB * cos(bb_2)
) * cos(bb_2) + (0.4e1 * m_b ^ 2 * cos(bb_2) * sin(bb_2) *
aa_F ^ 2 * cos(om * t) * JB - 0.4e1 * m_b ^ 2 * cos(bb_1) *
sin(bb_1) * aa_F ^ 2 * cos(om * t) * JB) * l) * l + ((((
(-0.32e2 - 0.32e2 * sin(bb_1) ^ 2) * sin(om * t) ^ 4 -
0.32e2 * cos(bb_1) ^ 2 * sin(om * t) ^ 2 + (0.32e2 +
(-0.64e2 - 0.32e2 * sin(bb_1) ^ 2) * sin(om * t) ^ 2 -
0.32e2 * cos(om * t) ^ 2) * cos(om * t) ^ 2) * aa_F * m_b *
JB ^ 2 + (-0.32e2 * sin(om * t) ^ 2 * cos(om * t) ^ 2 -
0.32e2 * sin(om * t) ^ 4) * aa_F * m_b * JB ^ 2 * sin(bb_2)
^ 2) * sin(bb_2) - 0.32e2 * sin(om * t) ^ 2 * sin(bb_2) *
aa_F * m_b * JB ^ 2 * cos(bb_2) ^ 2) * cos(bb_2) + (-0.16e2
* sin(om * t) ^ 2 + 0.16e2 - 0.16e2 * cos(om * t) ^ 2) * cos
(om * t) * m_b * JB ^ 2 * sin(bb_2) * cos(bb_2) * bb_F_2) *
bb_F_2 + ((0.16e2 * cos(bb_1) ^ 2 + 0.16e2 * sin(om * t) ^ 2
* sin(bb_1) ^ 2 + 0.16e2 * sin(bb_1) ^ 2 * cos(om * t) ^ 2)
* cos(om * t) * kb * m_b * JB + (0.16e2 * sin(om * t) ^ 2 +
0.16e2 * cos(om * t) ^ 2) * cos(om * t) * kb * m_b * JB *
sin(bb_2) ^ 2 + 0.16e2 * m_b * cos(om * t) * kb * cos(bb_2)
^ 2 * JB) * bb_2 + (((0.32e2 - 0.16e2 * sin(bb_1) ^ 2) * sin
(bb_1) ^ 2 * sin(om * t) ^ 3 + ((-0.16e2 * sin(bb_1) ^ 2 +
0.48e2 + (-0.16e2 - 0.16e2 * sin(bb_1) ^ 2) * sin(om * t) ^
2) * sin(om * t) - 0.16e2 * cos(bb_1) ^ 2 * sin(om * t)) *
cos(bb_1) ^ 2 + ((0.32e2 - 0.16e2 * sin(bb_1) ^ 2) * sin
(bb_1) ^ 2 * sin(om * t) + (-0.16e2 - 0.16e2 * sin(bb_1) ^
2) * sin(om * t) * cos(bb_1) ^ 2 * cos(om * t) ^ 2 * cos
(om * t) * aa_F * m_b * JB ^ 2 + ((-0.48e2 - 0.16e2 * sin
(bb_1) ^ 2) * sin(bb_1) ^ 2 * sin(om * t) ^ 3 + ((-0.32e2 -
0.16e2 * sin(bb_1) ^ 2 + (0.16e2 + 0.16e2 * sin(bb_1) ^ 2) *
sin(om * t) ^ 2) * sin(om * t) + 0.16e2 * cos(bb_1) ^ 2 *
sin(om * t)) * cos(bb_1) ^ 2 + ((-0.48e2 - 0.16e2 * sin
(bb_1) ^ 2) * sin(bb_1) ^ 2 * sin(om * t) + (0.16e2 + 0.16e2
* sin(bb_1) ^ 2) * sin(om * t) * cos(bb_1) ^ 2 * cos(om *
t) ^ 2) * m_b * JB ^ 2 * bb_F_1 + (((0.32e2 - 0.32e2 * sin
(bb_1) ^ 2) * sin(om * t) ^ 3 + (-0.16e2 - 0.16e2 * sin(om *
t) ^ 2) * sin(om * t) * cos(bb_1) ^ 2 + ((0.32e2 - 0.32e2 *
sin(bb_1) ^ 2) * sin(om * t) - 0.16e2 * cos(bb_1) ^ 2 * sin
(om * t)) * cos(om * t) ^ 2) * cos(om * t) * aa_F * m_b * JB
^ 2 + ((-0.16e2 - 0.16e2 * sin(bb_1) ^ 2) * sin(om * t) ^ 3
+ 0.16e2 * sin(om * t) ^ 3 * cos(bb_1) ^ 2 + ((-0.16e2 -
0.16e2 * sin(bb_1) ^ 2) * sin(om * t) + 0.16e2 * cos(bb_1) ^
2 * sin(om * t)) * cos(om * t) ^ 2) * m_b * JB ^ 2 * bb_F_1

```

```

+ (-0.16e2 * sin(om * t) ^ 3 - 0.16e2 * sin(om * t) * cos(om
* t) ^ 2) * cos(om * t) * aa_F * m_b * JB ^ 2 * sin(bb_2) ^
2) * sin(bb_2) ^ 2 + (((-0.16e2 * sin(bb_1) ^ 2 + 0.48e2 +
(-0.16e2 - 0.16e2 * sin(bb_1) ^ 2) * sin(om * t) ^ 2) * sin
(om * t) - 0.32e2 * cos(bb_1) ^ 2 * sin(om * t) + (-0.16e2 -
0.16e2 * sin(bb_1) ^ 2) * sin(om * t) * cos(om * t) ^ 2) *
cos(om * t) * aa_F * m_b * JB ^ 2 + ((-0.16e2 - 0.16e2 * sin
(bb_1) ^ 2) * sin(om * t) + 0.16e2 * cos(bb_1) ^ 2 * sin(om
* t)) * m_b * JB ^ 2 * bb_F_1 + ((-0.16e2 - 0.16e2 * sin(om
* t) ^ 2) * sin(om * t) - 0.16e2 * sin(om * t) * cos(om * t)
^ 2) * cos(om * t) * aa_F * m_b * JB ^ 2 * sin(bb_2) ^ 2 -
0.16e2 * cos(om * t) * m_b * sin(om * t) * aa_F * cos(bb_2)
^ 2 * JB ^ 2 * cos(bb_2) ^ 2 + ((0.16e2 * sin(om * t) * cos
(om * t) ^ 2 * sin(bb_1) ^ 2 + 0.16e2 * cos(bb_1) ^ 2 * sin
(om * t) + 0.16e2 * sin(om * t) ^ 3 * sin(bb_1) ^ 2) * m_b *
JB ^ 2 + (((0.16e2 * sin(bb_1) ^ 2 + 0.48e2) * sin(om * t) ^
3 + 0.16e2 * cos(bb_1) ^ 2 * sin(om * t) + (0.16e2 * sin
(bb_1) ^ 2 + 0.48e2) * sin(om * t) * cos(om * t) ^ 2) * m_b
* JB ^ 2 + (0.16e2 * sin(om * t) ^ 3 + 0.16e2 * sin(om * t)
* cos(om * t) ^ 2) * m_b * JB ^ 2 * sin(bb_2) ^ 2) * sin
(bb_2) ^ 2 + (((0.32e2 + (-0.16e2 - 0.16e2 * sin(bb_1) ^ 2)
* sin(om * t) ^ 2) * sin(om * t) - 0.16e2 * cos(bb_1) ^ 2 *
sin(om * t) + (-0.16e2 - 0.16e2 * sin(bb_1) ^ 2) * sin(om *
t) * cos(om * t) ^ 2) * m_b * JB ^ 2 + ((-0.16e2 * sin(om *
t) ^ 2 + 0.16e2) * sin(om * t) - 0.16e2 * sin(om * t) * cos
(om * t) ^ 2) * m_b * JB ^ 2 * sin(bb_2) ^ 2 - 0.16e2 * JB ^
2 * sin(om * t) * m_b * cos(bb_2) ^ 2) * cos(bb_2) ^ 2) *
bb_F_2) * om + ((0.8e1 * sin(bb_1) ^ 3 * cos(aa) * sin(om *
t) ^ 2 + 0.8e1 * sin(bb_1) * cos(aa) * cos(bb_1) ^ 2 +
(-0.8e1 * sin(bb_1) * cos(aa) * cos(bb_1) ^ 2 - 0.8e1 * sin
(bb_1) ^ 3 * cos(aa) * sin(om * t) ^ 2 + 0.8e1 * sin(bb_1) ^
3 * cos(aa) - 0.8e1 * sin(bb_1) ^ 3 * cos(aa) * cos(om * t)
^ 2) * cos(om * t) ^ 2) * g_ * m_b ^ 2 * JB + ((0.8e1 * cos
(aa) * sin(om * t) ^ 2 * sin(bb_1) ^ 2 + 0.8e1 * cos(aa) *
cos(bb_1) ^ 2 + (-0.8e1 * cos(aa) * cos(bb_1) ^ 2 + 0.8e1 *
cos(aa) * sin(bb_1) ^ 2 - 0.8e1 * cos(aa) * sin(om * t) ^ 2
* sin(bb_1) ^ 2 - 0.8e1 * cos(aa) * cos(om * t) ^ 2 * sin
(bb_1) ^ 2) * cos(om * t) ^ 2) * g_ * m_b ^ 2 * JB + ((0.8e1
* sin(bb_1) * cos(aa) * sin(om * t) ^ 2 + (0.8e1 * sin(bb_1)
* cos(aa) - 0.8e1 * sin(bb_1) * cos(aa) * sin(om * t) ^ 2 -
0.8e1 * sin(bb_1) * cos(om * t) ^ 2 * cos(aa)) * cos(om * t)
^ 2) * g_ * m_b ^ 2 * JB + (0.8e1 * cos(aa) * sin(om * t) ^

```

```

2 + (0.8e1 * cos(aa) - 0.8e1 * cos(aa) * sin(om * t) ^ 2 -
0.8e1 * cos(om * t) ^ 2 * cos(aa)) * cos(om * t) ^ 2) * g_ *
m_b ^ 2 * JB * sin(bb_2)) * sin(bb_2)) * sin(bb_2) + ((0.8e1
* sin(bb_1) * cos(aa) - 0.8e1 * sin(bb_1) * cos(om * t) ^ 2
* cos(aa)) * g_ * m_b ^ 2 * JB + (0.8e1 * cos(aa) - 0.8e1 *
cos(om * t) ^ 2 * cos(aa)) * g_ * m_b ^ 2 * JB * sin(bb_2))
* cos(bb_2) ^ 2 + ((-0.4e1 * sin(om * t) ^ 4 * sin(bb_1) *
cos(bb_1) ^ 2 + (0.4e1 * sin(bb_1) ^ 3 * sin(om * t) ^ 2 +
(-0.8e1 * sin(om * t) ^ 2 * sin(bb_1) + 0.8e1 * sin(bb_1)) *
cos(bb_1) ^ 2 + (-0.4e1 * sin(bb_1) * cos(bb_1) ^ 2 + 0.4e1
* sin(bb_1) ^ 3) * cos(om * t) ^ 2 * cos(om * t) ^ 2) *
aa_F ^ 2 * m_b ^ 2 * JB + ((-0.8e1 * sin(bb_1) * cos(bb_1) ^
2 - 0.8e1 * sin(bb_1) ^ 3 * sin(om * t) ^ 2 - 0.8e1 * sin
(bb_1) ^ 3 * cos(om * t) ^ 2) * cos(om * t) * aa_F * m_b ^ 2
* JB + (0.4e1 * sin(bb_1) ^ 3 * sin(om * t) ^ 2 + 0.4e1 *
sin(om * t) ^ 2 * sin(bb_1) * cos(bb_1) ^ 2 + (0.4e1 * sin
(bb_1) * cos(bb_1) ^ 2 + 0.4e1 * sin(bb_1) ^ 3) * cos(om *
t) ^ 2) * m_b ^ 2 * JB * bb_F_1) * bb_F_1 + ((0.4e1 * cos
(bb_1) ^ 2 + 0.4e1 * sin(om * t) ^ 2 * sin(bb_1) ^ 2 + 0.4e1
* sin(bb_1) ^ 2 * cos(om * t) ^ 2) * cos(om * t) ^ 2 * aa_F ^
2 * m_b ^ 2 * JB + ((-0.8e1 * sin(om * t) ^ 2 * sin(bb_1) -
0.8e1 * sin(bb_1) * cos(om * t) ^ 2) * cos(om * t) * aa_F *
m_b ^ 2 * JB + (0.4e1 * sin(om * t) ^ 2 * sin(bb_1) + 0.4e1
* sin(bb_1) * cos(om * t) ^ 2) * cos(om * t) ^ 2 * aa_F ^ 2
* m_b ^ 2 * JB + ((-0.8e1 * sin(om * t) ^ 2 * sin(bb_1) -
0.8e1 * sin(bb_1) * cos(om * t) ^ 2) * cos(om * t) * aa_F *
m_b ^ 2 * JB + (0.4e1 * sin(om * t) ^ 2 * sin(bb_1) + 0.4e1
* sin(bb_1) * cos(om * t) ^ 2) * m_b ^ 2 * JB * bb_F_1) *
bb_F_1 + (0.4e1 * sin(om * t) ^ 2 + 0.4e1 * cos(om * t) ^ 2)
* cos(om * t) ^ 2 * aa_F ^ 2 * m_b ^ 2 * JB * sin(bb_2)) *
sin(bb_2)) * sin(bb_2) + ((0.4e1 * sin(bb_1) * cos(om * t) ^
2 - 0.4e1 * sin(om * t) ^ 2 * sin(bb_1) * cos(bb_1) ^ 2) *
aa_F ^ 2 * m_b ^ 2 * JB + (-0.8e1 * m_b ^ 2 * sin(bb_1) *
aa_F * cos(om * t) * JB + 0.4e1 * m_b ^ 2 * sin(bb_1) * JB *
bb_F_1) * bb_F_1 + ((-0.4e1 - 0.4e1 * sin(bb_1) ^ 2) * sin
(om * t) ^ 4 - 0.4e1 * cos(bb_1) ^ 2 * sin(om * t) ^ 2 +
(0.8e1 + (-0.8e1 - 0.4e1 * sin(bb_1) ^ 2) * sin(om * t) ^ 2
- 0.4e1 * cos(om * t) ^ 2) * cos(om * t) ^ 2) * aa_F ^ 2 *
m_b ^ 2 * JB * sin(bb_2)) * cos(bb_2) ^ 2 + ((0.4e1 * cos(om
* t) ^ 2 * cos(bb_1) + 0.4e1 * cos(bb_1) * sin(om * t) ^ 2)
* kb * m_b ^ 2 * sin(bb_2) ^ 2 + 0.4e1 * m_b ^ 2 * cos(bb_1)
* kb * cos(bb_2) ^ 2) * bb_1) * 1 + (((0.8e1 * sin(om * t)

```

$$\begin{aligned}
& \cdot 2 * \sin(bb_1) ^ 2 + 0.8e1 * \cos(bb_1) ^ 2 + 0.8e1 * \sin \\
& (\text{bb}_1) ^ 2 * \cos(\text{om} * t) ^ 2) * \cos(\text{om} * t) * aa_F * m_b ^ 2 \\
& * JB + (0.8e1 * \sin(\text{om} * t) ^ 2 + 0.8e1 * \cos(\text{om} * t) ^ 2) * \\
& \cos(\text{om} * t) * aa_F * m_b ^ 2 * JB * \sin(bb_2) ^ 2) * \sin \\
& (\text{bb}_2) + 0.8e1 * m_b ^ 2 * \sin(bb_2) * aa_F * \cos(\text{om} * t) * \\
& \cos(\text{bb}_2) ^ 2 * JB) * 1 + (((0.4e1 * \cos(bb_1) ^ 2 + 0.4e1 * \\
& \sin(\text{om} * t) ^ 2 * \sin(bb_1) ^ 2 + 0.4e1 * \sin(\text{bb}_1) ^ 2 * \\
& \cos(\text{om} * t) ^ 2) * m_b ^ 2 * JB + (0.4e1 * \sin(\text{om} * t) ^ 2 + \\
& 0.4e1 * \cos(\text{om} * t) ^ 2) * m_b ^ 2 * JB * \sin(bb_2) ^ 2) * \\
& \sin(bb_2) + (0.4e1 * \sin(\text{om} * t) ^ 2 + 0.4e1 * \cos(\text{om} * t) ^ 2) * \\
& m_b ^ 2 * JB * \sin(bb_2) * \cos(bb_2) ^ 2) * 1 * bb_F_2) \\
& * bb_F_2 + (0.4e1 * \cos(bb_1) ^ 2 + 0.4e1 * \sin(\text{om} * t) ^ 2 \\
& * \sin(bb_1) ^ 2 + 0.4e1 * \sin(bb_1) ^ 2 * \cos(\text{om} * t) ^ 2) * \\
& kb * m_b ^ 2 * \cos(bb_2) * 1 * bb_2 + ((((-0.8e1 * \sin(\text{om} * \\
& t) ^ 3 * \sin(bb_1) ^ 2 + (-0.4e1 + 0.4e1 * \sin(\text{om} * t) ^ 2) \\
& * \sin(\text{om} * t) * \cos(bb_1) ^ 2) * \cos(bb_1) + (-0.8e1 * \sin \\
& (\text{om} * t) * \sin(bb_1) ^ 2 + 0.4e1 * \cos(bb_1) ^ 2 * \sin(\text{om} * \\
& t)) * \cos(bb_1) * \cos(\text{om} * t) ^ 2) * aa_F * m_b ^ 2 * JB + \\
& ((-0.4e1 - 0.4e1 * \sin(bb_1) ^ 2) * \sin(\text{om} * t) ^ 3 + 0.4e1 \\
& * \sin(\text{om} * t) ^ 3 * \cos(bb_1) ^ 2) * \cos(bb_1) + ((-0.4e1 - \\
& 0.4e1 * \sin(bb_1) ^ 2) * \sin(\text{om} * t) + 0.4e1 * \cos(bb_1) ^ 2 \\
& * \sin(\text{om} * t)) * \cos(bb_1) * \cos(\text{om} * t) ^ 2) * aa_F * m_b ^ 2 \\
& * JB * \sin(bb_2) ^ 2 + ((0.4e1 * \sin(\text{om} * t) * \cos(\text{om} * t) \\
& ^ 2 * \sin(bb_1) ^ 2 + 0.4e1 * \sin(\text{om} * t) ^ 3 * \sin(bb_1) ^ 2 \\
& + 0.4e1 * \cos(bb_1) ^ 2 * \sin(\text{om} * t)) * aa_F * m_b ^ 2 * \\
& JB + ((0.8e1 + 0.4e1 * \sin(bb_1) ^ 2) * \sin(\text{om} * t) ^ 3 + \\
& 0.4e1 * \cos(bb_1) ^ 2 * \sin(\text{om} * t) + (0.8e1 + 0.4e1 * \sin \\
& (\text{bb}_1) ^ 2) * \sin(\text{om} * t) * \cos(\text{om} * t) ^ 2) * aa_F * m_b ^ 2 \\
& * JB * \sin(bb_2) ^ 2 + (((-0.4e1 - 0.4e1 * \sin(bb_1) ^ 2) \\
& * \sin(\text{om} * t) + 0.4e1 * \cos(bb_1) ^ 2 * \sin(\text{om} * t)) * \cos \\
& (bb_1) * aa_F * m_b ^ 2 * JB + ((0.4e1 + (-0.4e1 - 0.4e1 * \\
& \sin(bb_1) ^ 2) * \sin(\text{om} * t) ^ 2) * \sin(\text{om} * t) - 0.4e1 * \\
& \cos(bb_1) ^ 2 * \sin(\text{om} * t) + (-0.4e1 - 0.4e1 * \sin(bb_1) ^ 2) \\
& * \sin(\text{om} * t) * \cos(\text{om} * t) ^ 2) * aa_F * m_b ^ 2 * JB * \\
& \cos(bb_2)) * \cos(bb_2)) * \cos(bb_2)) * 1 + ((0.4e1 * \sin \\
& (\text{bb}_1) * \cos(\text{om} * t) ^ 2 * \cos(bb_1) ^ 2 + 0.4e1 * \sin(\text{om} * \\
& t) ^ 2 * \sin(bb_1) * \cos(bb_1) ^ 2) * m_b ^ 2 * JB + (0.4e1 \\
& * \sin(bb_1) * \cos(\text{om} * t) ^ 2 * \cos(bb_1) ^ 2 + 0.4e1 * \sin \\
& (\text{om} * t) ^ 2 * \sin(bb_1) * \cos(bb_1) ^ 2) * m_b ^ 2 * JB * \\
& \sin(bb_2) ^ 2 + (0.4e1 * m_b ^ 2 * JB * \cos(bb_1) ^ 2 * \sin \\
& (\text{bb}_1) + ((0.4e1 + 0.4e1 * \sin(bb_1) ^ 2) * \sin(\text{om} * t) ^ 2 \\
& + 0.4e1 * \cos(bb_1) ^ 2 + (0.4e1 + 0.4e1 * \sin(bb_1) ^ 2) *
\end{aligned}$$

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cos(om * t) ^ 2) * m_b ^ 2 * JB * sin(bb_2)) * cos(bb_2) ^
2) * l * om) * om + (((0.4e1 * sin(om * t) ^ 6 * sin(bb_1) ^
3 + 0.4e1 * sin(om * t) ^ 4 * sin(bb_1) * cos(bb_1) ^ 2) *
cos(bb_1) + (((-0.4e1 * sin(bb_1) ^ 3 + 0.12e2 * sin(bb_1) ^
3 * sin(om * t) ^ 2) * sin(om * t) ^ 2 + (-0.4e1 * sin(bb_1) +
0.8e1 * sin(om * t) ^ 2 * sin(bb_1)) * cos(bb_1) ^ 2) *
cos(bb_1) + ((-0.4e1 * sin(bb_1) ^ 3 + 0.12e2 * sin(bb_1) ^
3 * sin(om * t) ^ 2 + 0.4e1 * sin(bb_1) * cos(bb_1) ^ 2) *
cos(bb_1) + 0.4e1 * sin(bb_1) ^ 3 * cos(bb_1) * cos(om * t)
^ 2) * cos(om * t) ^ 2) * cos(om * t) ^ 2) * aa_F ^
2 * m_b ^ 2 * JB + (((-0.8e1 * sin(om * t) ^ 6 * sin
(bb_1) ^ 3 - 0.8e1 * sin(om * t) ^ 4 * sin(bb_1) * cos(bb_1)
^ 2) * cos(bb_1) + (((0.8e1 * sin(bb_1) ^ 3 - 0.24e2 * sin
(bb_1) ^ 3 * sin(om * t) ^ 2) * sin(om * t) ^ 2 + (-0.16e2 *
sin(om * t) ^ 2 * sin(bb_1) + 0.8e1 * sin(bb_1)) * cos(bb_1)
^ 2) * cos(bb_1) + ((0.8e1 * sin(bb_1) ^ 3 - 0.24e2 * sin
(bb_1) ^ 3 * sin(om * t) ^ 2 - 0.8e1 * sin(bb_1) * cos(bb_1)
^ 2) * cos(bb_1) - 0.8e1 * sin(bb_1) ^ 3 * cos(bb_1) * cos
(om * t) ^ 2) * cos(om * t) ^ 2) * cos(om * t) ^ 2) * aa_F *
m_b ^ 2 * JB + (((-0.4e1 * sin(bb_1) ^ 3 + 0.4e1 * sin(bb_1)
^ 3 * sin(om * t) ^ 2) * sin(om * t) ^ 2 + (0.4e1 * sin(om *
t) ^ 2 * sin(bb_1) - 0.4e1 * sin(bb_1)) * cos(bb_1) ^ 2) *
cos(bb_1) + ((0.8e1 * sin(bb_1) ^ 3 * sin(om * t) ^ 2 -
0.4e1 * sin(bb_1) ^ 3 + 0.4e1 * sin(bb_1) * cos(bb_1) ^ 2) *
cos(bb_1) + 0.4e1 * sin(bb_1) ^ 3 * cos(bb_1) * cos(om * t)
^ 2) * cos(om * t) ^ 2) * cos(om * t) * m_b ^ 2 * JB *
bb_F_1) * bb_F_1 + ((-0.4e1 * aa * sin(om * t) ^ 4 * sin
(bb_1) ^ 2 - 0.4e1 * aa * sin(om * t) ^ 2 * cos(bb_1) ^ 2 +
(-0.8e1 * aa * sin(om * t) ^ 2 * sin(bb_1) ^ 2 - 0.4e1 * aa
* cos(bb_1) ^ 2 - 0.4e1 * aa * cos(om * t) ^ 2 * sin(bb_1) ^
2) * cos(om * t) ^ 2) * ka * m_b ^ 2 + (((0.4e1 + 0.4e1 *
sin(bb_1) ^ 2) * sin(bb_1) * sin(om * t) ^ 6 + 0.4e1 * sin
(om * t) ^ 4 * sin(bb_1) * cos(bb_1) ^ 2) * cos(bb_1) + (((-
0.4e1 * sin(bb_1) + (0.12e2 + 0.8e1 * sin(bb_1) ^ 2) * sin
(bb_1) * sin(om * t) ^ 2) * sin(om * t) ^ 2 + 0.4e1 * sin(om
* t) ^ 2 * sin(bb_1) * cos(bb_1) ^ 2) * cos(bb_1) + ((-0.4e1
* sin(bb_1) + (0.12e2 + 0.4e1 * sin(bb_1) ^ 2) * sin(bb_1) *
sin(om * t) ^ 2) * cos(bb_1) + 0.4e1 * sin(bb_1) * cos(bb_1)
* cos(om * t) ^ 2) * cos(om * t) ^ 2) * cos(om * t) ^ 2) *
cos(om * t) * aa_F ^ 2 * m_b ^ 2 * JB + ((((-0.8e1 - 0.8e1 *
sin(bb_1) ^ 2) * sin(bb_1) * sin(om * t) ^ 6 - 0.8e1 * sin
(om * t) ^ 4 * sin(bb_1) * cos(bb_1) ^ 2) * cos(bb_1) + (((

```

$$\begin{aligned}
& (0.8e1 * \sin(bb_1) + (-0.24e2 - 0.16e2 * \sin(bb_1)^2) * \\
& \sin(bb_1) * \sin(\text{om} * t)^2 * \sin(\text{om} * t)^2 - 0.8e1 * \sin \\
& (\text{om} * t)^2 * \sin(bb_1) * \cos(bb_1)^2 * \cos(bb_1) + \\
& (0.8e1 * \sin(bb_1) + (-0.24e2 - 0.8e1 * \sin(bb_1)^2) * \sin \\
& (bb_1) * \sin(\text{om} * t)^2 * \cos(bb_1) - 0.8e1 * \sin(bb_1) * \\
& \cos(bb_1) * \cos(\text{om} * t)^2 * \cos(\text{om} * t)^2 * \cos(\text{om} * \\
& t)^2 * aa_F * m_b^2 * JB + ((0.4e1 * \sin(\text{om} * t)^2 * \\
& \sin(bb_1) - 0.4e1 * \sin(bb_1)) * \sin(\text{om} * t)^2 * \cos(bb_1) \\
& + ((-0.4e1 * \sin(bb_1) + 0.8e1 * \sin(\text{om} * t)^2 * \sin(bb_1) \\
&) * \cos(bb_1) + 0.4e1 * \sin(bb_1) * \cos(bb_1) * \cos(\text{om} * t) \\
& ^2) * \cos(\text{om} * t) * m_b^2 * JB * \\
& bb_F_1) * bb_F_1) * \sin(bb_2)^2 + (((-0.4e1 * \sin(\text{om} * t) \\
& ^6 * \sin(bb_1)^2 - 0.4e1 * \sin(\text{om} * t)^4 * \cos(bb_1)^2 \\
& + ((0.4e1 * \sin(bb_1)^2 - 0.12e2 * \sin(\text{om} * t)^2 * \sin \\
& (bb_1)^2) * \sin(\text{om} * t)^2 + (0.4e1 - 0.8e1 * \sin(\text{om} * t) \\
& ^2) * \cos(bb_1)^2 + (-0.12e2 * \sin(\text{om} * t)^2 * \sin \\
& (bb_1)^2 - 0.4e1 * \cos(bb_1)^2 + 0.4e1 * \sin(bb_1)^2 - \\
& 0.4e1 * \sin(bb_1)^2 * \cos(\text{om} * t)^2 * \cos(\text{om} * t)^2) * \\
& * \cos(\text{om} * t)^2 * \cos(\text{om} * t) * aa_F^2 * m_b^2 * JB + \\
& ((-0.4e1 - 0.4e1 * \sin(bb_1)^2) * \sin(\text{om} * t)^6 - 0.4e1 \\
& * \sin(\text{om} * t)^4 * \cos(bb_1)^2 + ((0.4e1 + (-0.12e2 - \\
& 0.8e1 * \sin(bb_1)^2) * \sin(\text{om} * t)^2 * \sin(\text{om} * t)^2 \\
& - 0.4e1 * \cos(bb_1)^2 * \sin(\text{om} * t)^2 + (0.4e1 + (-0.4e1 \\
& * \sin(bb_1)^2 - 0.12e2) * \sin(\text{om} * t)^2 - 0.4e1 * \cos(\text{om} \\
& * t)^2 * \cos(\text{om} * t)^2 * \cos(\text{om} * t)^2 * \cos(\text{om} * \\
& t) * aa_F^2 * m_b^2 * JB * \sin(bb_2)^2 * \sin(bb_2) + \\
& ((-0.4e1 * aa * \sin(\text{om} * t)^2 * \sin(bb_1)^2 - 0.4e1 * aa \\
& * \cos(\text{om} * t)^2 * \sin(bb_1)^2 - 0.4e1 * aa * \cos(bb_1)^2 \\
& * ka * m_b^2 + (((0.4e1 + 0.4e1 * \sin(bb_1)^2) * \sin \\
& (bb_1) * \sin(\text{om} * t)^4 + 0.4e1 * \sin(\text{om} * t)^2 * \sin \\
& (bb_1) * \cos(bb_1)^2) * \cos(bb_1) + ((-0.4e1 * \sin(bb_1) + \\
& (0.8e1 + 0.4e1 * \sin(bb_1)^2) * \sin(bb_1) * \sin(\text{om} * t)^2 \\
& * \cos(bb_1) + 0.4e1 * \sin(bb_1) * \cos(bb_1) * \cos(\text{om} * t) \\
& ^2) * \cos(\text{om} * t)^2 * \cos(\text{om} * t) * aa_F^2 * m_b^2 * JB + \\
& ((((-0.8e1 - 0.8e1 * \sin(bb_1)^2) * \sin(bb_1) * \sin \\
& (\text{om} * t)^4 - 0.8e1 * \sin(\text{om} * t)^2 * \sin(bb_1) * \cos \\
& (bb_1)^2 * \cos(bb_1) + ((0.8e1 * \sin(bb_1) + (-0.16e2 - \\
& 0.8e1 * \sin(bb_1)^2) * \sin(bb_1) * \sin(\text{om} * t)^2 * \cos \\
& (bb_1) - 0.8e1 * \sin(bb_1)^2 * \cos(bb_1) * \cos(\text{om} * t)^2) * \\
& \cos(\text{om} * t)^2 * aa_F * m_b^2 * JB + ((0.4e1 * \sin(\text{om} * \\
& t)^2 * \sin(bb_1) - 0.4e1 * \sin(bb_1)) * \cos(bb_1) + 0.4e1 \\
& * \sin(bb_1) * \cos(bb_1) * \cos(\text{om} * t)^2 * \cos(\text{om} * t) *
\end{aligned}$$

$$\begin{aligned}
& (\text{bb_1})^2 * \sin(\text{om} * t)^2 + (-0.16e2 * \sin(\text{om} * t)^2 + \\
& 0.8e1) * \cos(\text{bb_1})^2 + (-0.8e1 * \cos(\text{bb_1})^2 + 0.8e1 * \\
& \sin(\text{bb_1})^2 - 0.24e2 * \sin(\text{om} * t)^2 * \sin(\text{bb_1})^2 - \\
& 0.8e1 * \sin(\text{bb_1})^2 * \cos(\text{om} * t)^2 * \cos(\text{om} * t)^2) \\
& * \cos(\text{om} * t)^2 * \text{aa_F} * \text{m_b}^2 * \text{JB} + ((-0.8e1 - 0.8e1 \\
& * \sin(\text{bb_1})^2) * \sin(\text{om} * t)^6 - 0.8e1 * \sin(\text{om} * t)^4 \\
& * \cos(\text{bb_1})^2 + ((0.8e1 + (-0.24e2 - 0.16e2 * \sin(\text{bb_1})^2) \\
& * \sin(\text{om} * t)^2 * \sin(\text{om} * t)^2 - 0.8e1 * \cos(\text{bb_1}) \\
& ^2 * \sin(\text{om} * t)^2 + (0.8e1 + (-0.24e2 - 0.8e1 * \sin \\
& (\text{bb_1})^2 * \sin(\text{om} * t)^2 - 0.8e1 * \cos(\text{om} * t)^2 * \\
& \cos(\text{om} * t)^2 * \cos(\text{om} * t)^2 * \text{aa_F} * \text{m_b}^2 * \text{JB} * \\
& \sin(\text{bb_2})^2) * \sin(\text{bb_2}) + ((-0.8e1 - 0.8e1 * \sin(\text{bb_1}) \\
& ^2) * \sin(\text{om} * t)^4 - 0.8e1 * \cos(\text{bb_1})^2 * \sin(\text{om} * t)^2 \\
& + (0.8e1 + (-0.16e2 - 0.8e1 * \sin(\text{bb_1})^2) * \sin(\text{om} * t) \\
& ^2 - 0.8e1 * \cos(\text{om} * t)^2 * \cos(\text{om} * t)^2 * \text{aa_F} * \\
& \text{m_b}^2 * \text{JB} * \sin(\text{bb_2}) * \cos(\text{bb_2})^2) * \cos(\text{bb_2}) + (((\\
& (0.4e1 * \sin(\text{bb_1})^2 - 0.4e1 * \sin(\text{om} * t)^2 * \sin(\text{bb_1}) \\
& ^2) * \sin(\text{om} * t)^2 + (-0.4e1 * \sin(\text{om} * t)^2 + 0.4e1) \\
& * \cos(\text{bb_1})^2 + (-0.4e1 * \cos(\text{bb_1})^2 + 0.4e1 * \sin \\
& (\text{bb_1})^2 - 0.8e1 * \sin(\text{om} * t)^2 * \sin(\text{bb_1})^2 - 0.4e1 \\
& * \sin(\text{bb_1})^2 * \cos(\text{om} * t)^2 * \cos(\text{om} * t)^2 * \cos \\
& (\text{om} * t) * \text{m_b}^2 * \text{JB} + ((-0.4e1 * \sin(\text{om} * t)^2 + 2 \\
& 0.4e1) * \sin(\text{om} * t)^2 + (0.4e1 - 0.8e1 * \sin(\text{om} * t)^2 \\
& - 0.4e1 * \cos(\text{om} * t)^2 * \cos(\text{om} * t)^2 * \cos(\text{om} * t) \\
& * \text{m_b}^2 * \text{JB} * \sin(\text{bb_2})^2 * \sin(\text{bb_2}) + (-0.4e1 * \sin \\
& (\text{om} * t)^2 + 0.4e1 - 0.4e1 * \cos(\text{om} * t)^2 * \cos(\text{om} * \\
& \text{t}) * \text{m_b}^2 * \text{JB} * \sin(\text{bb_2}) * \cos(\text{bb_2})^2 * \cos(\text{bb_2}) * \\
& \text{bb_F_2} + ((0.4e1 * \sin(\text{om} * t)^4 * \sin(\text{bb_1})^2 \\
& + 0.4e1 * \cos(\text{bb_1})^2 * \sin(\text{om} * t)^2 + (0.4e1 * \cos \\
& (\text{bb_1})^2 + 0.8e1 * \sin(\text{om} * t)^2 * \sin(\text{bb_1})^2 + 0.4e1 \\
& * \sin(\text{bb_1})^2 * \cos(\text{om} * t)^2 * \cos(\text{om} * t)^2 * \cos \\
& (\text{om} * t) * \text{kb} * \text{m_b}^2 * \sin(\text{bb_2})^2 + (0.4e1 * \cos(\text{bb_1}) \\
& ^2 + 0.4e1 * \sin(\text{om} * t)^2 * \sin(\text{bb_1})^2 + 0.4e1 * \sin \\
& (\text{bb_1})^2 * \cos(\text{om} * t)^2 * \cos(\text{om} * t) * \text{kb} * \text{m_b}^2 * \\
& \cos(\text{bb_2})^2 * \text{bb_2} + (((0.4e1 * \sin(\text{bb_1})^2 - 0.4e1 * \\
& \sin(\text{om} * t)^2 * \sin(\text{bb_1})^2 * \sin(\text{om} * t)^2 + 3 + (-0.4e1 \\
& * \sin(\text{om} * t)^2 + 0.4e1) * \sin(\text{om} * t) * \cos(\text{bb_1})^2 * \\
& \cos(\text{bb_1})^2 + (((0.4e1 * \sin(\text{bb_1})^2 - 0.8e1 * \sin(\text{om} * \\
& \text{t})^2 * \sin(\text{bb_1})^2 * \sin(\text{om} * \text{t}) - 0.4e1 * \cos(\text{bb_1}) \\
& ^2 * \sin(\text{om} * \text{t}) * \cos(\text{bb_1})^2 - 0.4e1 * \sin(\text{om} * \text{t}) * \cos \\
& (\text{bb_1})^2 * \cos(\text{om} * \text{t})^2 * \sin(\text{bb_1})^2 * \cos(\text{om} * \text{t}) \\
& ^2 * \cos(\text{om} * \text{t}) * \text{aa_F} * \text{m_b}^2 * \text{JB} + (-0.8e1 * \sin(\text{om}
\end{aligned}$$

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* t) ^ 5 * sin(bb_1) ^ 4 + ((-0.12e2 * sin(bb_1) ^ 2 + 0.4e1
* sin(om * t) ^ 2 * sin(bb_1) ^ 2) * sin(om * t) ^ 3 +
(-0.4e1 + 0.4e1 * sin(om * t) ^ 2) * sin(om * t) * cos(bb_1)
^ 2) * cos(bb_1) ^ 2 + (-0.16e2 * sin(om * t) ^ 3 * sin
(bb_1) ^ 4 + ((-0.12e2 * sin(bb_1) ^ 2 + 0.8e1 * sin(om * t)
^ 2 * sin(bb_1) ^ 2) * sin(om * t) + 0.4e1 * cos(bb_1) ^ 2 *
sin(om * t)) * cos(bb_1) ^ 2 + (0.4e1 * sin(om * t) * sin
(bb_1) ^ 2 * cos(bb_1) ^ 2 - 0.8e1 * sin(om * t) * sin(bb_1)
^ 4) * cos(om * t) ^ 2) * cos(om * t) ^ 2) * m_b ^ 2 * JB *
bb_F_1 + (((0.8e1 - 0.4e1 * sin(bb_1) ^ 2) * sin(bb_1) ^ 2 *
sin(om * t) ^ 5 + ((0.12e2 - 0.4e1 * sin(bb_1) ^ 2 + (-0.4e1
- 0.4e1 * sin(bb_1) ^ 2) * sin(om * t) ^ 2) * sin(om * t) ^
3 - 0.4e1 * sin(om * t) ^ 3 * cos(bb_1) ^ 2) * cos(bb_1) ^ 2
+ ((0.16e2 - 0.8e1 * sin(bb_1) ^ 2) * sin(bb_1) ^ 2 * sin(om
* t) ^ 3 + ((0.12e2 - 0.4e1 * sin(bb_1) ^ 2 + (-0.8e1 -
0.8e1 * sin(bb_1) ^ 2) * sin(om * t) ^ 2) * sin(om * t) -
0.4e1 * cos(bb_1) ^ 2 * sin(om * t)) * cos(bb_1) ^ 2 + (
(0.8e1 - 0.4e1 * sin(bb_1) ^ 2) * sin(bb_1) ^ 2 * sin(om *
t) + (-0.4e1 - 0.4e1 * sin(bb_1) ^ 2) * sin(om * t) * cos
(bb_1) ^ 2) * cos(om * t) ^ 2) * cos(om * t) ^ 2) * cos(om *
t) * aa_F * m_b ^ 2 * JB + ((-0.4e1 * sin(bb_1) ^ 2 -
0.12e2) * sin(bb_1) ^ 2 * sin(om * t) ^ 5 + ((-0.8e1 - 0.4e1
* sin(bb_1) ^ 2 + (0.4e1 + 0.4e1 * sin(bb_1) ^ 2) * sin(om *
t) ^ 2) * sin(om * t) ^ 3 + 0.4e1 * sin(om * t) ^ 3 * cos
(bb_1) ^ 2 * cos(bb_1) ^ 2 + ((-0.24e2 - 0.8e1 * sin(bb_1)
^ 2) * sin(bb_1) ^ 2 * sin(om * t) ^ 3 + ((-0.8e1 - 0.4e1 *
sin(bb_1) ^ 2 + (0.8e1 + 0.8e1 * sin(bb_1) ^ 2) * sin(om *
t) ^ 2) * sin(om * t) + 0.4e1 * cos(bb_1) ^ 2 * sin(om * t))
* cos(bb_1) ^ 2 + ((-0.4e1 * sin(bb_1) ^ 2 - 0.12e2) * sin
(bb_1) ^ 2 * sin(om * t) + (0.4e1 + 0.4e1 * sin(bb_1) ^ 2) *
sin(om * t) * cos(bb_1) ^ 2) * cos(om * t) ^ 2) * cos(om *
t) ^ 2) * m_b ^ 2 * JB * bb_F_1 + (-0.4e1 * sin(om * t) ^ 5
* sin(bb_1) ^ 2 - 0.4e1 * sin(om * t) ^ 3 * cos(bb_1) ^ 2 +
(-0.4e1 * cos(bb_1) ^ 2 * sin(om * t) - 0.8e1 * sin(om * t)
^ 3 * sin(bb_1) ^ 2 - 0.4e1 * sin(om * t) * cos(om * t) ^ 2
* sin(bb_1) ^ 2) * cos(om * t) ^ 2) * cos(om * t) * aa_F *
m_b ^ 2 * JB * sin(bb_2) ^ 2) * sin(bb_2) ^ 2 + (((0.12e2 -
0.4e1 * sin(bb_1) ^ 2) * sin(bb_1) ^ 2 - 0.4e1 * sin(om * t)
^ 2 * sin(bb_1) ^ 2) * sin(om * t) ^ 3 + ((0.16e2 - 0.4e1 *
sin(bb_1) ^ 2 + (-0.8e1 - 0.4e1 * sin(bb_1) ^ 2) * sin(om *
t) ^ 2) * sin(om * t) - 0.4e1 * cos(bb_1) ^ 2 * sin(om * t))
* cos(bb_1) ^ 2 + (((0.12e2 - 0.4e1 * sin(bb_1) ^ 2) * sin

```


$$\begin{aligned}
& (0.12e2 + 0.4e1 * \sin(bb_1) ^ 2 + (-0.8e1 - 0.8e1 * \sin(bb_1) ^ 2) * \sin(om * t) ^ 2 * \sin(om * t) - 0.4e1 * \cos(bb_1) ^ 2 * \sin(om * t) + (-0.4e1 - 0.4e1 * \sin(bb_1) ^ 2) * \sin(om * t) * \cos(om * t) ^ 2 * \cos(om * t) ^ 2) * m_b ^ 2 * JB * \sin(bb_2) ^ 2 + ((0.4e1 + (-0.4e1 - 0.4e1 * \sin(bb_1) ^ 2) * \sin(om * t) ^ 2 * \sin(om * t) - 0.4e1 * \cos(bb_1) ^ 2 * \sin(om * t) + (-0.4e1 - 0.4e1 * \sin(bb_1) ^ 2) * \sin(om * t) * \cos(om * t) ^ 2 * m_b ^ 2 * JB * \cos(bb_2) ^ 2) * \cos(bb_2) ^ 2 * bb_F_2) * om + (((0.2e1 * \sin(bb_1) * \cos(aa) * \sin(om * t) ^ 2 * \cos(bb_1) ^ 2 + 0.2e1 * \sin(bb_1) ^ 3 * \cos(aa) * \sin(om * t) ^ 4 + ((0.4e1 * \sin(bb_1) ^ 3 * \cos(aa) * \sin(om * t) ^ 2 * \sin(bb_1) ^ 2 + (0.2e1 * \sin(bb_1) * \cos(aa) - 0.2e1 * \sin(bb_1) ^ 3 * \cos(aa) * \sin(om * t) ^ 2 + (0.2e1 * \sin(bb_1) * \cos(aa) - 0.2e1 * \sin(bb_1) * \cos(aa) * \sin(om * t) ^ 2 * \cos(bb_1) ^ 2 + (-0.2e1 * \sin(bb_1) * \cos(aa) * \cos(bb_1) ^ 2 - 0.4e1 * \sin(bb_1) ^ 3 * \cos(aa) * \sin(om * t) ^ 2 + 0.2e1 * \sin(bb_1) ^ 3 * \cos(aa) * \sin(om * t) ^ 3 * \cos(aa) * \cos(om * t) ^ 2 * \cos(om * t) ^ 2 * \cos(om * t) ^ 2 * \cos(bb_1) ^ 2) * g_ * m_b ^ 3 + (0.2e1 * \cos(aa) * \sin(om * t) ^ 2 * \cos(bb_1) ^ 2 + 0.2e1 * \cos(aa) * \sin(om * t) ^ 4 * \sin(bb_1) ^ 2 + (0.4e1 * \cos(aa) * \sin(bb_1) ^ 2 - 0.2e1 * \cos(aa) * \sin(om * t) ^ 2 * \sin(bb_1) ^ 2 * \sin(om * t) ^ 2 + (0.2e1 * \cos(aa) * \sin(om * t) ^ 2 * \cos(bb_1) ^ 2 + (0.2e1 * \cos(aa) * \sin(bb_1) ^ 2 - 0.4e1 * \cos(aa) * \sin(om * t) ^ 2 * \sin(bb_1) ^ 2 - 0.2e1 * \cos(aa) * \cos(bb_1) ^ 2 - 0.2e1 * \cos(aa) * \cos(om * t) ^ 2 * \sin(bb_1) ^ 2 * \cos(om * t) ^ 2 * \cos(om * t) ^ 2 * \cos(bb_1) ^ 2) * g_ * m_b ^ 3 * \sin(bb_2) * \sin(bb_2) ^ 2 + ((0.2e1 * \sin(bb_1) * \cos(aa) * \cos(bb_1) ^ 2 + 0.2e1 * \sin(bb_1) ^ 3 * \cos(aa) * \sin(om * t) ^ 2 + (-0.2e1 * \sin(bb_1) ^ 3 * \cos(aa) * \sin(om * t) ^ 2 + 0.2e1 * \sin(bb_1) ^ 3 * \cos(aa) * \sin(om * t) ^ 3 * \cos(aa) * \cos(om * t) ^ 2 * \cos(om * t) ^ 2 * \cos(bb_1) ^ 2) * g_ * m_b ^ 3 + (0.2e1 * \cos(aa) * \sin(om * t) ^ 2 * \cos(bb_1) ^ 2 + 0.2e1 * \cos(aa) * \sin(om * t) ^ 4 * \sin(bb_1) ^ 2 + (bb_1) ^ 2 + (-0.2e1 * \cos(aa) * \cos(bb_1) ^ 2 - 0.2e1 * \cos(aa) * \sin(om * t) ^ 2 * \sin(bb_1) ^ 2 + 0.2e1 * \cos(aa) * \sin(bb_1) ^ 2 - 0.2e1 * \cos(aa) * \cos(om * t) ^ 2 * \sin(bb_1) ^ 2 * \cos(om * t) ^ 2 * \cos(bb_1) ^ 2) * g_ * m_b ^ 3 * \sin(bb_2) * \cos(bb_2) ^ 2 + (((-0.1e1 * \sin(om * t) ^ 6 * \sin(bb_1) * \cos(bb_1) ^ 2 + (\sin(om * t) ^ 4 * \sin(bb_1) ^ 3 + (0.2e1 * \sin(bb_1) - 0.3e1 * \sin(om * t) ^ 2 * \sin(bb_1)) * \sin(om * t) ^ 2 * \cos(bb_1) ^ 2 + (0.2e1 * \sin(bb_1) ^ 3 * \sin(om * t) ^ 2 * \cos(bb_1) ^ 2) * \sin(om * t) ^ 2 * \cos(bb_1) ^ 2) * g_ * m_b ^ 3 * \sin(bb_2) * \cos(bb_2) ^ 2 + (((-0.1e1 * \sin(om * t) ^ 6 * \sin(bb_1) * \cos(bb_1) ^ 2 + (\sin(om * t) ^ 4 * \sin(bb_1) ^ 3 + (0.2e1 * \sin(bb_1) - 0.3e1 * \sin(om * t) ^ 2 * \sin(bb_1)) * \sin(om * t) ^ 2 * \cos(bb_1) ^ 2 + (0.2e1 * \sin(bb_1) ^ 3 * \sin(om * t) ^ 2 * \cos(bb_1) ^ 2) * \sin(om * t) ^ 2 * \cos(bb_1) ^ 2) * g_ * m_b ^ 3 * \sin(bb_2) * \cos(bb_2) ^ 2)
\end{aligned}$$

$$\begin{aligned}
& t^2 + (0.2e1 * \sin(bb_1) - 0.3e1 * \sin(om * t)^2 * \sin(bb_1)) * \cos(bb_1)^2 + (\sin(bb_1)^3 - 0.1e1 * \sin(bb_1) * \cos(bb_1)^2 * \cos(om * t)^2 * \cos(om * t)^2 * aa_F^2 * m_b^3 + ((-0.2e1 * \sin(om * t)^2 * \sin(bb_1) * \cos(bb_1)^2 - 0.2e1 * \sin(om * t)^4 * \sin(bb_1)^3 + (-0.4e1 * \sin(bb_1)^3 * \sin(om * t)^2 - 0.2e1 * \sin(bb_1) * \cos(bb_1)^2 - 0.2e1 * \sin(bb_1)^3 * \cos(om * t)^2 * \cos(om * t)^2 * \cos(om * t)^2 * aa_F * m_b^3 + (\sin(om * t)^4 * \sin(bb_1) * \cos(bb_1)^2 + \sin(om * t)^4 * \sin(bb_1)^3 + (0.2e1 * \sin(om * t)^2 * \sin(bb_1)^3 + \sin(bb_1)^3 * \cos(bb_1)^2 + 0.2e1 * \sin(bb_1)^3 * \sin(om * t)^2 * \cos(om * t)^2 * \cos(om * t)^2 * bb_F_1 * bb_F_1 + (\cos(bb_1)^2 * \sin(om * t)^2 + \sin(om * t)^4 * \sin(bb_1)^2 + (\cos(bb_1)^2 + 0.2e1 * \sin(om * t)^2 * \sin(bb_1)^2 + \sin(bb_1)^2 * \cos(om * t)^2 * \cos(om * t)^2 * aa_F^2 * m_b^3 * \sin(bb_2)) * \sin(bb_2)^2 + ((-0.1e1 * \sin(om * t)^4 * \sin(bb_1) * \cos(bb_1)^2 + \cos(bb_1)^2 + (\sin(bb_1)^3 * \sin(om * t)^2 + (-0.2e1 * \sin(om * t)^2 * \sin(bb_1) + 0.2e1 * \sin(bb_1)) * \cos(bb_1)^2 + (\sin(bb_1)^3 - 0.1e1 * \sin(bb_1) * \cos(bb_1)^2 * \cos(om * t)^2 * aa_F^2 * m_b^3 + (-0.2e1 * \sin(bb_1)^3 * \sin(om * t)^2 - 0.2e1 * \sin(bb_1) * \cos(om * t)^2 * \sin(bb_1)^2 - 0.2e1 * \sin(bb_1) * \cos(bb_1)^2 * \cos(om * t)^2 * aa_F * m_b^3 + (\sin(om * t)^2 * \sin(bb_1)^3 + \sin(om * t)^2 * \sin(bb_1) * \cos(bb_1)^2 + (\sin(bb_1)^3 + \sin(bb_1) * \cos(bb_1)^2 * \cos(om * t)^2 * \cos(om * t)^2 * bb_F_1 + (-0.1e1 * \sin(om * t)^4 * \cos(bb_1)^2 - 0.1e1 * \sin(om * t)^6 * \sin(bb_1)^2 + ((0.2e1 * \sin(bb_1)^2 - 0.3e1 * \sin(om * t)^2 * \sin(bb_1)^2 + (0.2e1 - 0.2e1 * \sin(om * t)^2 * \cos(bb_1)^2 + (-0.3e1 * \sin(om * t)^2 * \sin(bb_1)^2 + 0.2e1 * \sin(bb_1)^2 * \cos(om * t)^2 - 0.1e1 * \cos(bb_1)^2 * \cos(om * t)^2 * aa_F^2 * m_b^3 * \sin(bb_2)) * \cos(bb_2)^2 + 1 + (((0.2e1 * \cos(bb_1)^2 * \sin(om * t)^2 + 0.2e1 * \sin(om * t)^4 * \sin(bb_1)^2 + (0.4e1 * \sin(om * t)^2 * \sin(bb_1)^2 + 0.2e1 * \cos(bb_1)^2 * \cos(om * t)^2 * \cos(om * t)^2 * aa_F * m_b^3 * \sin(bb_2)^3 + (0.2e1 * \cos(bb_1)^2 + 0.2e1 * \sin(om * t)^2 * \sin(bb_1)^2 + 0.2e1 * \sin(om * t)^2 * \sin(bb_1)^2 * \cos(om * t)^2 * \cos(om * t)^2 * aa_F * m_b^3)
\end{aligned}$$

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* sin(bb_2) * cos(bb_2) ^ 2) * l + ((cos(bb_1) ^ 2 * sin(om
* t) ^ 2 + sin(om * t) ^ 4 * sin(bb_1) ^ 2 + (cos(bb_1) ^ 2
+ 0.2e1 * sin(om * t) ^ 2 * sin(bb_1) ^ 2 + sin(bb_1) ^ 2 *
cos(om * t) ^ 2) * cos(om * t) ^ 2) * m_b ^ 3 * sin(bb_2) ^
3 + (cos(bb_1) ^ 2 * sin(om * t) ^ 2 + sin(om * t) ^ 4 * sin
(bb_1) ^ 2 + (cos(bb_1) ^ 2 + 0.2e1 * sin(om * t) ^ 2 * sin
(bb_1) ^ 2 + sin(bb_1) ^ 2 * cos(om * t) ^ 2) * cos(om * t)
^ 2) * m_b ^ 3 * sin(bb_2) * cos(bb_2) ^ 2) * l * bb_F_2) *
bb_F_2 + ((((-0.2e1 * sin(om * t) ^ 5 * sin(bb_1) ^ 2 +
(-0.1e1 + sin(om * t) ^ 2) * sin(om * t) ^ 3 * cos(bb_1) ^
2) * cos(bb_1) + ((-0.4e1 * sin(om * t) ^ 3 * sin(bb_1) ^ 2
+ (-0.1e1 + 0.2e1 * sin(om * t) ^ 2) * sin(om * t) * cos
(bb_1) ^ 2) * cos(bb_1) + (-0.2e1 * sin(om * t) * sin(bb_1)
^ 2 + cos(bb_1) ^ 2 * sin(om * t)) * cos(bb_1) * cos(om * t)
^ 2) * cos(om * t) ^ 2) * aa_F * m_b ^ 3 * sin(bb_2) ^ 2 + (
0.2e1 * sin(om * t) ^ 5 * sin(bb_1) ^ 2 + 0.2e1 * sin(om *
t) ^ 3 * cos(bb_1) ^ 2 + (0.4e1 * sin(om * t) ^ 3 * sin
(bb_1) ^ 2 + 0.2e1 * cos(bb_1) ^ 2 * sin(om * t) + 0.2e1 *
sin(om * t) * cos(om * t) ^ 2 * sin(bb_1) ^ 2) * cos(om * t)
^ 2) * aa_F * m_b ^ 3 * sin(bb_2) ^ 2 + ((((-0.2e1 * sin(om *
t) ^ 3 * sin(bb_1) ^ 2 + (-0.1e1 + sin(om * t) ^ 2) * sin(om
* t) * cos(bb_1) ^ 2) * cos(bb_1) + (-0.2e1 * sin(om * t) *
sin(bb_1) ^ 2 + cos(bb_1) ^ 2 * sin(om * t)) * cos(bb_1) *
cos(om * t) ^ 2) * aa_F * m_b ^ 3 + ((sin(bb_1) ^ 2 - 0.1e1
* sin(om * t) ^ 2 * sin(bb_1) ^ 2) * sin(om * t) ^ 3 +
(0.1e1 - 0.1e1 * sin(om * t) ^ 2) * sin(om * t) * cos(bb_1)
^ 2 + ((sin(bb_1) ^ 2 - 0.2e1 * sin(om * t) ^ 2 * sin(bb_1)
^ 2) * sin(om * t) - 0.1e1 * cos(bb_1) ^ 2 * sin(om * t) -
0.1e1 * sin(om * t) * cos(om * t) ^ 2 * sin(bb_1) ^ 2) * cos
(om * t) ^ 2) * aa_F * m_b ^ 3 * cos(bb_2)) * cos(bb_2)) *
cos(bb_2)) * l + ((sin(om * t) ^ 4 * sin(bb_1) * cos(bb_1) ^
2 + (0.2e1 * sin(om * t) ^ 2 * sin(bb_1) * cos(bb_1) ^ 2 +
sin(bb_1) * cos(om * t) ^ 2 * cos(bb_1) ^ 2) * cos(om * t) ^
2) * m_b ^ 3 * sin(bb_2) ^ 2 + ((sin(om * t) ^ 2 * sin(bb_1)
* cos(bb_1) ^ 2 + sin(bb_1) * cos(om * t) ^ 2 * cos(bb_1) ^
2) * m_b ^ 3 + (cos(bb_1) ^ 2 * sin(om * t) ^ 2 + sin(om *
t) ^ 4 * sin(bb_1) ^ 2 + (cos(bb_1) ^ 2 + 0.2e1 * sin(om *
t) ^ 2 * sin(bb_1) ^ 2 + sin(bb_1) ^ 2 * cos(om * t) ^ 2) *
cos(om * t) ^ 2) * m_b ^ 3 * sin(bb_2)) * cos(bb_2) ^ 2) * l
* om) * om + (((sin(om * t) ^ 8 * sin(bb_1) ^ 3 + sin(om *
t) ^ 6 * sin(bb_1) * cos(bb_1) ^ 2) * cos(bb_1) + ((((-0.1e1
* sin(bb_1) ^ 3 + 0.4e1 * sin(bb_1) ^ 3 * sin(om * t) ^ 2) *

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sin(om * t) ^ 4 + (-0.1e1 * sin(bb_1) + 0.3e1 * sin(om * t)
^ 2 * sin(bb_1)) * sin(om * t) ^ 2 * cos(bb_1) ^ 2) * cos
(bb_1) + (((-0.2e1 * sin(bb_1) ^ 3 + 0.6e1 * sin(bb_1) ^ 3 *
sin(om * t) ^ 2) * sin(om * t) ^ 2 + (-0.1e1 * sin(bb_1) +
0.3e1 * sin(om * t) ^ 2 * sin(bb_1)) * cos(bb_1) ^ 2) * cos
(bb_1) + ((-0.1e1 * sin(bb_1) ^ 3 + 0.4e1 * sin(bb_1) ^ 3 *
sin(om * t) ^ 2 + sin(bb_1) * cos(bb_1) ^ 2) * cos(bb_1) +
sin(bb_1) ^ 3 * cos(bb_1) * cos(om * t) ^ 2) * cos(om * t) ^
2) * cos(om * t) ^ 2) * cos(om * t) ^ 2) * cos(om * t) *
aa_F ^ 2 * m_b ^ 3 + (((-0.2e1 * sin(om * t) ^ 8 * sin(bb_1)
^ 3 - 0.2e1 * sin(om * t) ^ 6 * sin(bb_1) * cos(bb_1) ^ 2) *
cos(bb_1) + (((0.2e1 * sin(bb_1) ^ 3 - 0.8e1 * sin(bb_1) ^ 3
* sin(om * t) ^ 2) * sin(om * t) ^ 4 + (0.2e1 * sin(bb_1) -
0.6e1 * sin(om * t) ^ 2 * sin(bb_1)) * sin(om * t) ^ 2 * cos
(bb_1) ^ 2) * cos(bb_1) + (((0.4e1 * sin(bb_1) ^ 3 - 0.12e2
* sin(bb_1) ^ 3 * sin(om * t) ^ 2) * sin(om * t) ^ 2 +
(0.2e1 * sin(bb_1) - 0.6e1 * sin(om * t) ^ 2 * sin(bb_1)) *
cos(bb_1) ^ 2) * cos(bb_1) + ((0.2e1 * sin(bb_1) ^ 3 - 0.8e1
* sin(bb_1) ^ 3 * sin(om * t) ^ 2 - 0.2e1 * sin(bb_1) * cos
(bb_1) ^ 2) * cos(bb_1) - 0.2e1 * sin(bb_1) ^ 3 * cos(bb_1)
* cos(om * t) ^ 2) * cos(om * t) ^ 2) * cos(om * t) ^ 2) *
cos(om * t) ^ 2) * aa_F * m_b ^ 3 + (((-0.1e1 * sin(bb_1) ^
3 + sin(bb_1) ^ 3 * sin(om * t) ^ 2) * sin(om * t) ^ 4 +
(-0.1e1 * sin(bb_1) + sin(om * t) ^ 2 * sin(bb_1)) * sin(om
* t) ^ 2 * cos(bb_1) ^ 2) * cos(bb_1) + (((-0.2e1 * sin
(bb_1) ^ 3 + 0.3e1 * sin(bb_1) ^ 3 * sin(om * t) ^ 2) * sin
(om * t) ^ 2 + (-0.1e1 * sin(bb_1) + 0.2e1 * sin(om * t) ^ 2
* sin(bb_1)) * cos(bb_1) ^ 2) * cos(bb_1) + ((0.3e1 * sin
(bb_1) ^ 3 * sin(om * t) ^ 2 - 0.1e1 * sin(bb_1) ^ 3 + sin
(bb_1) * cos(bb_1) ^ 2) * cos(bb_1) + sin(bb_1) ^ 3 * cos
(bb_1) * cos(om * t) ^ 2) * cos(om * t) ^ 2) * cos(om * t) ^
2) * cos(om * t) * m_b ^ 3 * bb_F_1) * bb_F_1) * sin(bb_2) ^
2 + (((-0.1e1 * sin(om * t) ^ 6 * cos(bb_1) ^ 2 - 0.1e1 * sin
(om * t) ^ 8 * sin(bb_1) ^ 2 + ((sin(bb_1) ^ 2 - 0.4e1 * sin
(om * t) ^ 2 * sin(bb_1) ^ 2) * sin(om * t) ^ 4 + (0.1e1 -
0.3e1 * sin(om * t) ^ 2) * sin(om * t) ^ 2 * cos(bb_1) ^ 2 +
((0.2e1 * sin(bb_1) ^ 2 - 0.6e1 * sin(om * t) ^ 2 * sin
(bb_1) ^ 2) * sin(om * t) ^ 2 + (-0.3e1 * sin(om * t) ^ 2 +
0.1e1) * cos(bb_1) ^ 2 + (-0.1e1 * cos(bb_1) ^ 2 - 0.4e1 *
sin(om * t) ^ 2 * sin(bb_1) ^ 2 + sin(bb_1) ^ 2 - 0.1e1 *
sin(bb_1) ^ 2 * cos(om * t) ^ 2) * cos(om * t) ^ 2) * cos(om
* t) ^ 2) * cos(om * t) ^ 2) * cos(om * t) * aa_F ^ 2 * m_b

```

$$\begin{aligned}
& + 3 * \sin(bb_2) ^ 3 + (((\sin(om * t) ^ 6 * \sin(bb_1) ^ 3 + \\
& \sin(om * t) ^ 4 * \sin(bb_1) * \cos(bb_1) ^ 2) * \cos(bb_1) + \\
& ((0.3e1 * \sin(bb_1) ^ 3 * \sin(om * t) ^ 2 - 0.1e1 * \sin \\
& (bb_1) ^ 3) * \sin(om * t) ^ 2 + (-0.1e1 * \sin(bb_1) + 0.2e1 \\
& * \sin(om * t) ^ 2 * \sin(bb_1)) * \cos(bb_1) ^ 2) * \cos(bb_1) \\
& + ((0.3e1 * \sin(bb_1) ^ 3 * \sin(om * t) ^ 2 - 0.1e1 * \sin \\
& (bb_1) ^ 3 + \sin(bb_1) * \cos(bb_1) ^ 2) * \cos(bb_1) + \sin \\
& (bb_1) ^ 3 * \cos(bb_1) * \cos(om * t) ^ 2) * \cos(om * t) ^ 2) \\
& * \cos(om * t) ^ 2) * \cos(om * t) * aa_F ^ 2 * m_b ^ 3 + ((\\
& (-0.2e1 * \sin(om * t) ^ 6 * \sin(bb_1) ^ 3 - 0.2e1 * \sin(om * \\
& t) ^ 4 * \sin(bb_1) * \cos(bb_1) ^ 2) * \cos(bb_1) + (((0.2e1 * \\
& \sin(bb_1) ^ 3 - 0.6e1 * \sin(bb_1) ^ 3 * \sin(om * t) ^ 2) * \\
& \sin(om * t) ^ 2 + (0.2e1 * \sin(bb_1) - 0.4e1 * \sin(om * t) ^ \\
& 2 * \sin(bb_1)) * \cos(bb_1) ^ 2) * \cos(bb_1) + ((0.2e1 * \sin \\
& (bb_1) ^ 3 - 0.6e1 * \sin(bb_1) ^ 3 * \sin(om * t) ^ 2 - 0.2e1 \\
& * \sin(bb_1) * \cos(bb_1) ^ 2) * \cos(bb_1) - 0.2e1 * \sin(bb_1) \\
& ^ 3 * \cos(bb_1) * \cos(om * t) ^ 2) * \cos(om * t) ^ 2) * \cos \\
& (om * t) ^ 2) * aa_F * m_b ^ 3 + ((((-0.1e1 * \sin(bb_1) ^ 3 + \\
& \sin(bb_1) ^ 3 * \sin(om * t) ^ 2) * \sin(om * t) ^ 2 + (-0.1e1 \\
& * \sin(bb_1) + \sin(om * t) ^ 2 * \sin(bb_1)) * \cos(bb_1) ^ 2) \\
& * \cos(bb_1) + ((-0.1e1 * \sin(bb_1) ^ 3 + 0.2e1 * \sin(bb_1) ^ \\
& 3 * \sin(om * t) ^ 2 + \sin(bb_1) * \cos(bb_1) ^ 2) * \cos(bb_1) \\
& + \sin(bb_1) ^ 3 * \cos(bb_1) * \cos(om * t) ^ 2) * \cos(om * t) \\
& ^ 2) * \cos(om * t) * m_b ^ 3 * bb_F_1) * bb_F_1 + (-0.1e1 * \\
& \sin(om * t) ^ 4 * \cos(bb_1) ^ 2 - 0.1e1 * \sin(om * t) ^ 6 * \\
& \sin(bb_1) ^ 2 + ((\sin(bb_1) ^ 2 - 0.3e1 * \sin(om * t) ^ 2 * \\
& \sin(bb_1) ^ 2) * \sin(om * t) ^ 2 + (0.1e1 - 0.2e1 * \sin(om * \\
& t) ^ 2) * \cos(bb_1) ^ 2 + (\sin(bb_1) ^ 2 - 0.1e1 * \cos(bb_1) \\
& ^ 2 - 0.3e1 * \sin(om * t) ^ 2 * \sin(bb_1) ^ 2 - 0.1e1 * \sin \\
& (bb_1) ^ 2 * \cos(om * t) ^ 2) * \cos(om * t) ^ 2) * \cos(om * \\
& t) ^ 2) * \cos(om * t) * aa_F ^ 2 * m_b ^ 3 * \sin(bb_2) * \cos \\
& (bb_2) * \cos(bb_2) + ((((-0.2e1 * \sin(om * t) ^ 8 * \sin(bb_1) ^ 2 \\
& + ((0.2e1 * \sin(bb_1) ^ 2 - 0.8e1 * \sin(om * t) ^ 4 + (0.2e1 - 0.6e1 * \sin(om * t) \\
& ^ 2) * \sin(om * t) ^ 2 * \cos(bb_1) ^ 2 + ((0.4e1 * \sin(bb_1) \\
& ^ 2 - 0.12e2 * \sin(om * t) ^ 2 * \sin(bb_1) ^ 2) * \sin(om * \\
& t) ^ 2 + (0.2e1 - 0.6e1 * \sin(om * t) ^ 2) * \cos(bb_1) ^ 2 + \\
& (0.2e1 * \sin(bb_1) ^ 2 - 0.8e1 * \sin(om * t) ^ 2 * \sin(bb_1) \\
& ^ 2 - 0.2e1 * \cos(bb_1) ^ 2 - 0.2e1 * \sin(bb_1) ^ 2 * \cos(om \\
& * t) ^ 2) * \cos(om * t) ^ 2) * \cos(om * t) ^ 2) * \cos(om * \\
& t) ^ 2) * aa_F * m_b ^ 3 * \sin(bb_2) ^ 3 + (-0.2e1 * \sin(om
\end{aligned}$$

$$\begin{aligned}
& * t) ^ 4 * \cos(bb_1) ^ 2 - 0.2e1 * \sin(om * t) ^ 6 * \sin \\
& (bb_1) ^ 2 + ((0.2e1 * \sin(bb_1) ^ 2 - 0.6e1 * \sin(om * t) ^ 2 * \sin(bb_1) ^ 2) * \sin(om * t) ^ 2 + (-0.4e1 * \sin(om * t) ^ 2 + 0.2e1) * \cos(bb_1) ^ 2 + (0.2e1 * \sin(bb_1) ^ 2 - 0.6e1 * \sin(om * t) ^ 2 * \sin(bb_1) ^ 2 - 0.2e1 * \sin(bb_1) ^ 2 * \cos(om * t) ^ 2) * \cos(om * t) ^ 2) * \cos(bb_2) ^ 3 * \sin(bb_2) * \cos \\
& (bb_2) ^ 2) * \cos(bb_2) + (((\sin(bb_1) ^ 2 - 0.1e1 * \sin(om * t) ^ 2 * \sin(bb_1) ^ 2) * \sin(om * t) ^ 4 + (0.1e1 - 0.1e1 * \sin(om * t) ^ 2) * \sin(om * t) ^ 2 * \cos(bb_1) ^ 2 + (0.2e1 * \sin(bb_1) ^ 2 - 0.3e1 * \sin(om * t) ^ 2 * \sin(bb_1) ^ 2) * \sin(om * t) ^ 2 + (0.1e1 - 0.2e1 * \sin(om * t) ^ 2) * \cos(bb_1) ^ 2 + (\sin(bb_1) ^ 2 - 0.1e1 * \cos(bb_1) ^ 2 - 0.3e1 * \sin(om * t) ^ 2 * \sin(bb_1) ^ 2 - 0.1e1 * \sin(bb_1) ^ 2 * \cos(om * t) ^ 2) * \cos(om * t) ^ 2 * \cos(bb_1) ^ 2 * \cos(bb_2) ^ 3 * \sin(bb_2) ^ 3 + ((\sin(bb_1) ^ 2 - 0.1e1 * \sin(om * t) ^ 2 * \sin(bb_1) ^ 2) * \sin(om * t) ^ 2 + (-0.1e1 * \sin(om * t) ^ 2 + 0.1e1) * \cos(bb_1) ^ 2 + (-0.2e1 * \sin(om * t) ^ 2 * \sin(bb_1) ^ 2 - 0.1e1 * \cos(bb_1) ^ 2 + \sin(bb_1) ^ 2 - 0.1e1 * \sin(bb_1) ^ 2 * \cos(om * t) ^ 2) * \cos(om * t) ^ 2 * \cos(bb_1) ^ 2 * \cos(bb_2) ^ 2 * \cos(bb_2) * bb_F_2 + (((((\sin(bb_1) ^ 2 - 0.1e1 * \sin(om * t) ^ 2 * \sin(bb_1) ^ 2) * \sin(om * t) ^ 5 + (0.1e1 - 0.1e1 * \sin(om * t) ^ 2) * \sin(om * t) ^ 3 * \cos(bb_1) ^ 2) * \cos(bb_1) ^ 2 + (((0.2e1 * \sin(bb_1) ^ 2 - 0.3e1 * \sin(om * t) ^ 2 * \sin(bb_1) ^ 2) * \sin(om * t) ^ 3 + (0.1e1 - 0.2e1 * \sin(om * t) ^ 2) * \sin(om * t) ^ 2 * \cos(bb_1) ^ 2 + ((\sin(bb_1) ^ 2 - 0.3e1 * \sin(om * t) ^ 2 * \sin(bb_1) ^ 2) * \sin(om * t) ^ 2 * \cos(bb_1) ^ 2 + ((\sin(bb_1) ^ 2 - 0.1e1 * \sin(om * t) ^ 2 * \sin(bb_1) ^ 2) * \sin(om * t) ^ 2 * \cos(om * t) ^ 2 * \cos(bb_1) ^ 2 * \cos(bb_2) ^ 2 * \cos(bb_2) * bb_F_2 + (((((\sin(bb_1) ^ 2 - 0.1e1 * \sin(om * t) ^ 2 * \sin(bb_1) ^ 2) * \sin(om * t) ^ 5 + (-0.1e1 * \sin(om * t) ^ 2 * \sin(bb_1) ^ 2) * \sin(om * t) ^ 3 * \cos(bb_1) ^ 2) * \cos(bb_1) ^ 2 + (-0.6e1 * \sin(om * t) ^ 2 * \sin(bb_1) ^ 4 + ((-0.6e1 * \sin(bb_1) ^ 2 + 0.3e1 * \sin(om * t) ^ 2 * \sin(bb_1) ^ 2) * \sin(om * t) ^ 3 + (-0.1e1 + 0.2e1 * \sin(om * t) ^ 2) * \sin(om * t) ^ 2 * \cos(bb_1) ^ 2 * \cos(bb_1) ^ 2 + (-0.6e1 * \sin(om * t) ^ 2 * \sin(bb_1) ^ 3 * \sin(bb_1) ^ 4 + ((-0.3e1 * \sin(bb_1) ^ 2 + 0.3e1 * \sin(om * t) ^ 2 * \sin(bb_1) ^ 2) * \sin(om * t) ^ 2 * \sin(bb_1) ^ 2 * \sin(om * t) + \cos(bb_1) ^ 2 * \sin(om * t)) *
\end{aligned}$$

```

cos(bb_1) ^ 2 + (-0.2e1 * sin(om * t) * sin(bb_1) ^ 4 + sin
(om * t) * sin(bb_1) ^ 2 * cos(bb_1) ^ 2) * cos(om * t) ^ 2)
* cos(om * t) ^ 2) * cos(om * t) ^ 2) * m_b ^ 3 * bb_F_1) *
sin(bb_2) ^ 2 + (((sin(bb_1) ^ 2 - 0.1e1 * sin(om * t) ^ 2
* sin(bb_1) ^ 2) * sin(om * t) ^ 3 + (0.1e1 - 0.1e1 * sin(om
* t) ^ 2) * sin(om * t) * cos(bb_1) ^ 2) * cos(bb_1) ^ 2 + (
((sin(bb_1) ^ 2 - 0.2e1 * sin(om * t) ^ 2 * sin(bb_1) ^ 2) *
sin(om * t) - 0.1e1 * cos(bb_1) ^ 2 * sin(om * t)) * cos
(bb_1) ^ 2 - 0.1e1 * sin(om * t) * cos(bb_1) ^ 2 * cos(om *
t) ^ 2 * sin(bb_1) ^ 2) * cos(om * t) ^ 2) * cos(om * t) *
aa_F * m_b ^ 3 + (-0.2e1 * sin(om * t) ^ 5 * sin(bb_1) ^ 4 +
((-0.3e1 * sin(bb_1) ^ 2 + sin(om * t) ^ 2 * sin(bb_1) ^ 2)
* sin(om * t) ^ 3 + (-0.1e1 + sin(om * t) ^ 2) * sin(om *
t) * cos(bb_1) ^ 2) * cos(bb_1) ^ 2 + (-0.4e1 * sin(om * t) ^ 3
* sin(bb_1) ^ 4 + ((-0.3e1 * sin(bb_1) ^ 2 + 0.2e1 * sin(om
* t) ^ 2 * sin(bb_1) ^ 2) * sin(om * t) + cos(bb_1) ^ 2 *
sin(om * t)) * cos(bb_1) ^ 2 + (-0.2e1 * sin(om * t) * sin
(bb_1) ^ 4 + sin(om * t) * sin(bb_1) ^ 2 * cos(bb_1) ^ 2) *
cos(om * t) ^ 2) * cos(om * t) ^ 2) * m_b ^ 3 * bb_F_1 + (
(sin(bb_1) ^ 2 - 0.1e1 * sin(om * t) ^ 2 * sin(bb_1) ^ 2) *
sin(om * t) ^ 5 + (0.1e1 - 0.1e1 * sin(om * t) ^ 2) * sin(om
* t) ^ 3 * cos(bb_1) ^ 2 + ((0.2e1 * sin(bb_1) ^ 2 - 0.3e1 *
sin(om * t) ^ 2 * sin(bb_1) ^ 2) * sin(om * t) ^ 3 + (0.1e1
- 0.2e1 * sin(om * t) ^ 2) * sin(om * t) * cos(bb_1) ^ 2 + (
(sin(bb_1) ^ 2 - 0.3e1 * sin(om * t) ^ 2 * sin(bb_1) ^ 2) *
sin(om * t) - 0.1e1 * cos(bb_1) ^ 2 * sin(om * t) - 0.1e1 *
sin(om * t) * cos(om * t) ^ 2 * sin(bb_1) ^ 2) * cos(om * t)
^ 2) * cos(om * t) * aa_F * m_b ^ 3 * sin
(bb_2) ^ 2 + ((sin(bb_1) ^ 2 - 0.1e1 * sin(om * t) ^ 2 * sin
(bb_1) ^ 2) * sin(om * t) ^ 3 + (0.1e1 - 0.1e1 * sin(om *
t) ^ 2) * sin(om * t) * cos(bb_1) ^ 2 + ((sin(bb_1) ^ 2 - 0.2e1
* sin(om * t) ^ 2 * sin(bb_1) ^ 2) * sin(om * t) - 0.1e1 *
cos(bb_1) ^ 2 * sin(om * t) - 0.1e1 * sin(om * t) * cos(om *
t) ^ 2 * sin(bb_1) ^ 2) * cos(om * t) ^ 2) * cos(om * t) *
aa_F * m_b ^ 3 * cos(bb_2) ^ 2) * cos(bb_2) ^ 2 + ((0.2e1 *
sin(om * t) ^ 5 * cos(bb_1) ^ 2 + 0.2e1 * sin(om * t) ^ 7 *
sin(bb_1) ^ 2 + (0.4e1 * sin(om * t) ^ 3 * cos(bb_1) ^ 2 +
0.6e1 * sin(om * t) ^ 5 * sin(bb_1) ^ 2 + (0.2e1 * cos(bb_1)
^ 2 * sin(om * t) + 0.6e1 * sin(om * t) ^ 3 * sin(bb_1) ^ 2
+ 0.2e1 * sin(om * t) * cos(om * t) ^ 2 * sin(bb_1) ^ 2) *
cos(om * t) ^ 2) * cos(om * t) ^ 2) * m_b ^ 3 * sin(bb_2) ^
4 + (((0.3e1 * sin(bb_1) ^ 2 - 0.1e1 * sin(om * t) ^ 2 * sin

```

```

(bb_1) ^ 2) * sin(om * t) ^ 5 + (0.3e1 - 0.1e1 * sin(om * t)
^ 2) * sin(om * t) ^ 3 * cos(bb_1) ^ 2 + ((0.6e1 * sin(bb_1)
^ 2 - 0.3e1 * sin(om * t) ^ 2 * sin(bb_1) ^ 2) * sin(om * t)
^ 3 + (0.3e1 - 0.2e1 * sin(om * t) ^ 2) * sin(om * t) * cos
(bb_1) ^ 2 + ((0.3e1 * sin(bb_1) ^ 2 - 0.3e1 * sin(om * t) ^
2 * sin(bb_1) ^ 2) * sin(om * t) - 0.1e1 * cos(bb_1) ^ 2 *
sin(om * t) - 0.1e1 * sin(om * t) * cos(om * t) ^ 2 * sin
(bb_1) ^ 2) * cos(om * t) ^ 2) * cos(om * t) ^ 2) * m_b ^ 3
* sin(bb_2) ^ 2 + ((sin(bb_1) ^ 2 - 0.1e1 * sin(om * t) ^ 2
* sin(bb_1) ^ 2) * sin(om * t) ^ 3 + (0.1e1 - 0.1e1 * sin(om
* t) ^ 2) * sin(om * t) * cos(bb_1) ^ 2 + ((sin(bb_1) ^ 2 -
0.2e1 * sin(om * t) ^ 2 * sin(bb_1) ^ 2) * sin(om * t) -
0.1e1 * cos(bb_1) ^ 2 * sin(om * t) - 0.1e1 * sin(om * t) *
cos(om * t) ^ 2 * sin(bb_1) ^ 2) * cos(om * t) ^ 2) * m_b ^
3 * cos(bb_2) ^ 2) * cos(bb_2) ^ 2) * bb_F_2) * om) * R) *
R) * R) * R + (((0.32e2 * sin(om * t) ^ 2 * sin
(bb_1) * cos(bb_1) ^ 2 - 0.32e2 * sin(bb_1) * cos(om * t) ^
2) * cos(om * t) * aa_F ^ 2 * m_b * JB ^ 2 + (0.64e2 * m_b *
sin(bb_1) * aa_F * cos(om * t) ^ 2 * JB ^ 2 - 0.32e2 * m_b *
cos(om * t) * sin(bb_1) * JB ^ 2 * bb_F_1) * bb_F_1 + 0.32e2
* m_b * sin(bb_2) * aa_F ^ 2 * cos(om * t) ^ 3 * JB ^ 2 -
0.32e2 * m_b * cos(om * t) * aa_F ^ 2 * sin(om * t) ^ 2 *
sin(bb_2) * JB ^ 2 * cos(bb_2) ^ 2 - 0.32e2 * m_b * cos(om *
t) * cos(bb_1) * kb * bb_1 * JB + (0.64e2 * m_b * sin(bb_2)
* aa_F * cos(om * t) ^ 2 * JB ^ 2 + 0.32e2 * cos(om * t) *
m_b * sin(bb_2) * JB ^ 2 * bb_F_2) * bb_F_2 + 0.32e2 * m_b *
cos(om * t) * cos(bb_2) * kb * bb_2 * JB + (((0.64e2 +
0.32e2 * sin(bb_1) ^ 2 - 0.32e2 * sin(om * t) ^ 2) * sin(om
* t) - 0.32e2 * cos(bb_1) ^ 2 * sin(om * t)) * cos(bb_1) -
0.32e2 * cos(bb_1) * sin(om * t) * cos(om * t) ^ 2) * cos(om
* t) * aa_F * m_b * JB ^ 2 + ((-0.32e2 + 0.32e2 * sin(om *
t) ^ 2) * sin(om * t) * cos(bb_1) + 0.32e2 * cos(bb_1) * sin
(om * t) * cos(om * t) ^ 2) * m_b * JB ^ 2 * bb_F_1 + ((0.64e2 -
0.32e2 * sin(om * t) ^ 2) * sin(om * t) - 0.32e2 * sin(om
* t) * cos(om * t) ^ 2) * sin(om * t) * aa_F * m_b *
JB ^ 2 + 0.32e2 * cos(om * t) ^ 2 * sin(om * t) * aa_F * cos(om *
t) * sin(bb_2) ^ 2 * m_b - 0.32e2 * cos(om * t) * m_b * sin(om
* t) * aa_F * cos(bb_2) ^ 2 * JB ^ 2) * cos(bb_2) + ((0.32e2
- 0.32e2 * sin(om * t) ^ 2) * sin(om * t) - 0.32e2 * sin(om
* t) * cos(om * t) ^ 2) * m_b * JB ^ 2 * cos(bb_2) * bb_F_2
+ (-0.32e2 * m_b * cos(om * t) * JB ^ 2 * cos(bb_1) ^ 2 *
sin(bb_1) + 0.32e2 * m_b * cos(om * t) * JB ^ 2 * cos(bb_2)

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```

^ 2 * sin(bb_2)) * om) * om + ((0.16e2 * sin(aa) * cos(bb_1)
^ 2 - 0.16e2 * cos(bb_1) * sin(bb_1) * cos(om * t) * cos(aa)
) * cos(om * t) * g_ * m_b ^ 2 * JB + (-0.16e2 * m_b ^ 2 *
g_ * sin(bb_2) * cos(om * t) ^ 2 * cos(aa) * JB - 0.16e2 *
m_b ^ 2 * cos(om * t) * g_ * sin(aa) * JB * cos(bb_2)) * cos
(bb_2) + (0.16e2 * m_b ^ 2 * cos(bb_1) * sin(bb_1) * cos(om
* t) ^ 2 * aa_F ^ 2 * JB + 0.16e2 * m_b ^ 2 * cos(bb_2) *
sin(bb_2) * cos(om * t) ^ 2 * aa_F ^ 2 * JB) * l + (((((0.8e1
+ 0.8e1 * sin(om * t) ^ 2) * sin(om * t) * cos(bb_1) ^ 2 +
0.8e1 * sin(om * t) * cos(bb_1) ^ 2 * cos(om * t) ^ 2) *
aa_F * m_b ^ 2 * JB + ((-0.8e1 - 0.8e1 * sin(om * t) ^ 2) *
sin(om * t) - 0.8e1 * sin(om * t) * cos(om * t) ^ 2) * aa_F
* m_b ^ 2 * JB * cos(bb_2) ^ 2) * l + ((0.8e1 * sin(bb_1) *
cos(bb_1) * cos(om * t) ^ 2 + 0.8e1 * sin(om * t) ^ 2 * sin
(bb_1) * cos(bb_1)) * m_b ^ 2 * JB + (0.8e1 * sin(om * t) ^
2 + 0.8e1 * cos(om * t) ^ 2) * m_b ^ 2 * JB * sin(bb_2) *
cos(bb_2)) * l * om) * om + ((0.8e1 * sin(om * t) ^ 4 * sin
(bb_1) * cos(bb_1) ^ 2 + (-0.8e1 * sin(bb_1) ^ 3 * sin(om *
t) ^ 2 + (0.16e2 * sin(om * t) ^ 2 * sin(bb_1) - 0.16e2 *
sin(bb_1)) * cos(bb_1) ^ 2 + (0.8e1 * sin(bb_1) * cos(bb_1)
^ 2 - 0.8e1 * sin(bb_1) ^ 3) * cos(om * t) ^ 2) * cos(om *
t) ^ 2 * cos(om * t) * aa_F ^ 2 * m_b ^ 2 * JB + ((0.16e2 *
sin(bb_1) * cos(bb_1) ^ 2 + 0.16e2 * sin(bb_1) ^ 3 * sin(om
* t) ^ 2 + 0.16e2 * sin(bb_1) ^ 3 * cos(om * t) ^ 2) * cos
(om * t) ^ 2 * aa_F * m_b ^ 2 * JB + (-0.8e1 * sin(bb_1) ^ 3
* sin(om * t) ^ 2 - 0.8e1 * sin(om * t) ^ 2 * sin(bb_1) *
cos(bb_1) ^ 2 + (-0.8e1 * sin(bb_1) * cos(bb_1) ^ 2 - 0.8e1
* sin(bb_1) ^ 3) * cos(om * t) ^ 2) * cos(om * t) * m_b ^ 2
* JB * bb_F_1) * bb_F_1 + ((0.8e1 * sin(om * t) ^ 2 * sin
(bb_1) ^ 2 + 0.8e1 * cos(bb_1) ^ 2 + 0.8e1 * sin(bb_1) ^ 2 *
cos(om * t) ^ 2) * cos(om * t) ^ 3 * aa_F ^ 2 * m_b ^ 2 * JB
+ ((0.8e1 * sin(om * t) ^ 4 * sin(bb_1) * cos(bb_1) ^ 2 +
(-0.8e1 * sin(om * t) ^ 2 * sin(bb_1) + 0.8e1 * sin(om * t)
^ 2 * sin(bb_1) * cos(bb_1) ^ 2 - 0.8e1 * sin(bb_1) * cos(om
* t) ^ 2) * cos(om * t) ^ 2) * cos(om * t) * aa_F ^ 2 * m_b
^ 2 * JB + ((0.16e2 * sin(om * t) ^ 2 * sin(bb_1) + 0.16e2 *
sin(bb_1) * cos(om * t) ^ 2) * cos(om * t) ^ 2 * sin(bb_1) +
0.16e2 * sin(bb_1) * cos(om * t) ^ 2) * cos(om * t) * m_b
^ 2 * JB + (-0.8e1 * sin(om * t) ^ 2 * sin(bb_1) - 0.8e1 *
sin(bb_1) * cos(om * t) ^ 2) * cos(om * t) * m_b ^ 2 * JB *
bb_F_1) * bb_F_1 + (0.8e1 * sin(om * t) ^ 2 + 0.8e1 * cos(om
* t) ^ 2) * cos(om * t) ^ 3 * aa_F ^ 2 * m_b ^ 2 * JB * sin
(bb_2)) * sin(bb_2) + ((0.8e1 * sin(om * t) ^ 2

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* sin(bb_1) * cos(bb_1) ^ 2 - 0.8e1 * sin(bb_1) * cos(om *
t) ^ 2) * cos(om * t) * aa_F ^ 2 * m_b ^ 2 * JB + (0.16e2 *
m_b ^ 2 * sin(bb_1) * aa_F * cos(om * t) ^ 2 * JB - 0.8e1 *
m_b ^ 2 * cos(om * t) * sin(bb_1) * JB * bb_F_1) * bb_F_1 +
((-0.8e1 - 0.8e1 * sin(bb_1) ^ 2) * sin(om * t) ^ 4 - 0.8e1 *
cos(bb_1) ^ 2 * sin(om * t) ^ 2 + (0.16e2 + (-0.16e2 -
0.8e1 * sin(bb_1) ^ 2) * sin(om * t) ^ 2 - 0.8e1 * cos(om *
t) ^ 2) * cos(om * t) ^ 2) * aa_F ^ 2 * m_b ^ 2 * JB * sin(bb_2)) * cos(bb_2) ^ 2 + ((-0.8e1 * cos(bb_1) *
sin(om * t) ^ 2 - 0.8e1 * cos(om * t) ^ 2 * cos(bb_1)) * cos
(om * t) * kb * m_b ^ 2 * sin(bb_2) ^ 2 - 0.8e1 * m_b ^ 2 *
cos(om * t) * cos(bb_1) * kb * cos(bb_2) ^ 2) * bb_1 + ((0.16e2 * cos(bb_1) ^ 2 + 0.16e2 * sin(om * t) ^ 2 * sin
(bb_1) ^ 2 + 0.16e2 * sin(bb_1) ^ 2 * cos(om * t) ^ 2) * cos
(om * t) ^ 2 * aa_F * m_b ^ 2 * JB + (0.16e2 * sin(om * t) ^
2 + 0.16e2 * cos(om * t) ^ 2) * cos(om * t) ^ 2 * aa_F * m_b
^ 2 * JB * sin(bb_2) ^ 2) * sin(bb_2) + 0.16e2 * m_b ^ 2 *
sin(bb_2) * aa_F * cos(om * t) ^ 2 * cos(bb_2) ^ 2 * JB + ((0.8e1 * sin(om * t) ^ 2 * sin(bb_1) ^ 2 + 0.8e1 *
cos(bb_1) ^ 2 + 0.8e1 * sin(bb_1) ^ 2 * cos(om * t) ^ 2) * cos
(om * t) * m_b ^ 2 * JB * sin(bb_2) ^ 2) * sin(bb_2) + (0.8e1 *
sin(om * t) ^ 2 + 0.8e1 * cos(om * t) ^ 2) * cos(om * t) *
cos(om * t) * m_b ^ 2 * JB * sin(bb_2) * cos(bb_2) ^ 2) *
bb_F_2 + (0.8e1 * sin(om * t) ^ 2 * sin(bb_1) ^ 2 + 0.8e1 *
cos(bb_1) ^ 2 + 0.8e1 * sin(bb_1) ^ 2 * cos(om * t) ^ 2) * cos
(om * t) * kb * m_b ^ 2 * cos(bb_2) * bb_2 + (((0.24e2 * sin
(bb_1) ^ 2 - 0.8e1 * sin(om * t) ^ 2 * sin(bb_1) ^ 2) * sin
(bb_1) ^ 2 * sin(om * t) ^ 3 + (-0.16e2 * sin(om * t) ^ 2 +
0.16e2) * sin(om * t) * cos(bb_1) ^ 2) * cos(bb_1) + ((0.24e2 *
sin(bb_1) ^ 2 - 0.16e2 * sin(om * t) ^ 2 * sin(bb_1) ^ 2) * sin
(bb_1) ^ 2 * sin(om * t) - 0.16e2 * cos(bb_1) ^ 2 * sin(om *
t)) * cos(bb_1) - 0.8e1 * sin(om * t) * cos(bb_1) * cos(om *
t) ^ 2 * sin(bb_1) ^ 2) * cos(om * t) ^ 2) * cos(om * t) *
aa_F * m_b ^ 2 * JB + ((((-0.8e1 * sin(bb_1) ^ 2 + 0.8e1 *
sin(om * t) ^ 2 * sin(bb_1) ^ 2) * sin(om * t) * cos(bb_1) ^ 2) *
cos(bb_1) + ((((-0.8e1 * sin(bb_1) ^ 2 + 0.16e2 * sin(om * t)
^ 2 * sin(bb_1) ^ 2) * sin(om * t) + 0.8e1 * cos(bb_1) ^ 2 * sin
(om * t)) * cos(bb_1) + 0.8e1 * sin(om * t) * cos(bb_1) *
cos(om * t) ^ 2 * sin(bb_1) ^ 2) * cos(om * t) ^ 2) * m_b ^
2 * JB * bb_F_1 + (((((0.8e1 * sin(bb_1) ^ 2 + 0.16e2 - 0.8e1

```

$$\begin{aligned}
& * \sin(\omega * t) ^ 2 * \sin(\omega * t) ^ 3 - 0.8e1 * \sin(\omega * t) ^ 3 * \cos(bb_1) ^ 2 * \cos(bb_1) + (((0.8e1 * \sin(bb_1) ^ 2 + 0.16e2 - 0.16e2 * \sin(\omega * t) ^ 2) * \sin(\omega * t) - 0.8e1 * \cos(bb_1) ^ 2 * \sin(\omega * t)) * \cos(bb_1) - 0.8e1 * \cos(bb_1) ^ 2 * \sin(\omega * t) * \cos(\omega * t) ^ 2 * \cos(\omega * t) ^ 2 * \cos(\omega * t) * aa_F * m_b ^ 2 * JB + ((-0.8e1 + 0.8e1 * \sin(\omega * t) ^ 2) * \sin(\omega * t) ^ 3 * \cos(bb_1) + ((-0.8e1 + 0.16e2 * \sin(\omega * t) ^ 2) * \sin(\omega * t) * \cos(bb_1) + 0.8e1 * \cos(bb_1) * \sin(\omega * t) * \cos(\omega * t) ^ 2 * \cos(\omega * t) ^ 2 * m_b ^ 2 * JB * bb_F_1) * \sin(bb_2) ^ 2 + (((0.16e2 * \sin(bb_1) ^ 2 - 0.8e1 * \sin(\omega * t) ^ 2 * \sin(bb_1) ^ 2) * \sin(\omega * t) ^ 3 + (0.16e2 - 0.8e1 * \sin(\omega * t) ^ 2) * \sin(\omega * t) * \cos(bb_1) ^ 2 + ((0.16e2 * \sin(bb_1) ^ 2 - 0.16e2 * \sin(\omega * t) ^ 2 * \sin(bb_1) ^ 2) * \sin(\omega * t) - 0.8e1 * \cos(bb_1) ^ 2 * \sin(\omega * t) - 0.8e1 * \sin(\omega * t) * \cos(\omega * t) ^ 2 * \sin(bb_1) ^ 2 * \cos(\omega * t) ^ 2 * \cos(\omega * t) * aa_F * m_b ^ 2 * JB + ((0.8e1 * \sin(bb_1) ^ 2 + 0.24e2 - 0.8e1 * \sin(\omega * t) ^ 2) * \sin(\omega * t) ^ 3 + 0.8e1 * \cos(bb_1) ^ 2 * \sin(\omega * t) + ((0.8e1 * \sin(bb_1) ^ 2 + 0.24e2 - 0.16e2 * \sin(\omega * t) ^ 2) * \sin(\omega * t) - 0.8e1 * \sin(\omega * t) * \cos(\omega * t) ^ 2) * \cos(\omega * t) ^ 2 * \cos(\omega * t) * aa_F * m_b ^ 2 * JB * \sin(bb_2) ^ 2 + (((0.8e1 * \sin(bb_1) ^ 2 + 0.16e2 - 0.8e1 * \sin(\omega * t) ^ 2) * \sin(\omega * t) - 0.8e1 * \cos(bb_1) ^ 2 * \sin(\omega * t)) * \cos(bb_1) - 0.8e1 * \cos(bb_1) * \sin(\omega * t) * \cos(\omega * t) ^ 2 * \cos(\omega * t) * aa_F * m_b ^ 2 * JB + ((-0.8e1 + 0.8e1 * \sin(\omega * t) ^ 2) * \sin(\omega * t) * \cos(bb_1) + 0.8e1 * \cos(bb_1) * \sin(\omega * t) * \cos(\omega * t) ^ 2 * m_b ^ 2 * JB * bb_F_1 + ((0.16e2 + (-0.16e2 - 0.8e1 * \sin(bb_1) ^ 2) * \sin(\omega * t) ^ 2 * \sin(\omega * t) - 0.8e1 * \cos(bb_1) ^ 2 * \sin(\omega * t) + (-0.16e2 - 0.8e1 * \sin(bb_1) ^ 2) * \sin(\omega * t) * \cos(\omega * t) ^ 2 * \cos(\omega * t) * aa_F * m_b ^ 2 * JB * \cos(bb_2)) * \cos(bb_2) + (((0.8e1 * \sin(bb_1) ^ 2 - 0.8e1 * \sin(\omega * t) ^ 2 * \sin(bb_1) ^ 2) * \sin(\omega * t) ^ 3 + (0.8e1 - 0.8e1 * \sin(\omega * t) ^ 2) * \sin(\omega * t) * \cos(bb_1) ^ 2 + ((0.8e1 * \sin(bb_1) ^ 2 - 0.16e2 * \sin(\omega * t) ^ 2 * \sin(bb_1) ^ 2) * \sin(\omega * t) - 0.8e1 * \cos(bb_1) ^ 2 * \sin(\omega * t) - 0.8e1 * \sin(\omega * t) * \cos(\omega * t) ^ 2 * \sin(bb_1) ^ 2 * \cos(\omega * t) ^ 2 * \cos(\omega * t) * m_b ^ 2 * JB + ((0.8e1 - 0.8e1 * \sin(\omega * t) ^ 2) * \sin(\omega * t) ^ 3 + ((-0.16e2 * \sin(\omega * t) ^ 2 + 0.8e1) * \sin(\omega * t) - 0.8e1 * \sin(\omega * t) * \cos(\omega * t) ^ 2 * \cos(\omega * t) ^ 2 * m_b ^ 2 * JB * \sin(bb_2) ^ 2 + ((0.8e1 - 0.8e1 * \sin(\omega * t) ^ 2) * \sin(\omega * t) ^ 2 * \sin(\omega * t)
\end{aligned}$$

$$\begin{aligned}
& t) - 0.8e1 * \sin(\text{om} * t) * \cos(\text{om} * t) ^ 2 * \text{m_b} ^ 2 * \text{JB} * \\
& \cos(\text{bb_2}) ^ 2 * \cos(\text{bb_2}) * \text{bb_F_2} + ((-0.8e1 * \sin(\text{om} * t) \\
& ^ 2 * \sin(\text{bb_1}) * \cos(\text{bb_1}) ^ 2 - 0.8e1 * \sin(\text{bb_1}) * \cos(\text{om} \\
& * t) ^ 2 * \cos(\text{bb_1}) ^ 2) * \cos(\text{om} * t) * \text{m_b} ^ 2 * \text{JB} + \\
& (-0.8e1 * \sin(\text{om} * t) ^ 2 * \sin(\text{bb_1}) * \cos(\text{bb_1}) ^ 2 - \\
& 0.8e1 * \sin(\text{bb_1}) * \cos(\text{om} * t) ^ 2 * \cos(\text{bb_1}) ^ 2 * \cos \\
& (\text{om} * t) * \text{m_b} ^ 2 * \text{JB} * \sin(\text{bb_2}) ^ 2 + (-0.8e1 * \text{m_b} ^ 2 \\
& * \cos(\text{om} * t) * \text{JB} * \cos(\text{bb_1}) ^ 2 * \sin(\text{bb_1}) + ((0.8e1 + \\
& 0.8e1 * \sin(\text{bb_1}) ^ 2) * \sin(\text{om} * t) ^ 2 + 0.8e1 * \cos(\text{bb_1}) \\
& ^ 2 + (0.8e1 + 0.8e1 * \sin(\text{bb_1}) ^ 2) * \cos(\text{om} * t) ^ 2 * \\
& \cos(\text{om} * t) * \text{m_b} ^ 2 * \text{JB} * \sin(\text{bb_2})) * \cos(\text{bb_2}) ^ 2 * \\
& \text{om}) * \text{om} + ((0.4e1 * \sin(\text{aa}) * \sin(\text{om} * t) ^ 2 * \cos(\text{bb_1}) ^ \\
& 2 + (-0.4e1 * \cos(\text{bb_1}) * \sin(\text{bb_1}) * \cos(\text{aa}) * \sin(\text{om} * t) \\
& ^ 2 + (0.4e1 * \sin(\text{aa}) * \cos(\text{bb_1}) ^ 2 - 0.4e1 * \cos(\text{bb_1}) * \\
& \sin(\text{bb_1}) * \cos(\text{om} * t) * \cos(\text{aa})) * \cos(\text{om} * t)) * \cos(\text{om} * \\
& t)) * \cos(\text{om} * t) * \text{g_} * \text{m_b} ^ 3 * \sin(\text{bb_2}) ^ 2 + ((-0.4e1 \\
& * \cos(\text{aa}) * \cos(\text{bb_1}) ^ 2 - 0.4e1 * \cos(\text{aa}) * \sin(\text{om} * t) ^ \\
& 2 * \sin(\text{bb_1}) ^ 2 - 0.4e1 * \cos(\text{aa}) * \cos(\text{om} * t) ^ 2 * \sin \\
& (\text{bb_1}) ^ 2 * \cos(\text{om} * t) ^ 2 * \text{g_} * \text{m_b} ^ 3 * \sin(\text{bb_2}) + \\
& (-0.4e1 * \sin(\text{aa}) * \sin(\text{om} * t) ^ 2 * \sin(\text{bb_1}) ^ 2 + \\
& (-0.4e1 * \cos(\text{bb_1}) * \sin(\text{bb_1}) * \cos(\text{aa}) - 0.4e1 * \sin(\text{aa}) \\
& * \sin(\text{bb_1}) ^ 2 * \cos(\text{om} * t)) * \cos(\text{om} * t)) * \cos(\text{om} * t) \\
& * \text{g_} * \text{m_b} ^ 3 * \cos(\text{bb_2}) * \cos(\text{bb_2}) + ((0.4e1 * \sin(\text{om} * \\
& t) ^ 2 * \sin(\text{bb_1}) * \cos(\text{bb_1}) + 0.4e1 * \sin(\text{bb_1}) * \cos \\
& (\text{bb_1}) * \cos(\text{om} * t) ^ 2) * \cos(\text{om} * t) ^ 2 * \text{aa_F} ^ 2 * \text{m_b} \\
& ^ 3 * \sin(\text{bb_2}) ^ 2 + ((0.4e1 * \cos(\text{bb_1}) ^ 2 + 0.4e1 * \sin \\
& (\text{om} * t) ^ 2 * \sin(\text{bb_1}) ^ 2 + 0.4e1 * \sin(\text{bb_1}) ^ 2 * \cos \\
& (\text{om} * t) ^ 2) * \cos(\text{om} * t) ^ 2 * \text{aa_F} ^ 2 * \text{m_b} ^ 3 * \sin \\
& (\text{bb_2}) + 0.4e1 * \text{m_b} ^ 3 * \cos(\text{bb_1}) * \sin(\text{bb_1}) * \cos(\text{om} * \\
& t) ^ 2 * \text{aa_F} ^ 2 * \cos(\text{bb_2}) * \cos(\text{bb_2})) * 1 + (((0.2e1 \\
& + 0.2e1 * \sin(\text{om} * t) ^ 2) * \sin(\text{om} * t) ^ 3 * \cos(\text{bb_1}) ^ 2 \\
& + ((0.2e1 + 0.4e1 * \sin(\text{om} * t) ^ 2) * \sin(\text{om} * t) * \cos \\
& (\text{bb_1}) ^ 2 + 0.2e1 * \sin(\text{om} * t) * \cos(\text{bb_1}) ^ 2 * \cos(\text{om} * \\
& t) ^ 2) * \cos(\text{om} * t) ^ 2) * \text{aa_F} * \text{m_b} ^ 3 * \sin(\text{bb_2}) ^ 2 \\
& + ((-0.2e1 * \sin(\text{bb_1}) ^ 2 - 0.2e1 * \sin(\text{om} * t) ^ 2 * \sin \\
& (\text{bb_1}) ^ 2) * \sin(\text{om} * t) ^ 3 + ((-0.2e1 * \sin(\text{bb_1}) ^ 2 - \\
& 0.4e1 * \sin(\text{om} * t) ^ 2 * \sin(\text{bb_1}) ^ 2) * \sin(\text{om} * t) - \\
& 0.2e1 * \sin(\text{om} * t) * \cos(\text{om} * t) ^ 2 * \sin(\text{bb_1}) ^ 2 * \cos \\
& (\text{om} * t) ^ 2) * \text{aa_F} * \text{m_b} ^ 3 * \cos(\text{bb_2}) ^ 2) * 1 + (\\
& (0.2e1 * \sin(\text{om} * t) ^ 4 * \sin(\text{bb_1}) * \cos(\text{bb_1}) + (0.4e1 * \\
& \sin(\text{om} * t) ^ 2 * \sin(\text{bb_1}) * \cos(\text{bb_1}) + 0.2e1 * \sin(\text{bb_1}) \\
& * \cos(\text{bb_1}) * \cos(\text{om} * t) ^ 2 * \cos(\text{om} * t) ^ 2) * \text{m_b} ^ 3
\end{aligned}$$

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* sin(bb_2) ^ 2 + ((0.2e1 * cos(bb_1) ^ 2 * sin(om * t) ^ 2
+ 0.2e1 * sin(om * t) ^ 4 * sin(bb_1) ^ 2 + (0.4e1 * sin(om
* t) ^ 2 * sin(bb_1) ^ 2 + 0.2e1 * cos(bb_1) ^ 2 + 0.2e1 *
sin(bb_1) ^ 2 * cos(om * t) ^ 2) * cos(om * t) ^ 2) * m_b ^
3 * sin(bb_2) + (0.2e1 * sin(bb_1) * cos(bb_1) * cos(om * t)
^ 2 + 0.2e1 * sin(om * t) ^ 2 * sin(bb_1) * cos(bb_1)) * m_b
^ 3 * cos(bb_2)) * cos(bb_2)) * l * om) * om + (((0.2e1 *
sin(om * t) ^ 6 * sin(bb_1) * cos(bb_1) ^ 2 + (-0.2e1 * sin
(om * t) ^ 4 * sin(bb_1) ^ 3 + (-0.4e1 * sin(bb_1) + 0.6e1 *
sin(om * t) ^ 2 * sin(bb_1)) * sin(om * t) ^ 2 * cos(bb_1) ^
2 + (-0.4e1 * sin(bb_1) ^ 3 * sin(om * t) ^ 2 + (-0.4e1 *
sin(bb_1) + 0.6e1 * sin(om * t) ^ 2 * sin(bb_1)) * cos(bb_1)
^ 2 + (0.2e1 * sin(bb_1) * cos(bb_1) ^ 2 - 0.2e1 * sin(bb_1)
^ 3) * cos(om * t) ^ 2) * cos(om * t) ^ 2) * cos(om * t) ^
2) * cos(om * t) * aa_F ^ 2 * m_b ^ 3 + ((0.4e1 * sin(om *
t) ^ 2 * sin(bb_1) * cos(bb_1) ^ 2 + 0.4e1 * sin(om * t) ^
4 * sin(bb_1) ^ 3 + (0.4e1 * sin(bb_1) * cos(bb_1) ^ 2 + 0.8e1
* sin(bb_1) ^ 3 * sin(om * t) ^ 2 + 0.4e1 * sin(bb_1) ^ 3 *
cos(om * t) ^ 2) * cos(om * t) ^ 2) * cos(om * t) ^ 2 * aa_F
* m_b ^ 3 + (-0.2e1 * sin(om * t) ^ 4 * sin(bb_1) ^ 3 -
0.2e1 * sin(om * t) ^ 4 * sin(bb_1) * cos(bb_1) ^ 2 +
(-0.4e1 * sin(om * t) ^ 2 * sin(bb_1) * cos(bb_1) ^ 2 -
0.4e1 * sin(bb_1) ^ 3 * sin(om * t) ^ 2 + (-0.2e1 * sin
(bb_1) * cos(bb_1) ^ 2 - 0.2e1 * sin(bb_1) ^ 3) * cos(om *
t) ^ 2) * cos(om * t) ^ 2) * cos(om * t) * m_b ^ 3 * bb_F_1)
* bb_F_1 + (0.2e1 * cos(bb_1) ^ 2 * sin(om * t) ^ 2 + 0.2e1
* sin(om * t) ^ 4 * sin(bb_1) ^ 2 + (0.4e1 * sin(om * t) ^ 2
* sin(bb_1) ^ 2 + 0.2e1 * cos(bb_1) ^ 2 + 0.2e1 * sin(bb_1)
^ 2 * cos(om * t) ^ 2) * cos(om * t) ^ 2) * cos(om * t) ^ 3
* aa_F ^ 2 * m_b ^ 3 * sin(bb_2)) * sin(bb_2) ^ 2 + ((0.2e1
* sin(om * t) ^ 4 * sin(bb_1) * cos(bb_1) ^ 2 + (-0.2e1 *
sin(bb_1) ^ 3 * sin(om * t) ^ 2 + (0.4e1 * sin(om * t) ^ 2 *
sin(bb_1) - 0.4e1 * sin(bb_1)) * cos(bb_1) ^ 2 + (0.2e1 *
sin(bb_1) * cos(bb_1) ^ 2 - 0.2e1 * sin(bb_1) ^ 3) * cos(om
* t) ^ 2) * cos(om * t) ^ 2) * cos(om * t) * aa_F ^ 2 * m_b
^ 3 + ((0.4e1 * sin(bb_1) ^ 3 * sin(om * t) ^ 2 + 0.4e1 *
sin(bb_1) * cos(bb_1) ^ 2 + 0.4e1 * sin(bb_1) ^ 3 * cos(om *
t) ^ 2) * cos(om * t) ^ 2 * aa_F * m_b ^ 3 + (-0.2e1 * sin
(bb_1) ^ 3 * sin(om * t) ^ 2 - 0.2e1 * sin(om * t) ^ 2 * sin
(bb_1) * cos(bb_1) ^ 2 + (-0.2e1 * sin(bb_1) * cos(bb_1) ^
2 - 0.2e1 * sin(bb_1) ^ 3) * cos(om * t) ^ 2) * cos(om * t) *
m_b ^ 3 * bb_F_1) * bb_F_1 + (-0.2e1 * sin(om * t) ^ 4 * cos

```

```

(bb_1) ^ 2 - 0.2e1 * sin(om * t) ^ 6 * sin(bb_1) ^ 2 + (
(0.4e1 * sin(bb_1) ^ 2 - 0.6e1 * sin(om * t) ^ 2 * sin(bb_1)
^ 2) * sin(om * t) ^ 2 + (-0.4e1 * sin(om * t) ^ 2 + 0.4e1)
* cos(bb_1) ^ 2 + (-0.2e1 * cos(bb_1) ^ 2 + 0.4e1 * sin
(bb_1) ^ 2 - 0.6e1 * sin(om * t) ^ 2 * sin(bb_1) ^ 2 - 0.2e1
* sin(bb_1) ^ 2 * cos(om * t) ^ 2) * cos(om * t) ^ 2) * cos
(om * t) ^ 2) * cos(om * t) * aa_F ^ 2 * m_b ^ 3 * sin(bb_2)
) * cos(bb_2) ^ 2 + ((0.4e1 * sin(om * t) ^ 4 * sin(bb_1) ^
2 + 0.4e1 * cos(bb_1) ^ 2 * sin(om * t) ^ 2 + (0.4e1 * cos
(bb_1) ^ 2 + 0.8e1 * sin(om * t) ^ 2 * sin(bb_1) ^ 2 + 0.4e1
* sin(bb_1) ^ 2 * cos(om * t) ^ 2) * cos(om * t) ^ 2) * cos
(om * t) ^ 2 * aa_F * m_b ^ 3 * sin(bb_2) ^ 3 + (0.4e1 * cos
(bb_1) ^ 2 + 0.4e1 * sin(om * t) ^ 2 * sin(bb_1) ^ 2 + 0.4e1
* sin(bb_1) ^ 2 * cos(om * t) ^ 2) * cos(om * t) ^ 2 * aa_F
* m_b ^ 3 * sin(bb_2) * cos(bb_2) ^ 2 + ((0.2e1 * cos(bb_1)
^ 2 * sin(om * t) ^ 2 + 0.2e1 * sin(om * t) ^ 4 * sin(bb_1)
^ 2 + (0.4e1 * sin(om * t) ^ 2 * sin(bb_1) ^ 2 + 0.2e1 * cos
(bb_1) ^ 2 + 0.2e1 * sin(bb_1) ^ 2 * cos(om * t) ^ 2) * cos
(om * t) ^ 2) * cos(om * t) * m_b ^ 3 * sin(bb_2) ^ 3 +
(0.2e1 * cos(bb_1) ^ 2 * sin(om * t) ^ 2 + 0.2e1 * sin(om *
t) ^ 4 * sin(bb_1) ^ 2 + (0.4e1 * sin(om * t) ^ 2 * sin
(bb_1) ^ 2 + 0.2e1 * cos(bb_1) ^ 2 + 0.2e1 * sin(bb_1) ^ 2 *
cos(om * t) ^ 2) * cos(om * t) ^ 2) * cos(om * t) * m_b ^ 3
* sin(bb_2) * cos(bb_2) ^ 2) * bb_F_2) * bb_F_2 + (((((0.6e1
* sin(bb_1) ^ 2 - 0.2e1 * sin(om * t) ^ 2 * sin(bb_1) ^ 2) *
sin(om * t) ^ 5 + (-0.4e1 * sin(om * t) ^ 2 + 0.4e1) * sin
(om * t) ^ 3 * cos(bb_1) ^ 2) * cos(bb_1) + (((0.12e2 * sin
(bb_1) ^ 2 - 0.6e1 * sin(om * t) ^ 2 * sin(bb_1) ^ 2) * sin
(om * t) ^ 3 + (0.4e1 - 0.8e1 * sin(om * t) ^ 2) * sin(om *
t) * cos(bb_1) ^ 2) * cos(bb_1) + (((0.6e1 * sin(bb_1) ^ 2 -
0.6e1 * sin(om * t) ^ 2 * sin(bb_1) ^ 2) * sin(om * t) -
0.4e1 * cos(bb_1) ^ 2 * sin(om * t)) * cos(bb_1) - 0.2e1 *
sin(om * t) * cos(bb_1) * cos(om * t) ^ 2 * sin(bb_1) ^ 2) *
cos(om * t) ^ 2) * cos(om * t) ^ 2) * cos(om * t) * aa_F *
m_b ^ 3 + ((((-0.2e1 * sin(bb_1) ^ 2 + 0.2e1 * sin(om * t) ^
2 * sin(bb_1) ^ 2) * sin(om * t) ^ 5 + (-0.2e1 + 0.2e1 * sin
(om * t) ^ 2) * sin(om * t) ^ 3 * cos(bb_1) ^ 2) * cos(bb_1)
+ ((((-0.4e1 * sin(bb_1) ^ 2 + 0.6e1 * sin(om * t) ^ 2 * sin
(bb_1) ^ 2) * sin(om * t) ^ 3 + (-0.2e1 + 0.4e1 * sin(om *
t) ^ 2) * sin(om * t) * cos(bb_1) ^ 2) * cos(bb_1) + ((-
0.2e1 * sin(bb_1) ^ 2 + 0.6e1 * sin(om * t) ^ 2 * sin
(bb_1) ^ 2) * sin(om * t) + 0.2e1 * cos(bb_1) ^ 2 * sin(om *

```

$$\begin{aligned}
& t)) * \cos(bb_1) + 0.2e1 * \sin(om * t) * \cos(bb_1) * \cos(om * \\
& t) ^ 2 * \sin(bb_1) ^ 2) * \cos(om * t) ^ 2) * \cos(om * t) ^ \\
& 2) * m_b ^ 3 * bb_F_1) * \sin(bb_2) ^ 2 + (((0.6e1 * \sin \\
& (bb_1) ^ 2 - 0.2e1 * \sin(om * t) ^ 2 * \sin(bb_1) ^ 2) * \sin \\
& (om * t) ^ 5 + (0.6e1 - 0.2e1 * \sin(om * t) ^ 2) * \sin(om * \\
& t) ^ 3 * \cos(bb_1) ^ 2 + ((0.12e2 * \sin(bb_1) ^ 2 - 0.6e1 * \\
& \sin(om * t) ^ 2 * \sin(bb_1) ^ 2) * \sin(om * t) ^ 3 + (0.6e1 \\
& - 0.4e1 * \sin(om * t) ^ 2) * \sin(om * t) * \cos(bb_1) ^ 2 + (\\
& (0.6e1 * \sin(bb_1) ^ 2 - 0.6e1 * \sin(om * t) ^ 2 * \sin(bb_1) \\
& ^ 2) * \sin(om * t) - 0.2e1 * \cos(bb_1) ^ 2 * \sin(om * t) - \\
& 0.2e1 * \sin(om * t) * \cos(om * t) ^ 2 * \sin(bb_1) ^ 2) * \cos \\
& (om * t) ^ 2 * \cos(om * t) ^ 2) * \cos(om * t) * aa_F * m_b \\
& ^ 3 * \sin(bb_2) ^ 2 + (((0.6e1 * \sin(bb_1) ^ 2 - 0.2e1 * \\
& \sin(om * t) ^ 2 * \sin(bb_1) ^ 2) * \sin(om * t) ^ 3 + (-0.4e1 \\
& * \sin(om * t) ^ 2 + 0.4e1) * \sin(om * t) * \cos(bb_1) ^ 2) * \\
& \cos(bb_1) + (((0.6e1 * \sin(bb_1) ^ 2 - 0.4e1 * \sin(om * t) ^ \\
& 2 * \sin(bb_1) ^ 2) * \sin(om * t) - 0.4e1 * \cos(bb_1) ^ 2 * \\
& \sin(om * t)) * \cos(bb_1) - 0.2e1 * \sin(om * t) * \cos(bb_1) * \\
& \cos(om * t) ^ 2 * \sin(bb_1) ^ 2) * \cos(om * t) ^ 2) * \cos(om * \\
& t) * aa_F * m_b ^ 3 + ((((-0.2e1 * \sin(bb_1) ^ 2 + 0.2e1 * \\
& \sin(om * t) ^ 2 * \sin(bb_1) ^ 2) * \sin(om * t) ^ 3 + (-0.2e1 \\
& + 0.2e1 * \sin(om * t) ^ 2) * \sin(om * t) * \cos(bb_1) ^ 2) * \\
& \cos(bb_1) + ((((-0.2e1 * \sin(bb_1) ^ 2 + 0.4e1 * \sin(om * t) \\
& ^ 2 * \sin(bb_1) ^ 2) * \sin(om * t) + 0.2e1 * \cos(bb_1) ^ 2 * \\
& \sin(om * t)) * \cos(bb_1) + 0.2e1 * \sin(om * t) * \cos(bb_1) * \\
& \cos(om * t) ^ 2 * \sin(bb_1) ^ 2) * \cos(om * t) ^ 2) * m_b ^ \\
& 3 * bb_F_1 + ((0.4e1 * \sin(bb_1) ^ 2 - 0.4e1 * \sin(om * t) ^ \\
& 2 * \sin(bb_1) ^ 2) * \sin(om * t) ^ 3 + (-0.4e1 * \sin(om * t) \\
& ^ 2 + 0.4e1) * \sin(om * t) * \cos(bb_1) ^ 2 + ((0.4e1 * \sin \\
& (bb_1) ^ 2 - 0.8e1 * \sin(om * t) ^ 2 * \sin(bb_1) ^ 2) * \sin \\
& (om * t) - 0.4e1 * \cos(bb_1) ^ 2 * \sin(om * t) - 0.4e1 * \sin \\
& (om * t) * \cos(om * t) ^ 2 * \sin(bb_1) ^ 2) * \cos(om * t) ^ \\
& 2) * \cos(om * t) * aa_F * m_b ^ 3 * \cos(bb_2)) * \cos(bb_2)) \\
& * \cos(bb_2) + (((0.2e1 * \sin(bb_1) ^ 2 - 0.2e1 * \sin(om * t) \\
& ^ 2 * \sin(bb_1) ^ 2) * \sin(om * t) ^ 5 + (0.2e1 - 0.2e1 * \\
& \sin(om * t) ^ 2) * \sin(om * t) ^ 3 * \cos(bb_1) ^ 2 + ((0.4e1 \\
& * \sin(bb_1) ^ 2 - 0.6e1 * \sin(om * t) ^ 2 * \sin(bb_1) ^ 2) * \\
& \sin(om * t) ^ 3 + (-0.4e1 * \sin(om * t) ^ 2 + 0.2e1) * \sin \\
& (om * t) * \cos(bb_1) ^ 2 + ((0.2e1 * \sin(bb_1) ^ 2 - 0.6e1 * \\
& \sin(om * t) ^ 2 * \sin(bb_1) ^ 2) * \sin(om * t) - 0.2e1 * \cos \\
& (bb_1) ^ 2 * \sin(om * t) - 0.2e1 * \sin(om * t) * \cos(om * t) \\
& ^ 2 * \sin(bb_1) ^ 2) * \cos(om * t) ^ 2) * \cos(om * t) ^ 2) *
\end{aligned}$$

$$\begin{aligned}
& m_b^3 * \sin(bb_2)^2 + ((0.2e1 * \sin(bb_1)^2 - 0.2e1 * \\
& \sin(om * t)^2 * \sin(bb_1)^2) * \sin(om * t)^3 + (0.2e1 \\
& - 0.2e1 * \sin(om * t)^2) * \sin(om * t) * \cos(bb_1)^2 + \\
& (0.2e1 * \sin(bb_1)^2 - 0.4e1 * \sin(om * t)^2 * \sin(bb_1)^2) * \\
& \sin(om * t) - 0.2e1 * \cos(bb_1)^2 * \sin(om * t) - \\
& 0.2e1 * \sin(om * t) * \cos(om * t)^2 * \sin(bb_1)^2 * \cos \\
& (om * t)^2 * m_b^3 * \cos(bb_2)^2 * \cos(bb_2) * \\
& bb_F_2 + ((-0.2e1 * \sin(om * t)^4 * \sin(bb_1) * \cos(bb_1) \\
& ^2 + (-0.4e1 * \sin(om * t)^2 * \sin(bb_1) * \cos(bb_1)^2 \\
& - 0.2e1 * \sin(bb_1) * \cos(om * t)^2 * \cos(bb_1)^2) * \cos \\
& (om * t)^2 * \cos(om * t) * m_b^3 * \sin(bb_2)^2 + \\
& (-0.2e1 * \sin(om * t)^2 * \sin(bb_1) * \cos(bb_1)^2 - \\
& 0.2e1 * \sin(bb_1) * \cos(om * t)^2 * \cos(bb_1)^2) * \cos \\
& (om * t) * m_b^3 + (0.2e1 * \cos(bb_1)^2 * \sin(om * t)^2 \\
& + 0.2e1 * \sin(om * t)^4 * \sin(bb_1)^2 + (0.4e1 * \sin \\
& (om * t)^2 * \sin(bb_1)^2 + 0.2e1 * \cos(bb_1)^2 + 0.2e1 \\
& * \sin(bb_1)^2 * \cos(om * t)^2 * \cos(om * t)^2 * \cos \\
& (om * t) * m_b^3 * \sin(bb_2)) * \cos(bb_2)^2 * om * om \\
& * R * R * R + (0.256e3 * m_b * \sin(om * t) * om \\
& * aa_F * \cos(om * t) * JB^2 + (-0.16e2 * JB * m_b^2 * \\
& \sin(bb_1) * aa_F^2 * \cos(om * t)^3 * \cos(bb_1) + 0.16e2 \\
& * m_b^2 * \cos(bb_2) * \sin(bb_2) * \cos(om * t)^3 * aa_F \\
& ^2 * JB + ((0.64e2 * \sin(om * t)^3 * \sin(bb_1)^2 + \\
& (0.48e2 - 0.16e2 * \sin(om * t)^2) * \sin(om * t) * \cos \\
& (bb_1)^2 + (0.64e2 * \sin(om * t) * \sin(bb_1)^2 - 0.16e2 \\
& * \cos(bb_1)^2 * \sin(om * t)) * \cos(om * t)^2 * \cos(om * \\
& t) * aa_F * m_b^2 * JB + (0.64e2 * \sin(om * t)^3 + \\
& 0.64e2 * \sin(om * t) * \cos(om * t)^2 * \cos(om * t) * aa_F \\
& * m_b^2 * JB * \sin(bb_2)^2 + ((0.48e2 - 0.16e2 * \sin(om \\
& * t)^2) * \sin(om * t) - 0.16e2 * \sin(om * t) * \cos(om * t) \\
& ^2) * \cos(om * t) * aa_F * m_b^2 * JB * \cos(bb_2)^2 + \\
& (-0.16e2 * \sin(om * t)^2 * \sin(bb_1) * \cos(bb_1) - 0.16e2 \\
& * \sin(bb_1) * \cos(bb_1) * \cos(om * t)^2) * \cos(om * t) * \\
& m_b^2 * JB + (0.16e2 * \sin(om * t)^2 + 0.16e2 * \cos(om * \\
& t)^2) * \cos(om * t) * m_b^2 * JB * \sin(bb_2) * \cos(bb_2) \\
&) * om + ((-0.4e1 * \sin(om * t)^2 * \sin(bb_1) * \cos \\
& (bb_1) - 0.4e1 * \sin(bb_1) * \cos(bb_1) * \cos(om * t)^2) * \\
& \cos(om * t)^3 * aa_F^2 * m_b^3 * \sin(bb_2)^2 + \\
& (0.4e1 * \cos(bb_1)^2 + 0.4e1 * \sin(om * t)^2 * \sin(bb_1) \\
& ^2 + 0.4e1 * \sin(bb_1)^2 * \cos(om * t)^2) * \cos(om * t) \\
& ^3 * aa_F^2 * m_b^3 * \sin(bb_2) - 0.4e1 * m_b^3 * \cos \\
& (bb_1) * \sin(bb_1) * aa_F^2 * \cos(om * t)^3 * \cos(bb_2))
\end{aligned}$$

```

* cos(bb_2) + ((0.16e2 * sin(om * t) ^ 5 * sin(bb_1) ^ 2 +
(0.12e2 - 0.4e1 * sin(om * t) ^ 2) * sin(om * t) ^ 3 * cos
(bb_1) ^ 2 + (0.32e2 * sin(om * t) ^ 3 * sin(bb_1) ^ 2 +
(0.12e2 - 0.8e1 * sin(om * t) ^ 2) * sin(om * t) * cos(bb_1)
^ 2 + (0.16e2 * sin(om * t) * sin(bb_1) ^ 2 - 0.4e1 * cos
(bb_1) ^ 2 * sin(om * t)) * cos(om * t) ^ 2) * cos(om * t) ^
2) * cos(om * t) * aa_F * m_b ^ 3 * sin(bb_2) ^ 2 + ((0.12e2
* sin(bb_1) ^ 2 - 0.4e1 * sin(om * t) ^ 2 * sin(bb_1) ^ 2) *
sin(om * t) ^ 3 + (0.8e1 - 0.8e1 * sin(om * t) ^ 2) * sin(om
* t) * cos(bb_1) ^ 2 + ((0.12e2 * sin(bb_1) ^ 2 - 0.8e1 *
sin(om * t) ^ 2 * sin(bb_1) ^ 2) * sin(om * t) - 0.8e1 * cos
(bb_1) ^ 2 * sin(om * t) - 0.4e1 * sin(om * t) * cos(om * t)
^ 2 * sin(bb_1) ^ 2) * cos(om * t) ^ 2) * cos(om * t) * aa_F
* m_b ^ 3 * cos(bb_2) ^ 2 + ((-0.4e1 * sin(om * t) ^ 4 * sin
(bb_1) * cos(bb_1) + (-0.8e1 * sin(om * t) ^ 2 * sin(bb_1) *
cos(bb_1) - 0.4e1 * sin(bb_1) * cos(bb_1) * cos(om * t) ^ 2)
* cos(om * t) ^ 2) * cos(om * t) * m_b ^ 3 * sin(bb_2) ^ 2 +
((0.4e1 * sin(om * t) ^ 4 * sin(bb_1) ^ 2 + 0.4e1 * cos
(bb_1) ^ 2 * sin(om * t) ^ 2 + (0.4e1 * cos(bb_1) ^ 2 +
0.8e1 * sin(om * t) ^ 2 * sin(bb_1) ^ 2 + 0.4e1 * sin(bb_1)
^ 2 * cos(om * t) ^ 2) * cos(om * t) ^ 2) * cos(om * t) *
m_b ^ 3 * sin(bb_2) + (-0.4e1 * sin(om * t) ^ 2 * sin(bb_1)
* cos(bb_1) - 0.4e1 * sin(bb_1) * cos(bb_1) * cos(om * t) ^
2) * cos(om * t) * m_b ^ 3 * cos(bb_2)) * cos(bb_2)) * om) *
om) * R ^ 2) * R ^ 2) * e) * e) / ((0.256e3 * JT + 0.256e3 *
JB * sin(bb_1) ^ 2 * sin(om * t) ^ 2) * JB ^ 2 + 0.256e3 *
JB ^ 3 * sin(om * t) ^ 2 * sin(bb_2) ^ 2 + (0.128e3 * m_b +
0.16e2 * m_t) * JB ^ 2 * l ^ 2 + (((0.64e2 * sin(om * t) ^ 2
* sin(bb_1) ^ 2 + 0.64e2 * sin(bb_1) ^ 2 * cos(om * t) ^ 2 +
0.64e2 * cos(bb_1) ^ 2) * JT * m_b + ((0.64e2 + 0.64e2 * sin
(bb_1) ^ 2) * sin(bb_1) ^ 2 * sin(om * t) ^ 4 + 0.64e2 * cos
(bb_1) ^ 2 * sin(bb_1) ^ 2 * sin(om * t) ^ 2 + (0.64e2 +
0.64e2 * sin(bb_1) ^ 2) * sin(bb_1) ^ 2 * sin(om * t) ^ 2 *
cos(om * t) ^ 2) * m_b * JB) * JB + (((0.64e2 * sin(om * t)
^ 2 + 0.64e2 * cos(om * t) ^ 2) * JT * m_b + ((0.64e2 +
0.128e3 * sin(bb_1) ^ 2) * sin(om * t) ^ 4 + 0.64e2 * cos
(bb_1) ^ 2 * sin(om * t) ^ 2 + (0.64e2 + 0.128e3 * sin(bb_1)
^ 2) * sin(om * t) ^ 2 * cos(om * t) ^ 2) * m_b * JB) * JB +
(0.64e2 * sin(om * t) ^ 4 + 0.64e2 * sin(om * t) ^ 2 * cos
(om * t) ^ 2) * m_b * JB ^ 2 * sin(bb_2) ^ 2) * sin(bb_2) ^
2 + ((0.64e2 * m_b * JT + 0.64e2 * m_b * sin(bb_1) ^ 2 * sin
(om * t) ^ 2 * JB) * JB + 0.64e2 * m_b * JB ^ 2 * sin(om *

```



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sin(om * t) ^ 2 * sin(bb_1) ^ 2 + sin(bb_1) ^ 2 * cos(om *
t) ^ 2) * cos(om * t) ^ 2) * m_t + (0.8e1 * sin(om * t) ^ 4
* sin(bb_1) ^ 2 + 0.4e1 * cos(bb_1) ^ 2 * sin(om * t) ^ 2 +
(0.4e1 * cos(bb_1) ^ 2 + 0.16e2 * sin(om * t) ^ 2 * sin
(bb_1) ^ 2 + 0.8e1 * sin(bb_1) ^ 2 * cos(om * t) ^ 2) * cos
(om * t) ^ 2) * m_b) * m_b ^ 2 * sin(bb_2) ^ 2 + ((sin(om *
t) ^ 2 * sin(bb_1) ^ 2 + cos(bb_1) ^ 2 + sin(bb_1) ^ 2 * cos
(om * t) ^ 2) * m_t + (0.4e1 * sin(om * t) ^ 2 * sin(bb_1) ^
2 + 0.4e1 * sin(bb_1) ^ 2 * cos(om * t) ^ 2) * m_b) * m_b ^
2 * cos(bb_2) ^ 2) * l ^ 2 + (((0.4e1 * sin(om * t) ^ 6 *
cos(bb_1) ^ 2 * sin(bb_1) ^ 2 + 0.4e1 * sin(om * t) ^ 8 *
sin(bb_1) ^ 4 + (0.8e1 * cos(bb_1) ^ 2 * sin(bb_1) ^ 2 * sin
(om * t) ^ 4 + 0.12e2 * sin(om * t) ^ 6 * sin(bb_1) ^ 4 +
(0.4e1 * cos(bb_1) ^ 2 * sin(bb_1) ^ 2 * sin(om * t) ^ 2 +
0.12e2 * sin(om * t) ^ 4 * sin(bb_1) ^ 4 + 0.4e1 * cos(om *
t) ^ 2 * sin(bb_1) ^ 4 * sin(om * t) ^ 2) * cos(om * t) ^ 2)
* cos(om * t) ^ 2) * m_b ^ 3 + (0.4e1 * sin(om * t) ^ 8 *
sin(bb_1) ^ 2 + 0.4e1 * sin(om * t) ^ 6 * cos(bb_1) ^ 2 +
(0.8e1 * sin(om * t) ^ 4 * cos(bb_1) ^ 2 + 0.12e2 * sin(om *
t) ^ 6 * sin(bb_1) ^ 2 + (0.4e1 * cos(bb_1) ^ 2 * sin(om *
t) ^ 2 + 0.12e2 * sin(om * t) ^ 4 * sin(bb_1) ^ 2 + 0.4e1 *
sin(om * t) ^ 2 * sin(bb_1) ^ 2 * cos(om * t) ^ 2) * cos(om *
t) ^ 2) * cos(om * t) ^ 2) * m_b ^ 3 * sin(bb_2) ^ 2) *
sin(bb_2) ^ 2 + ((0.4e1 * sin(om * t) ^ 6 * sin(bb_1) ^ 4 +
0.4e1 * cos(bb_1) ^ 2 * sin(bb_1) ^ 2 * sin(om * t) ^ 4 +
(0.4e1 * cos(bb_1) ^ 2 * sin(bb_1) ^ 2 * sin(om * t) ^ 2 +
0.8e1 * sin(om * t) ^ 4 * sin(bb_1) ^ 4 + 0.4e1 * cos(om *
t) ^ 2 * sin(bb_1) ^ 4 * sin(om * t) ^ 2) * cos(om * t) ^ 2)
* m_b ^ 3 + (0.4e1 * sin(om * t) ^ 6 * sin(bb_1) ^ 2 + 0.4e1 *
sin(om * t) ^ 4 * cos(bb_1) ^ 2 + (0.8e1 * sin(om * t) ^ 4 *
sin(bb_1) ^ 2 + 0.4e1 * cos(bb_1) ^ 2 * sin(om * t) ^ 2 +
0.4e1 * sin(om * t) ^ 2 * sin(bb_1) ^ 2 * cos(om * t) ^ 2) *
cos(om * t) ^ 2) * m_b ^ 3 * sin(bb_2) ^ 2) * cos(bb_2) ^ 2)
* R ^ 2) * R ^ 2) * R ^ 2 + (((-0.64e2 * m_b ^ 2 * cos(om *
t) * cos(bb_2) ^ 2 * JB + 0.64e2 * JB * cos(om * t) * m_b ^
2 * cos(bb_1) ^ 2) * l + ((0.16e2 * cos(bb_1) ^ 2 * sin(om *
t) ^ 2 + 0.16e2 * cos(bb_1) ^ 2 * cos(om * t) ^ 2) * cos(om *
t) * m_b ^ 3 * sin(bb_2) ^ 2 + (-0.16e2 * sin(om * t) ^ 2 *
sin(bb_1) ^ 2 - 0.16e2 * sin(bb_1) ^ 2 * cos(om * t) ^ 2) *
cos(om * t) * m_b ^ 3 * cos(bb_2) ^ 2) * l * R ^ 2) * R ^
2 + (0.512e3 * JB ^ 2 * m_b * cos(om * t) ^ 2 + ((0.64e2 *
cos(bb_1) ^ 2 + 0.128e3 * sin(om * t) ^ 2 * sin(bb_1) ^ 2 +

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0.128e3 * sin(bb_1) ^ 2 * cos(om * t) ^ 2) * cos(om * t) ^ 2
* m_b ^ 2 * JB + (0.128e3 * sin(om * t) ^ 2 + 0.128e3 * cos
(om * t) ^ 2) * cos(om * t) ^ 2 * m_b ^ 2 * JB * sin(bb_2) ^
2 + 0.64e2 * m_b ^ 2 * cos(bb_2) ^ 2 * JB * cos(om * t) ^ 2
+ ((0.16e2 * cos(bb_1) ^ 2 * sin(om * t) ^ 2 + 0.32e2 * sin
(om * t) ^ 4 * sin(bb_1) ^ 2 + (0.16e2 * cos(bb_1) ^ 2 +
0.64e2 * sin(om * t) ^ 2 * sin(bb_1) ^ 2 + 0.32e2 * sin
(bb_1) ^ 2 * cos(om * t) ^ 2) * cos(om * t) ^ 2) * cos(om *
t) ^ 2 * m_b ^ 3 * sin(bb_2) ^ 2 + (0.16e2 * sin(om * t) ^ 2
* sin(bb_1) ^ 2 + 0.16e2 * sin(bb_1) ^ 2 * cos(om * t) ^ 2)
* cos(om * t) ^ 2 * m_b ^ 3 * cos(bb_2) ^ 2) * R ^ 2) * R ^
2) * e) * e);
> Matlab(eq_mo_rho_FF_lin, resultname="aa_FF_lin");
aa_FF_lin = 0.4e1 * ((-0.64e2 * ka * aa + 0.64e2 * cos(om *
t) * aa_F ^ 2 * sin(om * t) ^ 2 * bb_1 * JB) * JB ^ 2 -
0.128e3 * sin(om * t) ^ 2 * bb_1 * aa_F * bb_F_1 * JB ^ 3 -
0.64e2 * cos(om * t) * aa_F ^ 2 * sin(om * t) ^ 2 * bb_2 *
JB ^ 3 - 0.64e2 * cos(om * t) * kb * bb_1 * JB ^ 2 + (0.64e2
* m_b * g_ * aa + 0.16e2 * m_t * g_ * aa) * JB ^ 2 * l -
0.128e3 * sin(om * t) ^ 2 * bb_2 * aa_F * bb_F_2 * JB ^ 3 +
0.64e2 * cos(om * t) * kb * bb_2 * JB ^ 2 + (((0.128e3 -
0.64e2 * bb_1 ^ 2) * sin(om * t) - 0.64e2 * sin(om * t)) *
cos(om * t) * aa_F * JB ^ 3 + ((-0.64e2 * bb_1 ^ 2 - 0.64e2)
* sin(om * t) + 0.64e2 * sin(om * t)) * JB ^ 3 * bb_F_1 -
0.64e2 * cos(om * t) * JB ^ 3 * aa_F * sin(om * t) * bb_2 ^
2 - 0.64e2 * cos(om * t) * JB ^ 3 * sin(om * t) * aa_F +
0.64e2 * JB ^ 3 * sin(om * t) * bb_2 ^ 2 * bb_F_2) * om + (
(-0.32e2 * bb_1 * cos(om * t) ^ 2 + 0.32e2 * bb_1) * g_ *
m_b * JB ^ 2 + (0.32e2 - 0.32e2 * cos(om * t) ^ 2) * g_ *
m_b * JB ^ 2 * bb_2 + ((0.16e2 * bb_1 * cos(om * t) ^ 2 -
0.16e2 * sin(om * t) ^ 2 * bb_1) * aa_F ^ 2 * m_b * JB ^ 2 +
(-0.32e2 * m_b * bb_1 * aa_F * cos(om * t) * JB ^ 2 + 0.16e2
* m_b * bb_1 * JB ^ 2 * bb_F_1) * bb_F_1 + 0.16e2 * m_b *
bb_2 * aa_F ^ 2 * sin(om * t) ^ 2 * bb_2 * JB ^ 2 + 0.16e2 * m_b *
kb * bb_1 * JB) * l + (0.32e2 * m_b * l * bb_2 * aa_F * cos
(om * t) * JB ^ 2 + 0.16e2 * m_b * l * bb_2 * JB ^ 2 *
bb_F_2) * bb_F_2 + 0.16e2 * m_b * l * kb * bb_2 * JB + (((-
0.16e2 - 0.16e2 * bb_1 ^ 2) * sin(om * t) + 0.16e2 * sin
(om * t)) * aa_F * m_b * JB ^ 2 + 0.16e2 * m_b * JB ^ 2 *
aa_F * sin(om * t) * bb_2 ^ 2) * l + (0.16e2 * m_b * JB ^ 2
* bb_1 + 0.16e2 * m_b * JB ^ 2 * bb_2) * l * om) * om + ((
```

$$\begin{aligned}
& (-0.16e2 * aa - 0.16e2 * aa * \cos(\omega * t) ^ 2 * bb_1 ^ 2 - \\
& 0.16e2 * aa * \sin(\omega * t) ^ 2 * bb_1 ^ 2) * ka * m_b + (\\
& (0.16e2 + 0.16e2 * bb_1 ^ 2) * bb_1 * \sin(\omega * t) ^ 4 + \\
& 0.16e2 * \sin(\omega * t) ^ 2 * bb_1 + (-0.16e2 * bb_1 + (0.32e2 \\
& + 0.16e2 * bb_1 ^ 2) * bb_1 * \sin(\omega * t) ^ 2 + 0.16e2 * \\
& bb_1 * \cos(\omega * t) ^ 2) * \cos(\omega * t) ^ 2) * \cos(\omega * t) * \\
& aa_F ^ 2 * m_b * JB) * JB + (((-0.32e2 - 0.32e2 * bb_1 ^ 2) \\
& * bb_1 * \sin(\omega * t) ^ 4 - 0.32e2 * \sin(\omega * t) ^ 2 * bb_1 + \\
& (0.32e2 * bb_1 + (-0.64e2 - 0.32e2 * bb_1 ^ 2) * bb_1 * \sin \\
& (\omega * t) ^ 2 - 0.32e2 * bb_1 * \cos(\omega * t) ^ 2) * \cos(\omega * \\
& t) ^ 2) * aa_F * m_b * JB ^ 2 + (0.16e2 * \sin(\omega * t) ^ 2 * \\
& bb_1 - 0.16e2 * bb_1 + 0.16e2 * bb_1 * \cos(\omega * t) ^ 2) * \\
& \cos(\omega * t) * m_b * JB ^ 2 * bb_F_1) * bb_F_1 + (((-0.16e2 * \\
& aa * \sin(\omega * t) ^ 2 - 0.16e2 * aa * \cos(\omega * t) ^ 2) * ka * \\
& m_b + (0.16e2 * \sin(\omega * t) ^ 4 * bb_1 + 0.16e2 * \sin(\omega * \\
& t) ^ 2 * \cos(\omega * t) ^ 2 * bb_1) * \cos(\omega * t) * aa_F ^ 2 * \\
& m_b * JB) * JB + (-0.32e2 * \sin(\omega * t) ^ 2 * \cos(\omega * t) ^ \\
& 2 * bb_1 - 0.32e2 * \sin(\omega * t) ^ 4 * bb_1) * aa_F * m_b * \\
& JB ^ 2 * bb_F_1) * bb_2 ^ 2 + (((-0.16e2 - 0.16e2 * bb_1 ^ \\
& 2) * \sin(\omega * t) ^ 4 - 0.16e2 * \sin(\omega * t) ^ 2 + (0.16e2 + \\
& (-0.32e2 - 0.16e2 * bb_1 ^ 2) * \sin(\omega * t) ^ 2 - 0.16e2 * \\
& \cos(\omega * t) ^ 2) * \cos(\omega * t) ^ 2) * \cos(\omega * t) * aa_F ^ 2 \\
& * m_b * JB ^ 2 + (-0.16e2 * \sin(\omega * t) ^ 4 - 0.16e2 * \sin \\
& (\omega * t) ^ 2 * \cos(\omega * t) ^ 2) * \cos(\omega * t) * aa_F ^ 2 * \\
& m_b * JB ^ 2 * bb_2 ^ 2 + (-0.16e2 * ka * aa * m_b + \\
& 0.16e2 * \cos(\omega * t) * aa_F ^ 2 * \sin(\omega * t) ^ 2 * bb_1 * \\
& m_b * JB) * JB - 0.32e2 * \sin(\omega * t) ^ 2 * bb_1 * aa_F * \\
& bb_F_1 * m_b * JB ^ 2 - 0.16e2 * m_b * \cos(\omega * t) * aa_F ^ \\
& 2 * \sin(\omega * t) ^ 2 * bb_2 * JB ^ 2 + (((-0.16e2 * \sin(\omega * \\
& t) ^ 2 * bb_1 ^ 2 - 0.16e2 - 0.16e2 * bb_1 ^ 2 * \cos(\omega * t) \\
& ^ 2) * \cos(\omega * t) * kb * m_b * JB + (-0.16e2 * \sin(\omega * t) \\
& ^ 2 - 0.16e2 * \cos(\omega * t) ^ 2) * \cos(\omega * t) * kb * m_b * \\
& JB * bb_2 ^ 2 - 0.16e2 * m_b * \cos(\omega * t) * kb * JB) * bb_1 \\
& + (((0.4e1 * aa * \cos(\omega * t) ^ 2 * bb_1 ^ 2 + 0.4e1 * aa + \\
& 0.4e1 * aa * \sin(\omega * t) ^ 2 * bb_1 ^ 2) * g_ * m_t + (0.8e1 \\
& * aa + 0.16e2 * aa * \sin(\omega * t) ^ 2 * bb_1 ^ 2 + (0.8e1 * \\
& bb_1 + 0.16e2 * aa * bb_1 ^ 2 * \cos(\omega * t)) * \cos(\omega * t)) \\
& * g_ * m_b) * m_b * JB + ((0.4e1 * aa * \cos(\omega * t) ^ 2 + \\
& 0.4e1 * aa * \sin(\omega * t) ^ 2) * g_ * m_t + (0.16e2 * aa * \\
& \cos(\omega * t) ^ 2 + 0.16e2 * aa * \sin(\omega * t) ^ 2) * g_ * m_b) \\
& * m_b * JB * bb_2 ^ 2 - 0.8e1 * m_b ^ 2 * g_ * bb_2 * \cos(\omega * \\
& t) * JB + (0.4e1 * m_t * g_ * aa + 0.8e1 * m_b * g_ * aa)
\end{aligned}$$

$$\begin{aligned}
& * m_b * JB + (0.4e1 * m_b ^ 2 * bb_2 * aa_F ^ 2 * \cos(\text{om} * t) * \\
& t) * JB - 0.4e1 * m_b ^ 2 * bb_1 * aa_F ^ 2 * \cos(\text{om} * t) * \\
& JB) * 1) * 1 + ((((-0.32e2 - 0.32e2 * bb_1 ^ 2) * \sin(\text{om} * t) ^ 4 - \\
& 0.32e2 * \sin(\text{om} * t) ^ 2 + (0.32e2 + (-0.64e2 - \\
& 0.32e2 * bb_1 ^ 2) * \sin(\text{om} * t) ^ 2 - 0.32e2 * \cos(\text{om} * t) ^ 2) * \\
& \cos(\text{om} * t) ^ 2) * aa_F * m_b * JB ^ 2 + (-0.32e2 * \\
& \sin(\text{om} * t) ^ 2 * \cos(\text{om} * t) ^ 2 - 0.32e2 * \sin(\text{om} * t) ^ 4) * \\
& aa_F * m_b * JB ^ 2 * bb_2 ^ 2) * bb_2 - 0.32e2 * \sin \\
& (\text{om} * t) ^ 2 * bb_2 * aa_F * m_b * JB ^ 2 + (-0.16e2 * \sin \\
& (\text{om} * t) ^ 2 + 0.16e2 - 0.16e2 * \cos(\text{om} * t) ^ 2) * \cos(\text{om} * t) * \\
& m_b * JB ^ 2 * bb_2 * bb_F_2) * bb_F_2 + ((0.16e2 + \\
& 0.16e2 * \sin(\text{om} * t) ^ 2 * bb_1 ^ 2 + 0.16e2 * bb_1 ^ 2 * \\
& \cos(\text{om} * t) ^ 2) * \cos(\text{om} * t) * kb * m_b * JB + (0.16e2 * \\
& \sin(\text{om} * t) ^ 2 + 0.16e2 * \cos(\text{om} * t) ^ 2) * \cos(\text{om} * t) * \\
& kb * m_b * JB * bb_2 ^ 2 + 0.16e2 * m_b * \cos(\text{om} * t) * kb * \\
& JB) * bb_2 + (((0.32e2 - 0.16e2 * bb_1 ^ 2) * bb_1 ^ 2 * \sin \\
& (\text{om} * t) ^ 3 + (-0.16e2 * bb_1 ^ 2 + 0.48e2 + (-0.16e2 - \\
& 0.16e2 * bb_1 ^ 2) * \sin(\text{om} * t) ^ 2) * \sin(\text{om} * t) - 0.16e2 * \\
& \sin(\text{om} * t) + ((0.32e2 - 0.16e2 * bb_1 ^ 2) * bb_1 ^ 2 * \\
& \sin(\text{om} * t) + (-0.16e2 - 0.16e2 * bb_1 ^ 2) * \sin(\text{om} * t)) * \\
& \cos(\text{om} * t) ^ 2) * \cos(\text{om} * t) * aa_F * m_b * JB ^ 2 + (\\
& (-0.48e2 - 0.16e2 * bb_1 ^ 2) * bb_1 ^ 2 * \sin(\text{om} * t) ^ 3 + \\
& (-0.32e2 - 0.16e2 * bb_1 ^ 2 + (0.16e2 + 0.16e2 * bb_1 ^ 2) * \\
& \sin(\text{om} * t) ^ 2) * \sin(\text{om} * t) + 0.16e2 * \sin(\text{om} * t) + (\\
& (-0.48e2 - 0.16e2 * bb_1 ^ 2) * bb_1 ^ 2 * \sin(\text{om} * t) + \\
& (0.16e2 + 0.16e2 * bb_1 ^ 2) * \sin(\text{om} * t)) * \cos(\text{om} * t) ^ 2) * \\
& m_b * JB ^ 2 * bb_F_1 + (((0.32e2 - 0.32e2 * bb_1 ^ 2) * \\
& \sin(\text{om} * t) ^ 3 + (-0.16e2 - 0.16e2 * \sin(\text{om} * t) ^ 2) * \\
& \sin(\text{om} * t) + ((0.32e2 - 0.32e2 * bb_1 ^ 2) * \sin(\text{om} * t) - \\
& 0.16e2 * \sin(\text{om} * t)) * \cos(\text{om} * t) ^ 2) * \cos(\text{om} * t) * \\
& aa_F * m_b * JB ^ 2 + ((-0.16e2 - 0.16e2 * bb_1 ^ 2) * \sin \\
& (\text{om} * t) ^ 3 + 0.16e2 * \sin(\text{om} * t) ^ 3 + ((-0.16e2 - 0.16e2 * \\
& bb_1 ^ 2) * \sin(\text{om} * t) + 0.16e2 * \sin(\text{om} * t)) * \cos(\text{om} * t) ^ 2) * \\
& m_b * JB ^ 2 * bb_F_1 + (-0.16e2 * \sin(\text{om} * t) ^ 3 - 0.16e2 * \\
& \sin(\text{om} * t) * \cos(\text{om} * t) ^ 2) * \cos(\text{om} * t) * \\
& aa_F * m_b * JB ^ 2 * bb_2 ^ 2) * bb_2 ^ 2 + ((-0.16e2 * \\
& bb_1 ^ 2 + 0.48e2 + (-0.16e2 - 0.16e2 * bb_1 ^ 2) * \sin(\text{om} * t) ^ 2) * \\
& \sin(\text{om} * t) - 0.32e2 * \sin(\text{om} * t) + (-0.16e2 - \\
& 0.16e2 * bb_1 ^ 2) * \sin(\text{om} * t) * \cos(\text{om} * t) ^ 2) * \cos(\text{om} * t) * \\
& aa_F * m_b * JB ^ 2 + ((-0.16e2 - 0.16e2 * bb_1 ^ 2) * \\
& \sin(\text{om} * t) + 0.16e2 * \sin(\text{om} * t)) * m_b * JB ^ 2 * \\
& bb_F_1 + ((-0.16e2 - 0.16e2 * \sin(\text{om} * t) ^ 2) * \sin(\text{om} * t)
\end{aligned}$$

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- 0.16e2 * sin(om * t) * cos(om * t) ^ 2 * cos(om * t) *
aa_F * m_b * JB ^ 2 * bb_2 ^ 2 - 0.16e2 * cos(om * t) * m_b
* sin(om * t) * aa_F * JB ^ 2 + ((0.16e2 * sin(om * t) * cos
(om * t) ^ 2 * bb_1 ^ 2 + 0.16e2 * sin(om * t) + 0.16e2 *
sin(om * t) ^ 3 * bb_1 ^ 2) * m_b * JB ^ 2 + (((0.16e2 *
bb_1 ^ 2 + 0.48e2) * sin(om * t) ^ 3 + 0.16e2 * sin(om * t)
+ (0.16e2 * bb_1 ^ 2 + 0.48e2) * sin(om * t) * cos(om * t) ^
2) * m_b * JB ^ 2 + (0.16e2 * sin(om * t) ^ 3 + 0.16e2 * sin
(om * t) * cos(om * t) ^ 2) * m_b * JB ^ 2 * bb_2 ^ 2) *
bb_2 ^ 2 + ((0.32e2 + (-0.16e2 - 0.16e2 * bb_1 ^ 2) * sin(om
* t) ^ 2) * sin(om * t) - 0.16e2 * sin(om * t) + (-0.16e2 -
0.16e2 * bb_1 ^ 2) * sin(om * t) * cos(om * t) ^ 2) * m_b *
JB ^ 2 + ((-0.16e2 * sin(om * t) ^ 2 + 0.16e2) * sin(om * t)
- 0.16e2 * sin(om * t) * cos(om * t) ^ 2) * m_b * JB ^ 2 *
bb_2 ^ 2 - 0.16e2 * JB ^ 2 * sin(om * t) * m_b) * bb_F_2) *
om + ((0.8e1 * bb_1 ^ 3 * sin(om * t) ^ 2 + 0.8e1 * bb_1 +
(-0.8e1 * bb_1 - 0.8e1 * bb_1 ^ 3 * sin(om * t) ^ 2 + 0.8e1
* bb_1 ^ 3 - 0.8e1 * bb_1 ^ 3 * cos(om * t) ^ 2) * cos(om *
t) ^ 2) * g_ * m_b ^ 2 * JB + ((0.8e1 * sin(om * t) ^ 2 *
bb_1 ^ 2 + 0.8e1 + (-0.8e1 + 0.8e1 * bb_1 ^ 2 - 0.8e1 * sin
(om * t) ^ 2 * bb_1 ^ 2 - 0.8e1 * bb_1 ^ 2 * cos(om * t) ^
2) * cos(om * t) ^ 2) * g_ * m_b ^ 2 * JB + ((0.8e1 * sin(om
* t) ^ 2 * bb_1 + (0.8e1 * bb_1 - 0.8e1 * sin(om * t) ^ 2 *
bb_1 - 0.8e1 * bb_1 * cos(om * t) ^ 2) * cos(om * t) ^ 2) *
g_ * m_b ^ 2 * JB + (0.8e1 * sin(om * t) ^ 2 + (0.8e1 -
0.8e1 * sin(om * t) ^ 2 - 0.8e1 * cos(om * t) ^ 2) * cos(om
* t) ^ 2) * g_ * m_b ^ 2 * JB * bb_2) * bb_2) * bb_2 +
(0.8e1 * bb_1 - 0.8e1 * bb_1 * cos(om * t) ^ 2) * g_ * m_b ^
2 * JB + (0.8e1 - 0.8e1 * cos(om * t) ^ 2) * g_ * m_b ^ 2 *
JB * bb_2 + ((-0.4e1 * sin(om * t) ^ 4 * bb_1 + (0.4e1 *
bb_1 ^ 3 * sin(om * t) ^ 2 - 0.8e1 * sin(om * t) ^ 2 * bb_1
+ 0.8e1 * bb_1 + (-0.4e1 * bb_1 + 0.4e1 * bb_1 ^ 3) * cos(om
* t) ^ 2) * cos(om * t) ^ 2) * aa_F ^ 2 * m_b ^ 2 * JB + (
(-0.8e1 * bb_1 - 0.8e1 * bb_1 ^ 3 * sin(om * t) ^ 2 - 0.8e1
* bb_1 ^ 3 * cos(om * t) ^ 2) * cos(om * t) * aa_F * m_b ^ 2
* JB + (0.4e1 * bb_1 ^ 3 * sin(om * t) ^ 2 + 0.4e1 * sin(om
* t) ^ 2 * bb_1 + (0.4e1 * bb_1 + 0.4e1 * bb_1 ^ 3) * cos(om
* t) ^ 2) * m_b ^ 2 * JB * bb_F_1) * bb_F_1 + ((0.4e1 +
0.4e1 * sin(om * t) ^ 2 * bb_1 ^ 2 + 0.4e1 * bb_1 ^ 2 * cos
(om * t) ^ 2) * cos(om * t) ^ 2 * aa_F ^ 2 * m_b ^ 2 * JB +
((-0.4e1 * sin(om * t) ^ 4 * bb_1 + 0.4e1 * bb_1 * cos(om *
t) ^ 4) * aa_F ^ 2 * m_b ^ 2 * JB + ((-0.8e1 * sin(om * t) ^

```

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2 * bb_1 - 0.8e1 * bb_1 * cos(om * t) ^ 2) * cos(om * t) *
aa_F * m_b ^ 2 * JB + (0.4e1 * sin(om * t) ^ 2 * bb_1 +
0.4e1 * bb_1 * cos(om * t) ^ 2) * m_b ^ 2 * JB * bb_F_1) *
bb_F_1 + (0.4e1 * sin(om * t) ^ 2 + 0.4e1 * cos(om * t) ^ 2)
* cos(om * t) ^ 2 * aa_F ^ 2 * m_b ^ 2 * JB * bb_2) * bb_2)
* bb_2 + (0.4e1 * bb_1 * cos(om * t) ^ 2 - 0.4e1 * sin(om *
t) ^ 2 * bb_1) * aa_F ^ 2 * m_b ^ 2 * JB + (-0.8e1 * m_b ^ 2
* bb_1 * aa_F * cos(om * t) * JB + 0.4e1 * m_b ^ 2 * bb_1 *
JB * bb_F_1) * bb_F_1 + ((-0.4e1 - 0.4e1 * bb_1 ^ 2) * sin
(om * t) ^ 4 - 0.4e1 * sin(om * t) ^ 2 + (0.8e1 + (-0.8e1 -
0.4e1 * bb_1 ^ 2) * sin(om * t) ^ 2 - 0.4e1 * cos(om * t) ^
2) * cos(om * t) ^ 2) * aa_F ^ 2 * m_b ^ 2 * JB * bb_2 + (
(0.4e1 * sin(om * t) ^ 2 + 0.4e1 * cos(om * t) ^ 2) * kb *
m_b ^ 2 * bb_2 ^ 2 + 0.4e1 * m_b ^ 2 * kb) * bb_1) * l + ((((
0.8e1 * sin(om * t) ^ 2 * bb_1 ^ 2 + 0.8e1 + 0.8e1 * bb_1 ^
2 * cos(om * t) ^ 2) * cos(om * t) * aa_F * m_b ^ 2 * JB +
(0.8e1 * sin(om * t) ^ 2 + 0.8e1 * cos(om * t) ^ 2) * cos(om
* t) * aa_F * m_b ^ 2 * JB * bb_2 ^ 2) * bb_2 + 0.8e1 * m_b
^ 2 * bb_2 * aa_F * cos(om * t) * JB) * l + (((0.4e1 + 0.4e1
* sin(om * t) ^ 2 * bb_1 ^ 2 + 0.4e1 * bb_1 ^ 2 * cos(om *
t) ^ 2) * m_b ^ 2 * JB + (0.4e1 * sin(om * t) ^ 2 + 0.4e1 *
cos(om * t) ^ 2) * m_b ^ 2 * JB * bb_2 ^ 2) * bb_2 + (0.4e1
* sin(om * t) ^ 2 + 0.4e1 * cos(om * t) ^ 2) * m_b ^ 2 * JB
* bb_2) * l * bb_F_2 + (0.4e1 + 0.4e1 * sin(om *
t) ^ 2 * bb_1 ^ 2 + 0.4e1 * bb_1 ^ 2 * cos(om * t) ^ 2) * kb
* m_b ^ 2 * l * bb_2 + ((((-0.8e1 * sin(om * t) ^ 3 * bb_1 ^
2 + (-0.4e1 + 0.4e1 * sin(om * t) ^ 2) * sin(om * t) +
(-0.8e1 * sin(om * t) * bb_1 ^ 2 + 0.4e1 * sin(om * t)) *
cos(om * t) ^ 2) * aa_F * m_b ^ 2 * JB + ((-0.4e1 - 0.4e1 *
bb_1 ^ 2) * sin(om * t) ^ 3 + 0.4e1 * sin(om * t) ^ 3 + (
(-0.4e1 - 0.4e1 * bb_1 ^ 2) * sin(om * t) + 0.4e1 * sin(om *
t)) * cos(om * t) ^ 2) * aa_F * m_b ^ 2 * JB * bb_2 ^ 2 +
(0.4e1 * sin(om * t) * cos(om * t) ^ 2 * bb_1 ^ 2 + 0.4e1 *
sin(om * t) ^ 3 * bb_1 ^ 2 + 0.4e1 * sin(om * t)) * aa_F *
m_b ^ 2 * JB + ((0.8e1 + 0.4e1 * bb_1 ^ 2) * sin(om * t) ^ 3
+ 0.4e1 * sin(om * t) + (0.8e1 + 0.4e1 * bb_1 ^ 2) * sin(om
* t) * cos(om * t) ^ 2) * aa_F * m_b ^ 2 * JB * bb_2 ^ 2 + (
(-0.4e1 - 0.4e1 * bb_1 ^ 2) * sin(om * t) + 0.4e1 * sin(om *
t)) * aa_F * m_b ^ 2 * JB + ((0.4e1 + (-0.4e1 - 0.4e1 *
bb_1 ^ 2) * sin(om * t) ^ 2) * sin(om * t) - 0.4e1 * sin(om *
t) + (-0.4e1 - 0.4e1 * bb_1 ^ 2) * sin(om * t) * cos(om * t) ^
2) * aa_F * m_b ^ 2 * JB) * l + ((0.4e1 * sin(om * t) ^ 2 *

```

$$\begin{aligned}
& \text{bb_1} + 0.4e1 * \text{bb_1} * \cos(\text{om} * t) ^ 2 * \text{m_b} ^ 2 * \text{JB} + \\
& (0.4e1 * \sin(\text{om} * t) ^ 2 * \text{bb_1} + 0.4e1 * \text{bb_1} * \cos(\text{om} * t) \\
& ^ 2) * \text{m_b} ^ 2 * \text{JB} * \text{bb_2} ^ 2 + 0.4e1 * \text{m_b} ^ 2 * \text{JB} * \text{bb_1} \\
& + ((0.4e1 + 0.4e1 * \text{bb_1} ^ 2) * \sin(\text{om} * t) ^ 2 + 0.4e1 + \\
& (0.4e1 + 0.4e1 * \text{bb_1} ^ 2) * \cos(\text{om} * t) ^ 2) * \text{m_b} ^ 2 * \text{JB} \\
& * \text{bb_2}) * \text{l} * \text{om} + ((0.4e1 * \sin(\text{om} * t) ^ 6 * \text{bb_1} ^ 3 \\
& + 0.4e1 * \sin(\text{om} * t) ^ 4 * \text{bb_1} + ((-0.4e1 * \text{bb_1} ^ 3 + \\
& 0.12e2 * \text{bb_1} ^ 3 * \sin(\text{om} * t) ^ 2) * \sin(\text{om} * t) ^ 2 - \\
& 0.4e1 * \text{bb_1} + 0.8e1 * \sin(\text{om} * t) ^ 2 * \text{bb_1} + (-0.4e1 * \\
& \text{bb_1} ^ 3 + 0.12e2 * \text{bb_1} ^ 3 * \sin(\text{om} * t) ^ 2 + 0.4e1 * \\
& \text{bb_1} + 0.4e1 * \text{bb_1} ^ 3 * \cos(\text{om} * t) ^ 2) * \cos(\text{om} * t) ^ 2 \\
& * \cos(\text{om} * t) ^ 2 * \cos(\text{om} * t) * \text{aa_F} ^ 2 * \text{m_b} ^ 2 * \\
& \text{JB} + ((-0.8e1 * \sin(\text{om} * t) ^ 6 * \text{bb_1} ^ 3 - 0.8e1 * \sin(\text{om} \\
& * t) ^ 4 * \text{bb_1} + ((0.8e1 * \text{bb_1} ^ 3 - 0.24e2 * \text{bb_1} ^ 3 * \\
& \sin(\text{om} * t) ^ 2) * \sin(\text{om} * t) ^ 2 - 0.16e2 * \sin(\text{om} * t) ^ 2 * \\
& \text{bb_1} + 0.8e1 * \text{bb_1} + (0.8e1 * \text{bb_1} ^ 3 - 0.24e2 * \text{bb_1} \\
& ^ 3 * \sin(\text{om} * t) ^ 2 - 0.8e1 * \text{bb_1} - 0.8e1 * \text{bb_1} ^ 3 * \\
& \cos(\text{om} * t) ^ 2) * \cos(\text{om} * t) ^ 2 * \cos(\text{om} * t) ^ 2 * \\
& \text{aa_F} * \text{m_b} ^ 2 * \text{JB} + ((-0.4e1 * \text{bb_1} ^ 3 + 0.4e1 * \text{bb_1} ^ 3 \\
& * \sin(\text{om} * t) ^ 2) * \sin(\text{om} * t) ^ 2 + 0.4e1 * \sin(\text{om} * t) ^ 2 * \\
& \text{bb_1} - 0.4e1 * \text{bb_1} + (0.8e1 * \text{bb_1} ^ 3 * \sin(\text{om} * t) ^ 2 - \\
& 0.4e1 * \text{bb_1} ^ 3 + 0.4e1 * \text{bb_1} + 0.4e1 * \text{bb_1} ^ 3 * \cos(\text{om} * t) ^ 2 \\
& * \cos(\text{om} * t) ^ 2) * \cos(\text{om} * t) * \text{m_b} ^ 2 * \\
& \text{JB} * \text{bb_F_1}) * \text{bb_F_1} + ((-0.4e1 * \text{aa} * \sin(\text{om} * t) ^ 4 * \\
& \text{bb_1} ^ 2 - 0.4e1 * \text{aa} * \sin(\text{om} * t) ^ 2 + (-0.8e1 * \text{aa} * \sin(\text{om} * t) \\
& ^ 2 * \text{bb_1} ^ 2 - 0.4e1 * \text{aa} - 0.4e1 * \text{aa} * \cos(\text{om} * t) ^ 2 * \\
& \text{bb_1} ^ 2) * \cos(\text{om} * t) ^ 2 * \text{ka} * \text{m_b} ^ 2 + \\
& ((0.4e1 + 0.4e1 * \text{bb_1} ^ 2) * \text{bb_1} * \sin(\text{om} * t) ^ 6 + 0.4e1 * \\
& \sin(\text{om} * t) ^ 4 * \text{bb_1} + ((-0.4e1 * \text{bb_1} + (0.12e2 + 0.8e1 * \\
& \text{bb_1} ^ 2) * \text{bb_1} * \sin(\text{om} * t) ^ 2) * \sin(\text{om} * t) ^ 2 + \\
& 0.4e1 * \sin(\text{om} * t) ^ 2 * \text{bb_1} + (-0.4e1 * \text{bb_1} + (0.12e2 + \\
& 0.4e1 * \text{bb_1} ^ 2) * \text{bb_1} * \sin(\text{om} * t) ^ 2 + 0.4e1 * \text{bb_1} * \\
& \cos(\text{om} * t) ^ 2) * \cos(\text{om} * t) ^ 2 * \cos(\text{om} * t) ^ 2 * \cos(\text{om} * t) * \\
& \text{aa_F} ^ 2 * \text{m_b} ^ 2 * \text{JB} + (((-0.8e1 - 0.8e1 * \\
& \text{bb_1} ^ 2) * \text{bb_1} * \sin(\text{om} * t) ^ 6 - 0.8e1 * \sin(\text{om} * t) ^ 4 * \\
& \text{bb_1} + ((0.8e1 * \text{bb_1} + (-0.24e2 - 0.16e2 * \text{bb_1} ^ 2) * \\
& \text{bb_1} * \sin(\text{om} * t) ^ 2) * \sin(\text{om} * t) ^ 2 - 0.8e1 * \sin(\text{om} * t) \\
& ^ 2 * \text{bb_1} + (0.8e1 * \text{bb_1} + (-0.24e2 - 0.8e1 * \text{bb_1} ^ 2) * \\
& \text{bb_1} * \sin(\text{om} * t) ^ 2 - 0.8e1 * \text{bb_1} * \cos(\text{om} * t) ^ 2) * \\
& \cos(\text{om} * t) ^ 2 * \cos(\text{om} * t) ^ 2 * \text{aa_F} * \text{m_b} ^ 2 * \text{JB} + \\
& ((0.4e1 * \sin(\text{om} * t) ^ 2 * \text{bb_1} - 0.4e1 * \text{bb_1}) * \sin(\text{om} * t) \\
& ^ 2 + (-0.4e1 * \text{bb_1} + 0.8e1 * \sin(\text{om} * t) ^ 2 * \text{bb_1} +
\end{aligned}$$

```

0.4e1 * bb_1 * cos(om * t) ^ 2 * cos(om * t) ^ 2 * cos(om
* t) * m_b ^ 2 * JB * bb_F_1) * bb_F_1) * bb_2 ^ 2 + (
(-0.4e1 * sin(om * t) ^ 6 * bb_1 ^ 2 - 0.4e1 * sin(om * t) ^
4 + ((0.4e1 * bb_1 ^ 2 - 0.12e2 * sin(om * t) ^ 2 * bb_1 ^
2) * sin(om * t) ^ 2 + 0.4e1 - 0.8e1 * sin(om * t) ^ 2 +
(-0.12e2 * sin(om * t) ^ 2 * bb_1 ^ 2 - 0.4e1 + 0.4e1 * bb_1
^ 2 - 0.4e1 * bb_1 ^ 2 * cos(om * t) ^ 2) * cos(om * t) ^ 2)
* cos(om * t) ^ 2 * cos(om * t) * aa_F ^ 2 * m_b ^ 2 * JB +
((-0.4e1 - 0.4e1 * bb_1 ^ 2) * sin(om * t) ^ 6 - 0.4e1 * sin
(om * t) ^ 4 + ((0.4e1 + (-0.12e2 - 0.8e1 * bb_1 ^ 2) * sin
(om * t) ^ 2 - 0.4e1 * sin(om * t) ^ 2 + (0.4e1 + (-0.4e1 * bb_1
^ 2 - 0.12e2) * sin(om * t) ^ 2 - 0.4e1 * cos(om * t) ^ 2 *
cos(om * t) * aa_F ^ 2 * m_b ^ 2 * JB * bb_2 ^ 2) *
bb_2 + (-0.4e1 * aa * sin(om * t) ^ 2 * bb_1 ^ 2 - 0.4e1 *
aa * cos(om * t) ^ 2 * bb_1 ^ 2 - 0.4e1 * aa) * ka * m_b ^ 2
+ ((0.4e1 + 0.4e1 * bb_1 ^ 2) * bb_1 * sin(om * t) ^ 4 +
0.4e1 * sin(om * t) ^ 2 * bb_1 + (-0.4e1 * bb_1 + (0.8e1 +
0.4e1 * bb_1 ^ 2) * bb_1 * sin(om * t) ^ 2 + 0.4e1 * bb_1 *
cos(om * t) ^ 2) * cos(om * t) ^ 2 * cos(om * t) * aa_F ^ 2
* m_b ^ 2 * JB + (((-0.8e1 - 0.8e1 * bb_1 ^ 2) * bb_1 * sin
(om * t) ^ 4 - 0.8e1 * sin(om * t) ^ 2 * bb_1 + (0.8e1 *
bb_1 + (-0.16e2 - 0.8e1 * bb_1 ^ 2) * bb_1 * sin(om * t) ^ 2
- 0.8e1 * bb_1 * cos(om * t) ^ 2) * cos(om * t) ^ 2) * aa_F
* m_b ^ 2 * JB + (0.4e1 * sin(om * t) ^ 2 * bb_1 - 0.4e1 *
bb_1 + 0.4e1 * bb_1 * cos(om * t) ^ 2) * cos(om * t) * m_b ^
2 * JB * bb_F_1) * bb_F_1 + ((-0.4e1 - 0.4e1 * bb_1 ^ 2) *
sin(om * t) ^ 4 - 0.4e1 * sin(om * t) ^ 2 + (0.4e1 + (-0.8e1
- 0.4e1 * bb_1 ^ 2) * sin(om * t) ^ 2 - 0.4e1 * cos(om * t)
^ 2) * cos(om * t) ^ 2 * cos(om * t) * aa_F ^ 2 * m_b ^ 2 *
JB * bb_2 + ((-0.4e1 * sin(om * t) ^ 4 * bb_1 ^ 2 - 0.4e1 *
sin(om * t) ^ 2 + (-0.4e1 - 0.8e1 * sin(om * t) ^ 2 * bb_1 ^
2 - 0.4e1 * bb_1 ^ 2 * cos(om * t) ^ 2) * cos(om * t) ^ 2) *
cos(om * t) * kb * m_b ^ 2 * bb_2 ^ 2 + (-0.4e1 - 0.4e1 *
sin(om * t) ^ 2 * bb_1 ^ 2 - 0.4e1 * bb_1 ^ 2 * cos(om * t)
^ 2) * cos(om * t) * kb * m_b ^ 2 * bb_1 + (((aa * sin(om *
t) ^ 2 + aa * sin(om * t) ^ 4 * bb_1 ^ 2 + (0.2e1 * aa * sin
(om * t) ^ 2 * bb_1 ^ 2 + aa + aa * cos(om * t) ^ 2 * bb_1 ^
2) * cos(om * t) ^ 2) * g_ * m_t + (0.2e1 * aa * sin(om * t)
^ 2 + 0.4e1 * aa * sin(om * t) ^ 4 * bb_1 ^ 2 + (0.2e1 * sin
(om * t) ^ 2 * bb_1 + (0.2e1 * aa + 0.8e1 * aa * sin(om * t)
^ 2 * bb_1 ^ 2 + (0.2e1 * bb_1 + 0.4e1 * aa * bb_1 ^ 2 * cos

```

$$\begin{aligned}
& (\text{om} * \text{t}) * \cos(\text{om} * \text{t}) * \cos(\text{om} * \text{t}) * \cos(\text{om} * \text{t}) * \text{g}_- \\
& * \text{m_b}) * \text{m_b}^2 * \text{bb_2}^2 + (-0.2e1 - 0.2e1 * \sin(\text{om} * \text{t}) \\
& ^2 * \text{bb_1}^2 - 0.2e1 * \text{bb_1}^2 * \cos(\text{om} * \text{t})^2) * \cos \\
& (\text{om} * \text{t}) * \text{g}_- * \text{m_b}^3 * \text{bb_2} + ((\text{aa} + \text{aa} * \cos(\text{om} * \text{t})^2 \\
& * \text{bb_1}^2 + \text{aa} * \sin(\text{om} * \text{t})^2 * \text{bb_1}^2) * \text{g}_- * \text{m_t} + \\
& (0.2e1 * \text{aa} * \sin(\text{om} * \text{t})^2 * \text{bb_1}^2 + (0.2e1 * \text{bb_1} + \\
& 0.2e1 * \text{aa} * \text{bb_1}^2 * \cos(\text{om} * \text{t})) * \cos(\text{om} * \text{t})) * \text{g}_- * \\
& \text{m_b}) * \text{m_b}^2 + ((-0.1e1 * \sin(\text{om} * \text{t})^2 * \text{bb_1} - 0.1e1 * \\
& \text{bb_1} * \cos(\text{om} * \text{t})^2) * \cos(\text{om} * \text{t}) * \text{aa_F}^2 * \text{m_b}^3 * \\
& \text{bb_2}^2 + (\sin(\text{om} * \text{t})^2 * \text{bb_1}^2 + 0.1e1 * \text{bb_1}^2 * \\
& \cos(\text{om} * \text{t})^2) * \cos(\text{om} * \text{t}) * \text{aa_F}^2 * \text{m_b}^3 * \text{bb_2} - \\
& 0.1e1 * \text{m_b}^3 * \text{bb_1} * \text{aa_F}^2 * \cos(\text{om} * \text{t})) * 1) * 1 + \\
& (((-0.8e1 * \sin(\text{om} * \text{t})^4 - 0.8e1 * \sin(\text{om} * \text{t})^6 * \text{bb_1} \\
& ^2 + ((0.8e1 * \text{bb_1}^2 - 0.24e2 * \sin(\text{om} * \text{t})^2 * \text{bb_1}^2 \\
& * \sin(\text{om} * \text{t})^2 - 0.16e2 * \sin(\text{om} * \text{t})^2 + 0.8e1 + \\
& (-0.8e1 + 0.8e1 * \text{bb_1}^2 - 0.24e2 * \sin(\text{om} * \text{t})^2 * \text{bb_1} \\
& ^2 - 0.8e1 * \text{bb_1}^2 * \cos(\text{om} * \text{t})^2) * \cos(\text{om} * \text{t})^2) * \\
& \cos(\text{om} * \text{t})^2 * \text{aa_F} * \text{m_b}^2 * \text{JB} + ((-0.8e1 - 0.8e1 \\
& * \text{bb_1}^2) * \sin(\text{om} * \text{t})^6 - 0.8e1 * \sin(\text{om} * \text{t})^4 + \\
& (0.8e1 + (-0.24e2 - 0.16e2 * \text{bb_1}^2) * \sin(\text{om} * \text{t})^2 * \\
& \sin(\text{om} * \text{t})^2 - 0.8e1 * \sin(\text{om} * \text{t})^2 + (0.8e1 + \\
& (-0.24e2 - 0.8e1 * \text{bb_1}^2) * \sin(\text{om} * \text{t})^2 - 0.8e1 * \cos \\
& (\text{om} * \text{t})^2 * \cos(\text{om} * \text{t})^2) * \cos(\text{om} * \text{t})^2) * \text{aa_F} * \\
& \text{m_b}^2 * \text{JB} * \text{bb_2}^2 * \text{bb_2} + ((-0.8e1 - 0.8e1 * \text{bb_1}^2 \\
& * \sin(\text{om} * \text{t})^4 - 0.8e1 * \sin(\text{om} * \text{t})^2 + (0.8e1 + \\
& (-0.16e2 - 0.8e1 * \text{bb_1}^2) * \sin(\text{om} * \text{t})^2 - 0.8e1 * \cos \\
& (\text{om} * \text{t})^2 * \cos(\text{om} * \text{t})^2) * \cos(\text{om} * \text{t})^2) * \text{aa_F} * \text{m_b}^2 * \\
& \text{JB} * \text{bb_2} + (((0.4e1 * \text{bb_1}^2 - 0.4e1 * \sin(\text{om} * \text{t})^2 * \text{bb_1} \\
& ^2 * \sin(\text{om} * \text{t})^2 - 0.4e1 * \sin(\text{om} * \text{t})^2 + 0.4e1 + \\
& (-0.4e1 + 0.4e1 * \text{bb_1}^2 - 0.8e1 * \sin(\text{om} * \text{t})^2 * \text{bb_1} \\
& ^2 - 0.4e1 * \text{bb_1}^2 * \cos(\text{om} * \text{t})^2) * \cos(\text{om} * \text{t})^2) * \\
& \cos(\text{om} * \text{t}) * \text{m_b}^2 * \text{JB} + ((-0.4e1 * \sin(\text{om} * \text{t})^2 + 2 + \\
& 0.4e1) * \sin(\text{om} * \text{t})^2 + (0.4e1 - 0.8e1 * \sin(\text{om} * \text{t})^2 \\
& - 0.4e1 * \cos(\text{om} * \text{t})^2 * \cos(\text{om} * \text{t})^2) * \cos(\text{om} * \text{t}) \\
& * \text{m_b}^2 * \text{JB} * \text{bb_2}^2 * \text{bb_2} + (-0.4e1 * \sin(\text{om} * \text{t})^2 \\
& + 0.4e1 - 0.4e1 * \cos(\text{om} * \text{t})^2 * \cos(\text{om} * \text{t}) * \text{m_b}^2 \\
& * \text{JB} * \text{bb_2}^2 * \text{bb_F_2} * \text{bb_F_2} + ((0.4e1 * \sin(\text{om} * \text{t})^4 \\
& * \text{bb_1}^2 + 0.4e1 * \sin(\text{om} * \text{t})^2 + (0.4e1 + 0.8e1 * \sin \\
& (\text{om} * \text{t})^2 * \text{bb_1}^2 + 0.4e1 * \text{bb_1}^2 * \cos(\text{om} * \text{t})^2 \\
& * \cos(\text{om} * \text{t})^2 * \cos(\text{om} * \text{t}) * \text{kb} * \text{m_b}^2 * \text{bb_2}^2 \\
& + (0.4e1 + 0.4e1 * \sin(\text{om} * \text{t})^2 * \text{bb_1}^2 + 0.4e1 * \\
& \text{bb_1}^2 * \cos(\text{om} * \text{t})^2 * \cos(\text{om} * \text{t}) * \text{kb} * \text{m_b}^2 * \\
& \text{bb_1}^2 * \cos(\text{om} * \text{t})^2 * \cos(\text{om} * \text{t}) * \text{kb} * \text{m_b}^2 *
\end{aligned}$$

```

bb_2 + (((0.4e1 * bb_1 ^ 2 - 0.4e1 * sin(om * t) ^ 2 * bb_1
^ 2) * sin(om * t) ^ 3 + (-0.4e1 * sin(om * t) ^ 2 + 0.4e1)
* sin(om * t) + ((0.4e1 * bb_1 ^ 2 - 0.8e1 * sin(om * t) ^ 2
* bb_1 ^ 2) * sin(om * t) - 0.4e1 * sin(om * t) - 0.4e1 *
sin(om * t) * cos(om * t) ^ 2 * bb_1 ^ 2) * cos(om * t) ^ 2
* cos(om * t) * aa_F * m_b ^ 2 * JB + (-0.8e1 * sin(om * t)
^ 5 * bb_1 ^ 4 + (-0.12e2 * bb_1 ^ 2 + 0.4e1 * sin(om * t)
^ 2 * bb_1 ^ 2) * sin(om * t) ^ 3 + (-0.4e1 + 0.4e1 * sin(om *
t) ^ 2) * sin(om * t) + (-0.16e2 * sin(om * t) ^ 3 * bb_1 ^
4 + (-0.12e2 * bb_1 ^ 2 + 0.8e1 * sin(om * t) ^ 2 * bb_1 ^
2) * sin(om * t) + 0.4e1 * sin(om * t) + (0.4e1 * sin(om *
t) * bb_1 ^ 2 - 0.8e1 * sin(om * t) * bb_1 ^ 4) * cos(om *
t) ^ 2) * cos(om * t) ^ 2 * m_b ^ 2 * JB * bb_F_1 + ((0.8e1 -
0.4e1 * bb_1 ^ 2) * bb_1 ^ 2 * sin(om * t) ^ 5 +
(0.12e2 - 0.4e1 * bb_1 ^ 2 + (-0.4e1 - 0.4e1 * bb_1 ^ 2) *
sin(om * t) ^ 2) * sin(om * t) ^ 3 - 0.4e1 * sin(om * t) ^ 3
+ ((0.16e2 - 0.8e1 * bb_1 ^ 2) * bb_1 ^ 2 * sin(om * t) ^ 3
+ (0.12e2 - 0.4e1 * bb_1 ^ 2 + (-0.8e1 - 0.8e1 * bb_1 ^ 2) *
sin(om * t) ^ 2) * sin(om * t) - 0.4e1 * sin(om * t) + (
(0.8e1 - 0.4e1 * bb_1 ^ 2) * bb_1 ^ 2 * sin(om * t) +
(-0.4e1 - 0.4e1 * bb_1 ^ 2) * sin(om * t)) * cos(om * t) ^
2) * cos(om * t) ^ 2 * cos(om * t) * aa_F * m_b ^ 2 * JB +
((-0.4e1 * bb_1 ^ 2 - 0.12e2) * bb_1 ^ 2 * sin(om * t) ^ 5 +
(-0.8e1 - 0.4e1 * bb_1 ^ 2 + (0.4e1 + 0.4e1 * bb_1 ^ 2) *
sin(om * t) ^ 2) * sin(om * t) ^ 3 + 0.4e1 * sin(om * t) ^ 3
+ ((-0.24e2 - 0.8e1 * bb_1 ^ 2) * bb_1 ^ 2 * sin(om * t) ^ 3
+ (-0.8e1 - 0.4e1 * bb_1 ^ 2 + (0.8e1 + 0.8e1 * bb_1 ^ 2) *
sin(om * t) ^ 2) * sin(om * t) + 0.4e1 * sin(om * t) + (
(-0.4e1 * bb_1 ^ 2 - 0.12e2) * bb_1 ^ 2 * sin(om * t) +
(0.4e1 + 0.4e1 * bb_1 ^ 2) * sin(om * t)) * cos(om * t) ^ 2)
* cos(om * t) ^ 2 * m_b ^ 2 * JB * bb_F_1 + (-0.4e1 * sin(
om * t) ^ 5 * bb_1 ^ 2 - 0.4e1 * sin(om * t) ^ 3 + (-0.4e1 *
sin(om * t) - 0.8e1 * sin(om * t) ^ 3 * bb_1 ^ 2 - 0.4e1 *
sin(om * t) * cos(om * t) ^ 2 * bb_1 ^ 2) * cos(om * t) ^ 2)
* cos(om * t) * aa_F * m_b ^ 2 * JB * bb_2 ^ 2) * bb_2 ^ 2 +
(((0.12e2 - 0.4e1 * bb_1 ^ 2) * bb_1 ^ 2 - 0.4e1 * sin(om *
t) ^ 2 * bb_1 ^ 2) * sin(om * t) ^ 3 + (0.16e2 - 0.4e1 *
bb_1 ^ 2 + (-0.8e1 - 0.4e1 * bb_1 ^ 2) * sin(om * t) ^ 2) *
sin(om * t) - 0.4e1 * sin(om * t) + (((0.12e2 - 0.4e1 * bb_1
^ 2) * bb_1 ^ 2 - 0.8e1 * sin(om * t) ^ 2 * bb_1 ^ 2) * sin(
om * t) + (-0.8e1 - 0.4e1 * bb_1 ^ 2) * sin(om * t) - 0.4e1 *
sin(om * t) * cos(om * t) ^ 2 * bb_1 ^ 2) * cos(om * t) ^

```

$$\begin{aligned}
& 2) * \cos(\text{om} * t) * \text{aa_F} * \text{m_b}^2 * \text{JB} + ((-0.4e1 * \text{bb_1}^2 \\
& - 0.12e2) * \text{bb_1}^2 * \sin(\text{om} * t)^3 + (-0.8e1 - 0.4e1 * \\
& \text{bb_1}^2 + (0.4e1 + 0.4e1 * \text{bb_1}^2) * \sin(\text{om} * t)^2 * \\
& \sin(\text{om} * t) + 0.4e1 * \sin(\text{om} * t) + ((-0.4e1 * \text{bb_1}^2 - \\
& 0.12e2) * \text{bb_1}^2 * \sin(\text{om} * t) + (0.4e1 + 0.4e1 * \text{bb_1}^2 \\
& 2) * \sin(\text{om} * t)) * \cos(\text{om} * t)^2 * \text{m_b}^2 * \text{JB} * \text{bb_F_1} \\
& + ((0.4e1 - 0.4e1 * \text{bb_1}^2 + (-0.4e1 - 0.4e1 * \text{bb_1}^2) * \\
& \sin(\text{om} * t)^2) * \sin(\text{om} * t)^3 + (-0.4e1 - 0.4e1 * \sin \\
& (\text{om} * t)^2) * \sin(\text{om} * t) + ((0.4e1 - 0.4e1 * \text{bb_1}^2 + \\
& (-0.8e1 - 0.8e1 * \text{bb_1}^2) * \sin(\text{om} * t)^2) * \sin(\text{om} * t) \\
& - 0.4e1 * \sin(\text{om} * t) + (-0.4e1 - 0.4e1 * \text{bb_1}^2) * \sin(\text{om} \\
& * t) * \cos(\text{om} * t)^2 * \cos(\text{om} * t)^2 * \cos(\text{om} * \\
& \text{aa_F} * \text{m_b}^2 * \text{JB} * \text{bb_2}^2 + ((0.4e1 + (-0.4e1 - 0.4e1 * \\
& \text{bb_1}^2) * \sin(\text{om} * t)^2) * \sin(\text{om} * t) - 0.4e1 * \sin(\text{om} \\
& * t) + (-0.4e1 - 0.4e1 * \text{bb_1}^2) * \sin(\text{om} * t) * \cos(\text{om} * \\
& t)^2 * \cos(\text{om} * t) * \text{aa_F} * \text{m_b}^2 * \text{JB} + (((0.12e2 * \\
& \sin(\text{om} * t)^5 * \text{bb_1}^2 + 0.12e2 * \sin(\text{om} * t)^3 + \\
& (0.24e2 * \sin(\text{om} * t)^3 * \text{bb_1}^2 + 0.12e2 * \sin(\text{om} * t) \\
& + 0.12e2 * \sin(\text{om} * t) * \cos(\text{om} * t)^2 * \text{bb_1}^2 * \cos \\
& (\text{om} * t)^2 * \text{m_b}^2 * \text{JB} + ((0.8e1 + 0.4e1 * \text{bb_1}^2) * \\
& \sin(\text{om} * t)^5 + 0.4e1 * \sin(\text{om} * t)^3 + ((0.8e1 * \text{bb_1}^2 \\
& + 0.16e2) * \sin(\text{om} * t)^3 + 0.4e1 * \sin(\text{om} * t) + (0.8e1 \\
& + 0.4e1 * \text{bb_1}^2) * \sin(\text{om} * t) * \cos(\text{om} * t)^2 * \cos \\
& (\text{om} * t)^2 * \text{m_b}^2 * \text{JB} * \text{bb_2}^2 * \text{bb_2}^2 + \\
& (0.8e1 * \text{bb_1}^2 - 0.4e1 * \sin(\text{om} * t)^2 * \text{bb_1}^2) * \\
& \sin(\text{om} * t)^3 + (0.8e1 - 0.4e1 * \sin(\text{om} * t)^2) * \sin(\text{om} \\
& * t) + ((0.8e1 * \text{bb_1}^2 - 0.8e1 * \sin(\text{om} * t)^2 * \text{bb_1}^2 \\
& 2) * \sin(\text{om} * t) - 0.4e1 * \sin(\text{om} * t) - 0.4e1 * \sin(\text{om} * t) \\
& * \cos(\text{om} * t)^2 * \text{bb_1}^2 * \cos(\text{om} * t)^2 * \text{m_b}^2 * \\
& \text{JB} + ((0.12e2 + 0.4e1 * \text{bb_1}^2 + (-0.4e1 - 0.4e1 * \text{bb_1}^2 \\
& 2) * \sin(\text{om} * t)^2) * \sin(\text{om} * t)^3 + (-0.4e1 * \sin(\text{om} * \\
& t)^2 + 0.4e1) * \sin(\text{om} * t) + ((0.12e2 + 0.4e1 * \text{bb_1}^2 \\
& + (-0.8e1 - 0.8e1 * \text{bb_1}^2) * \sin(\text{om} * t)^2) * \sin(\text{om} * \\
& t) - 0.4e1 * \sin(\text{om} * t) + (-0.4e1 - 0.4e1 * \text{bb_1}^2) * \sin \\
& (\text{om} * t) * \cos(\text{om} * t)^2 * \cos(\text{om} * t)^2 * \text{m_b}^2 * \\
& \text{JB} * \text{bb_2}^2 + ((0.4e1 + (-0.4e1 - 0.4e1 * \text{bb_1}^2) * \sin \\
& (\text{om} * t)^2) * \sin(\text{om} * t) - 0.4e1 * \sin(\text{om} * t) + (-0.4e1 \\
& - 0.4e1 * \text{bb_1}^2) * \sin(\text{om} * t) * \cos(\text{om} * t)^2 * \text{m_b}^2 \\
& * \text{JB} * \text{bb_F_2}) * \text{om} + (((0.2e1 * \sin(\text{om} * t)^2 * \text{bb_1}^2 + \\
& 0.2e1 * \text{bb_1}^3 * \sin(\text{om} * t)^4 + ((0.4e1 * \text{bb_1}^3 - \\
& 0.2e1 * \text{bb_1}^3) * \sin(\text{om} * t)^2 * \sin(\text{om} * t)^2 + \\
& 0.2e1 * \text{bb_1}^2 - 0.2e1 * \sin(\text{om} * t)^2 * \text{bb_1} + (-0.2e1 *
\end{aligned}$$

```

bb_1 - 0.4e1 * bb_1 ^ 3 * sin(om * t) ^ 2 + 0.2e1 * bb_1 ^ 3
- 0.2e1 * bb_1 ^ 3 * cos(om * t) ^ 2) * cos(om * t) ^ 2) *
cos(om * t) ^ 2) * g_ * m_b ^ 3 + (0.2e1 * sin(om * t) ^ 2 +
0.2e1 * sin(om * t) ^ 4 * bb_1 ^ 2 + ((0.4e1 * bb_1 ^ 2 -
0.2e1 * sin(om * t) ^ 2 * bb_1 ^ 2) * sin(om * t) ^ 2 +
0.2e1 - 0.2e1 * sin(om * t) ^ 2 + (0.2e1 * bb_1 ^ 2 - 0.4e1
* sin(om * t) ^ 2 * bb_1 ^ 2 - 0.2e1 - 0.2e1 * bb_1 ^ 2 *
cos(om * t) ^ 2) * cos(om * t) ^ 2) * cos(om * t) ^ 2) * g_
* m_b ^ 3 * bb_2) * bb_2 ^ 2 + (0.2e1 * bb_1 + 0.2e1 * bb_1
^ 3 * sin(om * t) ^ 2 + (-0.2e1 * bb_1 ^ 3 * sin(om * t) ^ 2
+ 0.2e1 * bb_1 ^ 3 - 0.2e1 * bb_1 - 0.2e1 * bb_1 ^ 3 * cos
(om * t) ^ 2) * cos(om * t) ^ 2) * g_ * m_b ^ 3 + (0.2e1 +
0.2e1 * sin(om * t) ^ 2 * bb_1 ^ 2 + (-0.2e1 - 0.2e1 * sin
(om * t) ^ 2 * bb_1 ^ 2 + 0.2e1 * bb_1 ^ 2 - 0.2e1 * bb_1 ^
2 * cos(om * t) ^ 2) * cos(om * t) ^ 2) * g_ * m_b ^ 3 *
bb_2 + (((-0.1e1 * sin(om * t) ^ 6 * bb_1 + (bb_1 ^ 3 * sin
(om * t) ^ 4 + (0.2e1 * bb_1 - 0.3e1 * sin(om * t) ^ 2 *
bb_1) * sin(om * t) ^ 2 + (0.2e1 * bb_1 ^ 3 * sin(om * t) ^
2 + 0.2e1 * bb_1 - 0.3e1 * sin(om * t) ^ 2 * bb_1 + (bb_1 ^
3 - 0.1e1 * bb_1) * cos(om * t) ^ 2) * cos(om * t) ^ 2) *
cos(om * t) ^ 2) * aa_F ^ 2 * m_b ^ 3 + ((-0.2e1 * sin(om *
t) ^ 2 * bb_1 - 0.2e1 * bb_1 ^ 3 * sin(om * t) ^ 4 + (-0.4e1
* bb_1 ^ 3 * sin(om * t) ^ 2 - 0.2e1 * bb_1 - 0.2e1 * bb_1 ^
3 * cos(om * t) ^ 2) * cos(om * t) ^ 2) * cos(om * t) * aa_F
* m_b ^ 3 + (sin(om * t) ^ 4 * bb_1 + bb_1 ^ 3 * sin(om * t)
^ 4 + (0.2e1 * sin(om * t) ^ 2 * bb_1 + 0.2e1 * bb_1 ^ 3 *
sin(om * t) ^ 2 + (bb_1 ^ 3 + bb_1) * cos(om * t) ^ 2) * cos
(om * t) ^ 2) * m_b ^ 3 * bb_F_1) * bb_F_1 + (sin(om * t) ^
2 + sin(om * t) ^ 4 * bb_1 ^ 2 + (0.1e1 + 0.2e1 * sin(om *
t) ^ 2 * bb_1 ^ 2 + bb_1 ^ 2 * cos(om * t) ^ 2) * cos(om *
t) ^ 2) * cos(om * t) ^ 2 * aa_F ^ 2 * m_b ^ 3 * bb_2) *
bb_2 ^ 2 + (-0.1e1 * sin(om * t) ^ 4 * bb_1 + (bb_1 ^ 3 *
sin(om * t) ^ 2 + 0.2e1 * bb_1 - 0.2e1 * sin(om * t) ^ 2 *
bb_1 + (bb_1 ^ 3 - 0.1e1 * bb_1) * cos(om * t) ^ 2) * cos(om
* t) ^ 2) * aa_F ^ 2 * m_b ^ 3 + ((-0.2e1 * bb_1 ^ 3 * sin
(om * t) ^ 2 - 0.2e1 * bb_1 - 0.2e1 * bb_1 ^ 3 * cos(om * t)
^ 2) * cos(om * t) * aa_F * m_b ^ 3 + (bb_1 ^ 3 * sin(om *
t) ^ 2 + sin(om * t) ^ 2 * bb_1 + (bb_1 ^ 3 + bb_1) * cos(om
* t) ^ 2) * m_b ^ 3 * bb_F_1) * bb_F_1 + (-0.1e1 * sin(om *
t) ^ 4 - 0.1e1 * sin(om * t) ^ 6 * bb_1 ^ 2 + ((0.2e1 * bb_1
^ 2 - 0.3e1 * sin(om * t) ^ 2 * bb_1 ^ 2) * sin(om * t) ^ 2
+ 0.2e1 - 0.2e1 * sin(om * t) ^ 2 + (-0.3e1 * sin(om * t) ^

```

$$\begin{aligned}
& 2 * \text{bb_1}^2 + 0.2e1 * \text{bb_1}^2 - 0.1e1 - 0.1e1 * \text{bb_1}^2 * \\
& \cos(\text{om} * t)^2 * \cos(\text{om} * t)^2 * \cos(\text{om} * t)^2 * \\
& \text{aa_F}^2 * \text{m_b}^3 * \text{bb_2}) * 1 + (((0.2e1 * \sin(\text{om} * t)^2 \\
& + 0.2e1 * \sin(\text{om} * t)^4 * \text{bb_1}^2 + (0.4e1 * \sin(\text{om} * t) \\
& ^2 * \text{bb_1}^2 + 0.2e1 + 0.2e1 * \text{bb_1}^2 * \cos(\text{om} * t)^2) * \\
& * \cos(\text{om} * t)^2 * \cos(\text{om} * t) * \text{aa_F} * \text{m_b}^3 * \text{bb_2}^3 \\
& + (0.2e1 + 0.2e1 * \sin(\text{om} * t)^2 * \text{bb_1}^2 + 0.2e1 * \text{bb_1} \\
& ^2 * \cos(\text{om} * t)^2) * \cos(\text{om} * t) * \text{aa_F} * \text{m_b}^3 * \\
& \text{bb_2}) * 1 + ((\sin(\text{om} * t)^2 + \sin(\text{om} * t)^4 * \text{bb_1}^2 + \\
& (0.1e1 + 0.2e1 * \sin(\text{om} * t)^2 * \text{bb_1}^2 + \text{bb_1}^2 * \cos \\
& (\text{om} * t)^2) * \cos(\text{om} * t)^2 * \text{m_b}^3 * \text{bb_2}^3 + (\sin \\
& (\text{om} * t)^2 + \sin(\text{om} * t)^4 * \text{bb_1}^2 + (0.1e1 + 0.2e1 * \\
& \sin(\text{om} * t)^2 * \text{bb_1}^2 + \text{bb_1}^2 * \cos(\text{om} * t)^2) * \\
& * \cos(\text{om} * t)^2 * \text{m_b}^3 * \text{bb_2}) * 1 * \text{bb_F_2}) * \text{bb_F_2} + \\
& (((-0.2e1 * \sin(\text{om} * t)^5 * \text{bb_1}^2 + (-0.1e1 + \sin(\text{om} * \\
& t)^2) * \sin(\text{om} * t)^3 + (-0.4e1 * \sin(\text{om} * t)^3 * \text{bb_1} \\
& ^2 + (-0.1e1 + 0.2e1 * \sin(\text{om} * t)^2) * \sin(\text{om} * t) + \\
& (-0.2e1 * \sin(\text{om} * t)^2 * \text{bb_1}^2 + \sin(\text{om} * t)) * \cos(\text{om} * \\
& t)^2 * \cos(\text{om} * t)^2 * \text{aa_F} * \text{m_b}^3 * \text{bb_2}^2 + \\
& (0.2e1 * \sin(\text{om} * t)^5 * \text{bb_1}^2 + 0.2e1 * \sin(\text{om} * t)^3 + \\
& (0.4e1 * \sin(\text{om} * t)^3 * \text{bb_1}^2 + 0.2e1 * \sin(\text{om} * \\
& t) + 0.2e1 * \sin(\text{om} * t)^2 * \cos(\text{om} * t)^2 * \text{bb_1}^2 * \cos \\
& (\text{om} * t)^2) * \text{aa_F} * \text{m_b}^3 * \text{bb_2}^2 + (-0.2e1 * \sin(\text{om} * \\
& t)^3 * \text{bb_1}^2 + (-0.1e1 + \sin(\text{om} * t)^2) * \sin(\text{om} * \\
& t) + (-0.2e1 * \sin(\text{om} * t)^2 * \text{bb_1}^2 + \sin(\text{om} * t)) * \cos \\
& (\text{om} * t)^2 * \text{aa_F} * \text{m_b}^3 + ((\text{bb_1}^2 - 0.1e1 * \sin(\text{om} * \\
& t)^2 * \text{bb_1}^2) * \sin(\text{om} * t)^3 + (0.1e1 - 0.1e1 * \\
& \sin(\text{om} * t)^2 * \sin(\text{om} * t) + ((\text{bb_1}^2 - 0.2e1 * \sin(\text{om} * \\
& t)^2 * \text{bb_1}^2) * \sin(\text{om} * t)^2 - 0.1e1 * \sin(\text{om} * t) - \\
& 0.1e1 * \sin(\text{om} * t)^2 * \cos(\text{om} * t)^2 * \text{bb_1}^2 * \cos(\text{om} * \\
& t)^2 * \text{aa_F} * \text{m_b}^3) * 1 + ((\sin(\text{om} * t)^4 * \text{bb_1}^2 + \\
& (0.2e1 * \sin(\text{om} * t)^2 * \text{bb_1}^2 + \text{bb_1}^2 * \cos(\text{om} * t)^2) * \\
& \cos(\text{om} * t)^2 * \text{m_b}^3 * \text{bb_2}^2 + (\sin(\text{om} * t)^2 * \\
& \text{bb_1}^2 + \text{bb_1}^2 * \cos(\text{om} * t)^2 * \text{m_b}^3 + (\sin(\text{om} * t)^2 \\
& + \sin(\text{om} * t)^4 * \text{bb_1}^2 + (0.1e1 + 0.2e1 * \sin(\text{om} * t) \\
& ^2 * \text{bb_1}^2 + \text{bb_1}^2 * \cos(\text{om} * t)^2) * \cos(\text{om} * t)^2 * \\
& \text{m_b}^3 * \text{bb_2}^2 * 1 * \text{om} + (((\sin(\text{om} * t)^8 * \\
& \text{bb_1}^3 + \sin(\text{om} * t)^6 * \text{bb_1}^2 + ((-0.1e1 * \text{bb_1}^3 + \\
& 0.4e1 * \text{bb_1}^3 * \sin(\text{om} * t)^2) * \sin(\text{om} * t)^4 + \\
& (-0.1e1 * \text{bb_1}^2 + 0.3e1 * \sin(\text{om} * t)^2 * \text{bb_1}) * \sin(\text{om} * \\
& t)^2 + ((-0.2e1 * \text{bb_1}^3 + 0.6e1 * \text{bb_1}^3 * \sin(\text{om} * \\
& t)^2) * \sin(\text{om} * t)^2 - 0.1e1 * \text{bb_1}^2 + 0.3e1 * \sin(\text{om} *
\end{aligned}$$

$$\begin{aligned}
& t) ^ 2 * bb_1 + (-0.1e1 * bb_1 ^ 3 + 0.4e1 * bb_1 ^ 3 * \sin(\omega * t) ^ 2 + bb_1 + bb_1 ^ 3 * \cos(\omega * t) ^ 2) * \cos(\omega * t) ^ 2 * \cos(\omega * t) \\
& * aa_F ^ 2 * m_b ^ 3 + ((-0.2e1 * \sin(\omega * t) ^ 8 * bb_1 ^ 3 - 0.2e1 * \sin(\omega * t) ^ 6 * bb_1 + ((0.2e1 * bb_1 ^ 3 - 0.8e1 * bb_1 ^ 3 * \sin(\omega * t) ^ 2) * \sin(\omega * t) ^ 4 + (0.2e1 * bb_1 - 0.6e1 * \sin(\omega * t) ^ 2 * bb_1) * \sin(\omega * t) ^ 2 + ((0.4e1 * bb_1 ^ 3 - 0.12e2 * bb_1 ^ 3 * \sin(\omega * t) ^ 2) * \sin(\omega * t) ^ 2 + 0.2e1 * bb_1 - 0.6e1 * \sin(\omega * t) ^ 2 * bb_1 + (0.2e1 * bb_1 ^ 3 - 0.8e1 * bb_1 ^ 3 * \sin(\omega * t) ^ 2 - 0.2e1 * bb_1 - 0.2e1 * bb_1 ^ 3 * \cos(\omega * t) ^ 2) * \cos(\omega * t) ^ 2 * \cos(\omega * t) ^ 2 * aa_F * m_b ^ 3 + ((-0.1e1 * bb_1 ^ 3 + bb_1 ^ 3 * \sin(\omega * t) ^ 2) * \sin(\omega * t) ^ 4 + (-0.1e1 * bb_1 + \sin(\omega * t) ^ 2 * bb_1) * \sin(\omega * t) ^ 2 + ((-0.2e1 * bb_1 ^ 3 + 0.3e1 * bb_1 ^ 3 * \sin(\omega * t) ^ 2) * \sin(\omega * t) ^ 2 - 0.1e1 * bb_1 + 0.2e1 * \sin(\omega * t) ^ 2 * bb_1 + (0.3e1 * bb_1 ^ 3 * \sin(\omega * t) ^ 2 - 0.1e1 * bb_1 ^ 3 + bb_1 + bb_1 ^ 3 * \cos(\omega * t) ^ 2) * \cos(\omega * t) ^ 2 * \cos(\omega * t) ^ 2 * \cos(\omega * t) * m_b ^ 3 * bb_F_1) * bb_F_1) * bb_2 ^ 2 + (-0.1e1 * \sin(\omega * t) ^ 6 - 0.1e1 * \sin(\omega * t) ^ 8 * bb_1 ^ 2 + ((bb_1 ^ 2 - 0.4e1 * \sin(\omega * t) ^ 2 * bb_1 ^ 2) * \sin(\omega * t) ^ 4 + (0.1e1 - 0.3e1 * \sin(\omega * t) ^ 2) * \sin(\omega * t) ^ 2 + ((0.2e1 * bb_1 ^ 2 - 0.6e1 * \sin(\omega * t) ^ 2 * bb_1 ^ 2) * \sin(\omega * t) ^ 2 - 0.3e1 * \sin(\omega * t) ^ 2 + 0.1e1 + (-0.1e1 - 0.4e1 * \sin(\omega * t) ^ 2 * bb_1 ^ 2 + bb_1 ^ 2 - 0.1e1 * bb_1 ^ 2 * \cos(\omega * t) ^ 2) * \cos(\omega * t) ^ 2 * \cos(\omega * t) ^ 2 * \cos(\omega * t) ^ 2 * \cos(\omega * t) * aa_F ^ 2 * m_b ^ 3 * bb_2 ^ 3 + (\sin(\omega * t) ^ 6 * bb_1 ^ 3 + \sin(\omega * t) ^ 4 * bb_1 + ((0.3e1 * bb_1 ^ 3 * \sin(\omega * t) ^ 2 - 0.1e1 * bb_1 ^ 3) * \sin(\omega * t) ^ 2 - 0.1e1 * bb_1 + 0.2e1 * \sin(\omega * t) ^ 2 * bb_1 + (0.3e1 * bb_1 ^ 3 * \sin(\omega * t) ^ 2 - 0.1e1 * bb_1 ^ 3 + bb_1 + bb_1 ^ 3 * \cos(\omega * t) ^ 2) * \cos(\omega * t) ^ 2 * \cos(\omega * t) ^ 2 * \cos(\omega * t) * aa_F ^ 2 * m_b ^ 3 + ((-0.2e1 * \sin(\omega * t) ^ 6 * bb_1 ^ 3 - 0.2e1 * \sin(\omega * t) ^ 4 * bb_1 + ((0.2e1 * bb_1 ^ 3 - 0.6e1 * bb_1 ^ 3 * \sin(\omega * t) ^ 2) * \sin(\omega * t) ^ 2 + 0.2e1 * bb_1 - 0.4e1 * \sin(\omega * t) ^ 2 * bb_1 + (0.2e1 * bb_1 ^ 3 - 0.6e1 * bb_1 ^ 3 * \sin(\omega * t) ^ 2) * \cos(\omega * t) ^ 2) * \cos(\omega * t) ^ 2 * \cos(\omega * t) ^ 2 * aa_F * m_b ^ 3 + ((-0.1e1 * bb_1 ^ 3 + bb_1 ^ 3 * \sin(\omega * t) ^ 2) * \sin(\omega * t) ^ 2 - 0.1e1 * bb_1 + \sin(\omega * t) ^ 2 * bb_1)
\end{aligned}$$

$$\begin{aligned}
& \text{bb_1} + (-0.1e1 * \text{bb_1}^3 + 0.2e1 * \text{bb_1}^3 * \sin(\text{om} * t) \\
& + 2 * \text{bb_1} + \text{bb_1}^3 * \cos(\text{om} * t)^2 * \cos(\text{om} * t)^2 * \\
& \cos(\text{om} * t) * \text{m_b}^3 * \text{bb_F_1}) * \text{bb_F_1} + (-0.1e1 * \sin(\text{om} \\
& * t)^4 - 0.1e1 * \sin(\text{om} * t)^6 * \text{bb_1}^2 + ((\text{bb_1}^2 - \\
& 0.3e1 * \sin(\text{om} * t)^2 * \text{bb_1}^2) * \sin(\text{om} * t)^2 + \\
& 0.1e1 - 0.2e1 * \sin(\text{om} * t)^2 + (\text{bb_1}^2 - 0.1e1 - 0.3e1 \\
& * \sin(\text{om} * t)^2 * \text{bb_1}^2 - 0.1e1 * \text{bb_1}^2 * \cos(\text{om} * \\
& t)^2) * \cos(\text{om} * t)^2 * \cos(\text{om} * t)^2 * \cos(\text{om} * t) \\
& * \text{aa_F}^2 * \text{m_b}^3 * \text{bb_2} + ((-0.2e1 * \sin(\text{om} * t)^8 * \\
& \text{bb_1}^2 - 0.2e1 * \sin(\text{om} * t)^6 + ((0.2e1 * \text{bb_1}^2 - \\
& 0.8e1 * \sin(\text{om} * t)^2 * \text{bb_1}^2) * \sin(\text{om} * t)^4 + \\
& (0.2e1 - 0.6e1 * \sin(\text{om} * t)^2) * \sin(\text{om} * t)^2 + \\
& (0.4e1 * \text{bb_1}^2 - 0.12e2 * \sin(\text{om} * t)^2 * \text{bb_1}^2) * \\
& \sin(\text{om} * t)^2 + 0.2e1 - 0.6e1 * \sin(\text{om} * t)^2 + (0.2e1 * \\
& \text{bb_1}^2 - 0.8e1 * \sin(\text{om} * t)^2 * \text{bb_1}^2 - 0.2e1 - \\
& 0.2e1 * \text{bb_1}^2 * \cos(\text{om} * t)^2 * \cos(\text{om} * t)^2 * \cos \\
& (\text{om} * t)^2 * \cos(\text{om} * t)^2 * \text{aa_F} * \text{m_b}^3 * \text{bb_2}^3 \\
& + (-0.2e1 * \sin(\text{om} * t)^4 - 0.2e1 * \sin(\text{om} * t)^6 * \text{bb_1} \\
& ^2 + ((0.2e1 * \text{bb_1}^2 - 0.6e1 * \sin(\text{om} * t)^2 * \text{bb_1}^2) * \\
& \sin(\text{om} * t)^2 - 0.4e1 * \sin(\text{om} * t)^2 + 0.2e1 + \\
& (0.2e1 * \text{bb_1}^2 - 0.6e1 * \sin(\text{om} * t)^2 * \text{bb_1}^2 - \\
& 0.2e1 - 0.2e1 * \text{bb_1}^2 * \cos(\text{om} * t)^2 * \cos(\text{om} * t)^2 \\
& * \cos(\text{om} * t)^2 * \text{aa_F} * \text{m_b}^3 * \text{bb_2} + (((\text{bb_1}^2 \\
& - 0.1e1 * \sin(\text{om} * t)^2 * \text{bb_1}^2) * \sin(\text{om} * t)^4 + \\
& (0.1e1 - 0.1e1 * \sin(\text{om} * t)^2) * \sin(\text{om} * t)^2 + \\
& (0.2e1 * \text{bb_1}^2 - 0.3e1 * \sin(\text{om} * t)^2 * \text{bb_1}^2) * \\
& \sin(\text{om} * t)^2 + 0.1e1 - 0.2e1 * \sin(\text{om} * t)^2 + (\text{bb_1}^2 \\
& - 0.1e1 - 0.3e1 * \sin(\text{om} * t)^2 * \text{bb_1}^2 - 0.1e1 * \\
& \text{bb_1}^2 * \cos(\text{om} * t)^2 * \cos(\text{om} * t)^2 * \cos(\text{om} * t) \\
& ^2 * \cos(\text{om} * t) * \text{m_b}^3 * \text{bb_2}^3 + ((\text{bb_1}^2 - 0.1e1 \\
& * \sin(\text{om} * t)^2 * \text{bb_1}^2) * \sin(\text{om} * t)^2 - 0.1e1 * \\
& \sin(\text{om} * t)^2 + 0.1e1 + (-0.2e1 * \sin(\text{om} * t)^2 * \text{bb_1}^2 \\
& - 0.1e1 + \text{bb_1}^2 - 0.1e1 * \text{bb_1}^2 * \cos(\text{om} * t)^2 * \\
& \cos(\text{om} * t)^2 * \cos(\text{om} * t) * \text{m_b}^3 * \text{bb_2} * \text{bb_F_2}) * \\
& \text{bb_F_2} + (((\text{bb_1}^2 - 0.1e1 * \sin(\text{om} * t)^2 * \text{bb_1}^2) \\
& * \sin(\text{om} * t)^5 + (0.1e1 - 0.1e1 * \sin(\text{om} * t)^2) * \sin \\
& (\text{om} * t)^3 + ((0.2e1 * \text{bb_1}^2 - 0.3e1 * \sin(\text{om} * t)^2 \\
& * \text{bb_1}^2) * \sin(\text{om} * t)^3 + (0.1e1 - 0.2e1 * \sin(\text{om} * t) \\
& ^2 * \sin(\text{om} * t) + ((\text{bb_1}^2 - 0.3e1 * \sin(\text{om} * t)^2 * \\
& \text{bb_1}^2) * \sin(\text{om} * t) - 0.1e1 * \sin(\text{om} * t) - 0.1e1 * \sin \\
& (\text{om} * t) * \cos(\text{om} * t)^2 * \text{bb_1}^2 * \cos(\text{om} * t)^2 * \cos \\
& (\text{om} * t)^2 * \cos(\text{om} * t) * \text{aa_F} * \text{m_b}^3 + (-0.2e1 *
\end{aligned}$$

$$\begin{aligned}
& \sin(\omega * t) ^ 7 * b_{b1} ^ 4 + (-0.3e1 * b_{b1} ^ 2 + \sin(\omega * t) ^ 2 * b_{b1} ^ 2) * \sin(\omega * t) ^ 5 + (-0.1e1 + \sin(\omega * t) ^ 2) * \sin(\omega * t) ^ 3 + (-0.6e1 * \sin(\omega * t) ^ 5 * b_{b1} ^ 4 + (-0.6e1 * b_{b1} ^ 2 + 0.3e1 * \sin(\omega * t) ^ 2 * b_{b1} ^ 2) * \sin(\omega * t) ^ 3 + (-0.1e1 + 0.2e1 * \sin(\omega * t) ^ 2) * \sin(\omega * t) + (-0.6e1 * \sin(\omega * t) ^ 3 * b_{b1} ^ 4 + (-0.3e1 * b_{b1} ^ 2 + 0.3e1 * \sin(\omega * t) ^ 2 * b_{b1} ^ 2) * \sin(\omega * t) + \sin(\omega * t) + (-0.2e1 * \sin(\omega * t) * b_{b1} ^ 4 + \sin(\omega * t) * b_{b1} ^ 2 * \cos(\omega * t) ^ 2) * \cos(\omega * t) ^ 2 * \cos(\omega * t) ^ 2 * \cos(\omega * t) ^ 2 * m_b ^ 3 * b_{bF1} * b_{b2} ^ 2 + 0.2e1 * (b_{b1} ^ 2 - 0.1e1 * \sin(\omega * t) ^ 2 * b_{b1} ^ 2) * \sin(\omega * t) ^ 3 + (0.1e1 - 0.1e1 * \sin(\omega * t) ^ 2) * \sin(\omega * t) + (b_{b1} ^ 2 - 0.2e1 * \sin(\omega * t) ^ 2 * b_{b1} ^ 2) * \sin(\omega * t) - 0.1e1 * \sin(\omega * t) - 0.1e1 * \sin(\omega * t) * \cos(\omega * t) ^ 2 * b_{b1} ^ 2) * \cos(\omega * t) ^ 2 * \cos(\omega * t) * a_{aF} * m_b ^ 3 + (-0.2e1 * \sin(\omega * t) ^ 5 * b_{b1} ^ 4 + (-0.3e1 * b_{b1} ^ 2 + 0.2e1 * \sin(\omega * t) ^ 2 * b_{b1} ^ 2) * \sin(\omega * t) + (-0.4e1 * \sin(\omega * t) ^ 3 * b_{b1} ^ 4 + (-0.3e1 * b_{b1} ^ 2 + 0.2e1 * \sin(\omega * t) ^ 2 * b_{b1} ^ 2) * \sin(\omega * t) + \sin(\omega * t) + (-0.2e1 * \sin(\omega * t) * b_{b1} ^ 4 + \sin(\omega * t) * b_{b1} ^ 2) * \cos(\omega * t) ^ 2) * \cos(\omega * t) ^ 2 * m_b ^ 3 * b_{bF1} + ((b_{b1} ^ 2 - 0.1e1 * \sin(\omega * t) ^ 2 * b_{b1} ^ 2) * \sin(\omega * t) ^ 5 + (0.1e1 - 0.1e1 * \sin(\omega * t) ^ 2) * \sin(\omega * t) ^ 3 + (0.2e1 * b_{b1} ^ 2 - 0.3e1 * \sin(\omega * t) ^ 2 * b_{b1} ^ 2) * \sin(\omega * t) ^ 3 + (0.1e1 - 0.2e1 * \sin(\omega * t) ^ 2) * \sin(\omega * t) + ((b_{b1} ^ 2 - 0.3e1 * \sin(\omega * t) ^ 2 * b_{b1} ^ 2) * \sin(\omega * t) - 0.1e1 * \sin(\omega * t) - 0.1e1 * \sin(\omega * t) * \cos(\omega * t) ^ 2 * b_{b1} ^ 2) * \cos(\omega * t) ^ 2 * \cos(\omega * t) ^ 2 * \cos(\omega * t) * a_{aF} * m_b ^ 3 * b_{b2} ^ 2 + ((0.2e1 * \sin(\omega * t) ^ 5 + 0.2e1 * \sin(\omega * t) ^ 7 * b_{b1} ^ 2 + (0.4e1 * \sin(\omega * t) ^ 3 + 0.6e1 * \sin(\omega * t) ^ 5 * b_{b1} ^ 2 + (0.2e1 * \sin(\omega * t) + 0.6e1 * \sin(\omega * t) ^ 3 * b_{b1} ^ 2 + 0.2e1 * \sin(\omega * t) * \cos(\omega * t) ^ 2 * b_{b1} ^ 2) * \cos(\omega * t) ^ 2) * \cos(\omega * t) ^ 2 * m_b ^ 3 * b_{b2} ^ 4 + ((0.3e1 * b_{b1} ^ 2 - 0.1e1 * \sin(\omega * t) ^ 2 * b_{b1} ^ 2) * \sin(\omega * t) ^ 5 + (0.3e1 - 0.1e1 * \sin(\omega * t) ^ 2) * \sin(\omega * t) ^ 3 + ((0.6e1 * b_{b1} ^ 2 - 0.3e1 * \sin(\omega * t) ^ 2 * b_{b1} ^ 2) * \sin(\omega * t) ^ 3 + (0.3e1 - 0.2e1 * \sin(\omega * t) ^ 2 * b_{b1} ^ 2) * \sin(\omega * t) + ((0.3e1 * b_{b1} ^ 2 - 0.3e1 * \sin(\omega * t) ^ 2 * b_{b1} ^ 2) * \sin(\omega * t) - 0.1e1 * \sin(\omega * t) - 0.1e1 * \sin(\omega * t) * \cos(\omega * t) ^ 2 * b_{b1} ^ 2) * \cos(\omega * t) ^ 2
\end{aligned}$$

$$\begin{aligned}
& 2) * \cos(\text{om} * t)^2 * m_b^3 * bb_2^2 + ((bb_1^2 - \\
& 0.1e1 * \sin(\text{om} * t)^2 * bb_1^2) * \sin(\text{om} * t)^3 + \\
& (0.1e1 - 0.1e1 * \sin(\text{om} * t)^2) * \sin(\text{om} * t) + ((bb_1^2 \\
& - 0.2e1 * \sin(\text{om} * t)^2 * bb_1^2) * \sin(\text{om} * t) - 0.1e1 \\
& * \sin(\text{om} * t) - 0.1e1 * \sin(\text{om} * t) * \cos(\text{om} * t)^2 * bb_1 \\
& ^2) * \cos(\text{om} * t)^2 * m_b^3 * bb_F_2) * \text{om}) * R) * R) \\
& * R) * R + (((0.32e2 * \sin(\text{om} * t)^2 * bb_1 - \\
& 0.32e2 * bb_1 * \cos(\text{om} * t)^2) * \cos(\text{om} * t) * aa_F^2 * \\
& m_b * JB^2 + (0.64e2 * m_b * bb_1 * aa_F * \cos(\text{om} * t)^2 \\
& * JB^2 - 0.32e2 * m_b * \cos(\text{om} * t) * bb_1 * JB^2 * \\
& bb_F_1) * bb_F_1 + 0.32e2 * m_b * bb_2 * aa_F^2 * \cos(\text{om} * \\
& t)^3 * JB^2 - 0.32e2 * m_b * \cos(\text{om} * t) * aa_F^2 * \\
& \sin(\text{om} * t)^2 * bb_2 * JB^2 - 0.32e2 * m_b * \cos(\text{om} * t) \\
& * kb * bb_1 * JB + (0.64e2 * m_b * bb_2 * aa_F * \cos(\text{om} * t) \\
& ^2 * JB^2 + 0.32e2 * \cos(\text{om} * t) * m_b * bb_2 * JB^2 * \\
& bb_F_2) * bb_F_2 + 0.32e2 * m_b * \cos(\text{om} * t) * kb * bb_2 * \\
& JB + (((0.64e2 + 0.32e2 * bb_1^2 - 0.32e2 * \sin(\text{om} * t)^2 \\
& * \sin(\text{om} * t) - 0.32e2 * \sin(\text{om} * t) - 0.32e2 * \sin(\text{om} * \\
& t) * \cos(\text{om} * t)^2 * \cos(\text{om} * t) * aa_F * m_b * JB^2 + \\
& ((-0.32e2 + 0.32e2 * \sin(\text{om} * t)^2) * \sin(\text{om} * t) + 0.32e2 \\
& * \sin(\text{om} * t) * \cos(\text{om} * t)^2 * m_b * JB^2 * bb_F_1 + (\\
& (0.64e2 - 0.32e2 * \sin(\text{om} * t)^2) * \sin(\text{om} * t) - 0.32e2 * \\
& \sin(\text{om} * t) * \cos(\text{om} * t)^2 * \cos(\text{om} * t) * aa_F * m_b * \\
& JB^2 + 0.32e2 * \cos(\text{om} * t)^2 * \sin(\text{om} * t) * aa_F * \cos(\text{om} * \\
& t) * bb_2^2 * m_b - 0.32e2 * \cos(\text{om} * t) * m_b * \sin(\text{om} * t) \\
& * aa_F * JB^2 + ((0.32e2 - 0.32e2 * \sin(\text{om} * t)^2) * \sin(\text{om} * \\
& t) - 0.32e2 * \sin(\text{om} * t) * \cos(\text{om} * t)^2 * m_b * \\
& JB^2 * bb_F_2 + (-0.32e2 * m_b * \cos(\text{om} * t) * JB^2 * \\
& bb_1 + 0.32e2 * m_b * \cos(\text{om} * t) * JB^2 * bb_2) * \text{om}) * \\
& \text{om} + ((0.16e2 * aa - 0.16e2 * bb_1 * \cos(\text{om} * t)) * \cos(\text{om} * \\
& t) * g_2 * m_b^2 * JB - 0.16e2 * m_b^2 * g_2 * bb_2 * \cos \\
& (\text{om} * t)^2 * JB - 0.16e2 * m_b^2 * \cos(\text{om} * t) * g_2 * aa \\
& * JB + (0.16e2 * m_b^2 * bb_1 * \cos(\text{om} * t)^2 * aa_F^2 \\
& * JB + 0.16e2 * m_b^2 * bb_2 * \cos(\text{om} * t)^2 * aa_F^2 \\
& * JB) * l + (((0.8e1 + 0.8e1 * \sin(\text{om} * t)^2) * \sin(\text{om} * \\
& t) + 0.8e1 * \sin(\text{om} * t) * \cos(\text{om} * t)^2 * aa_F * m_b^2 \\
& * JB + ((-0.8e1 - 0.8e1 * \sin(\text{om} * t)^2) * \sin(\text{om} * t) - \\
& 0.8e1 * \sin(\text{om} * t) * \cos(\text{om} * t)^2 * aa_F * m_b^2 * \\
& JB) * l + ((0.8e1 * bb_1 * \cos(\text{om} * t)^2 + 0.8e1 * \sin(\text{om} * \\
& t)^2 * bb_1) * m_b^2 * JB + (0.8e1 * \sin(\text{om} * t)^2 + 0.8e1 * \\
& \cos(\text{om} * t)^2 * bb_2) * m_b^2 * JB * bb_2) * l * \text{om}) * \\
& \text{om} + ((0.8e1 * \sin(\text{om} * t)^4 * bb_1 + (-0.8e1 * bb_1^3 * \\
& 3 *
\end{aligned}$$

```

sin(om * t) ^ 2 + 0.16e2 * sin(om * t) ^ 2 * bb_1 - 0.16e2 *
bb_1 + (0.8e1 * bb_1 - 0.8e1 * bb_1 ^ 3) * cos(om * t) ^ 2)
* cos(om * t) ^ 2) * cos(om * t) * aa_F ^ 2 * m_b ^ 2 * JB +
((0.16e2 * bb_1 + 0.16e2 * bb_1 ^ 3 * sin(om * t) ^ 2 +
0.16e2 * bb_1 ^ 3 * cos(om * t) ^ 2) * cos(om * t) ^ 2 *
aa_F * m_b ^ 2 * JB + (-0.8e1 * bb_1 ^ 3 * sin(om * t) ^ 2 -
0.8e1 * sin(om * t) ^ 2 * bb_1 + (-0.8e1 * bb_1 - 0.8e1 *
bb_1 ^ 3) * cos(om * t) ^ 2) * cos(om * t) * m_b ^ 2 * JB *
bb_F_1) * bb_F_1 + ((0.8e1 * sin(om * t) ^ 2 * bb_1 ^ 2 +
0.8e1 + 0.8e1 * bb_1 ^ 2 * cos(om * t) ^ 2) * cos(om * t) ^
3 * aa_F ^ 2 * m_b ^ 2 * JB + ((0.8e1 * sin(om * t) ^ 4 *
bb_1 - 0.8e1 * bb_1 * cos(om * t) ^ 4) * cos(om * t) * aa_F
^ 2 * m_b ^ 2 * JB + ((0.16e2 * sin(om * t) ^ 2 * bb_1 +
0.16e2 * bb_1 * cos(om * t) ^ 2) * cos(om * t) ^ 2 * aa_F *
m_b ^ 2 * JB + (-0.8e1 * sin(om * t) ^ 2 * bb_1 - 0.8e1 *
bb_1 * cos(om * t) ^ 2) * cos(om * t) * m_b ^ 2 * JB *
bb_F_1) * bb_F_1 + (0.8e1 * sin(om * t) ^ 2 + 0.8e1 * cos(om
* t) ^ 2) * cos(om * t) ^ 3 * aa_F ^ 2 * m_b ^ 2 * JB *
bb_2) * bb_2 + (0.8e1 * sin(om * t) ^ 2 * bb_1 -
0.8e1 * bb_1 * cos(om * t) ^ 2) * cos(om * t) * aa_F ^ 2 *
m_b ^ 2 * JB + (0.16e2 * m_b ^ 2 * bb_1 * aa_F * cos(om * t)
^ 2 * JB - 0.8e1 * m_b ^ 2 * cos(om * t) * bb_1 * JB *
bb_F_1) * bb_F_1 + ((-0.8e1 - 0.8e1 * bb_1 ^ 2) * sin(om *
t) ^ 4 - 0.8e1 * sin(om * t) ^ 2 + (0.16e2 + (-0.16e2 -
0.8e1 * bb_1 ^ 2) * sin(om * t) ^ 2 - 0.8e1 * cos(om * t) ^
2) * cos(om * t) ^ 2) * cos(om * t) * aa_F ^ 2 * m_b ^ 2 *
JB * bb_2 + ((-0.8e1 * sin(om * t) ^ 2 - 0.8e1 * cos(om * t)
^ 2) * cos(om * t) * kb * m_b ^ 2 * bb_2 ^ 2 - 0.8e1 * m_b ^
2 * cos(om * t) * kb) * bb_1 + (((0.16e2 + 0.16e2 * sin(om *
t) ^ 2 * bb_1 ^ 2 + 0.16e2 * bb_1 ^ 2 * cos(om * t) ^ 2) *
cos(om * t) ^ 2 * aa_F * m_b ^ 2 * JB + (0.16e2 * sin(om *
t) ^ 2 + 0.16e2 * cos(om * t) ^ 2) * cos(om * t) ^ 2 * aa_F
* m_b ^ 2 * JB * bb_2 ^ 2) * bb_2 + 0.16e2 * m_b ^ 2 * bb_2
* aa_F * cos(om * t) ^ 2 * JB + (((0.8e1 * sin(om * t) ^ 2 *
bb_1 ^ 2 + 0.8e1 + 0.8e1 * bb_1 ^ 2 * cos(om * t) ^ 2) * cos
(om * t) * m_b ^ 2 * JB + (0.8e1 * sin(om * t) ^ 2 + 0.8e1 *
cos(om * t) ^ 2) * cos(om * t) * m_b ^ 2 * JB * bb_2 ^ 2) *
bb_2 + (0.8e1 * sin(om * t) ^ 2 + 0.8e1 * cos(om * t) ^ 2) *
cos(om * t) * m_b ^ 2 * JB * bb_2) * bb_F_2) * bb_F_2 +
(0.8e1 * sin(om * t) ^ 2 * bb_1 ^ 2 + 0.8e1 + 0.8e1 * bb_1 ^
2 * cos(om * t) ^ 2) * cos(om * t) * kb * m_b ^ 2 * bb_2 + (
((0.24e2 * bb_1 ^ 2 - 0.8e1 * sin(om * t) ^ 2 * bb_1 ^ 2) *

```

```

sin(om * t) ^ 3 + (-0.16e2 * sin(om * t) ^ 2 + 0.16e2) * sin
(om * t) + ((0.24e2 * bb_1 ^ 2 - 0.16e2 * sin(om * t) ^ 2 *
bb_1 ^ 2) * sin(om * t) - 0.16e2 * sin(om * t) - 0.8e1 * sin
(om * t) * cos(om * t) ^ 2 * bb_1 ^ 2) * cos(om * t) ^ 2) *
cos(om * t) * aa_F * m_b ^ 2 * JB + ((-0.8e1 * bb_1 ^ 2 +
0.8e1 * sin(om * t) ^ 2 * bb_1 ^ 2) * sin(om * t) ^ 3 +
(-0.8e1 + 0.8e1 * sin(om * t) ^ 2) * sin(om * t) + ((-0.8e1
* bb_1 ^ 2 + 0.16e2 * sin(om * t) ^ 2 * bb_1 ^ 2) * sin(om *
t) + 0.8e1 * sin(om * t) + 0.8e1 * sin(om * t) * cos(om * t)
^ 2 * bb_1 ^ 2) * cos(om * t) ^ 2 * m_b ^ 2 * JB * bb_F_1 +
(((0.8e1 * bb_1 ^ 2 + 0.16e2 - 0.8e1 * sin(om * t) ^ 2) *
sin(om * t) ^ 3 - 0.8e1 * sin(om * t) ^ 3 + ((0.8e1 * bb_1 ^
2 + 0.16e2 - 0.16e2 * sin(om * t) ^ 2) * sin(om * t) - 0.8e1
* sin(om * t) - 0.8e1 * sin(om * t) * cos(om * t) ^ 2) * cos
(om * t) ^ 2) * cos(om * t) * aa_F * m_b ^ 2 * JB + ((-0.8e1
+ 0.8e1 * sin(om * t) ^ 2) * sin(om * t) ^ 3 + ((-0.8e1 +
0.16e2 * sin(om * t) ^ 2) * sin(om * t) + 0.8e1 * sin(om *
t) * cos(om * t) ^ 2) * cos(om * t) ^ 2 * m_b ^ 2 * JB *
bb_F_1) * bb_2 ^ 2 + ((0.16e2 * bb_1 ^ 2 - 0.8e1 * sin(om *
t) ^ 2 * bb_1 ^ 2) * sin(om * t) ^ 3 + (0.16e2 - 0.8e1 * sin
(om * t) ^ 2) * sin(om * t) + ((0.16e2 * bb_1 ^ 2 - 0.16e2 *
sin(om * t) ^ 2 * bb_1 ^ 2) * sin(om * t) - 0.8e1 * sin(om *
t) - 0.8e1 * sin(om * t) * cos(om * t) ^ 2 * bb_1 ^ 2) * cos
(om * t) ^ 2) * cos(om * t) * aa_F * m_b ^ 2 * JB + ((0.8e1
* bb_1 ^ 2 + 0.24e2 - 0.8e1 * sin(om * t) ^ 2) * sin(om * t)
^ 3 + 0.8e1 * sin(om * t) + ((0.8e1 * bb_1 ^ 2 + 0.24e2 -
0.16e2 * sin(om * t) ^ 2) * sin(om * t) - 0.8e1 * sin(om *
t) * cos(om * t) ^ 2) * cos(om * t) ^ 2 * cos(om * t) *
aa_F * m_b ^ 2 * JB * bb_2 ^ 2 + ((0.8e1 * bb_1 ^ 2 + 0.16e2
- 0.8e1 * sin(om * t) ^ 2) * sin(om * t) - 0.8e1 * sin(om *
t) - 0.8e1 * sin(om * t) * cos(om * t) ^ 2) * cos(om * t) *
aa_F * m_b ^ 2 * JB + ((-0.8e1 + 0.8e1 * sin(om * t) ^ 2) *
sin(om * t) + 0.8e1 * sin(om * t) * cos(om * t) ^ 2) * m_b ^
2 * JB * bb_F_1 + ((0.16e2 + (-0.16e2 - 0.8e1 * bb_1 ^ 2) *
sin(om * t) ^ 2) * sin(om * t) - 0.8e1 * sin(om * t) +
(-0.16e2 - 0.8e1 * bb_1 ^ 2) * sin(om * t) * cos(om * t) ^
2) * cos(om * t) * aa_F * m_b ^ 2 * JB + (((0.8e1 * bb_1 ^
2 - 0.8e1 * sin(om * t) ^ 2 * bb_1 ^ 2) * sin(om * t) ^ 3 +
(0.8e1 - 0.8e1 * sin(om * t) ^ 2) * sin(om * t) + ((0.8e1 *
bb_1 ^ 2 - 0.16e2 * sin(om * t) ^ 2 * bb_1 ^ 2) * sin(om *
t) - 0.8e1 * sin(om * t) - 0.8e1 * sin(om * t) * cos(om * t)
^ 2 * bb_1 ^ 2) * cos(om * t) ^ 2) * m_b ^ 2 * JB + ((0.8e1

```

$$\begin{aligned}
& -0.8e1 * \sin(\text{om} * t) ^ 2 * \sin(\text{om} * t) ^ 3 + ((-0.16e2 * \\
& \sin(\text{om} * t) ^ 2 + 0.8e1) * \sin(\text{om} * t) - 0.8e1 * \sin(\text{om} * t) \\
& * \cos(\text{om} * t) ^ 2) * \cos(\text{om} * t) ^ 2 * m_b ^ 2 * \text{JB} * \text{bb}_2 \\
& ^ 2 + ((0.8e1 - 0.8e1 * \sin(\text{om} * t) ^ 2) * \sin(\text{om} * t) - \\
& 0.8e1 * \sin(\text{om} * t) * \cos(\text{om} * t) ^ 2) * m_b ^ 2 * \text{JB} * \\
& \text{bb}_F_2 + ((-0.8e1 * \sin(\text{om} * t) ^ 2 * \text{bb}_1 - 0.8e1 * \text{bb}_1 * \\
& \cos(\text{om} * t) ^ 2) * \cos(\text{om} * t) * m_b ^ 2 * \text{JB} + (-0.8e1 * \\
& \sin(\text{om} * t) ^ 2 * \text{bb}_1 - 0.8e1 * \text{bb}_1 * \cos(\text{om} * t) ^ 2) * \\
& \cos(\text{om} * t) * m_b ^ 2 * \text{JB} * \text{bb}_2 ^ 2 - 0.8e1 * m_b ^ 2 * \\
& \cos(\text{om} * t) * \text{JB} * \text{bb}_1 + ((0.8e1 + 0.8e1 * \text{bb}_1 ^ 2) * \sin \\
& (\text{om} * t) ^ 2 + 0.8e1 + (0.8e1 + 0.8e1 * \text{bb}_1 ^ 2) * \cos(\text{om} * \\
& t) ^ 2) * \cos(\text{om} * t) * m_b ^ 2 * \text{JB} * \text{bb}_2) * \text{om}) * \text{om} + \\
& (0.4e1 * \text{aa} * \sin(\text{om} * t) ^ 2 + (-0.4e1 * \sin(\text{om} * t) ^ 2 * \\
& \text{bb}_1 + (0.4e1 * \text{aa} - 0.4e1 * \text{bb}_1 * \cos(\text{om} * t)) * \cos(\text{om} * \\
& t)) * \cos(\text{om} * t) * g_ * m_b ^ 3 * \text{bb}_2 ^ 2 + \\
& (-0.4e1 - 0.4e1 * \sin(\text{om} * t) ^ 2 * \text{bb}_1 ^ 2 - 0.4e1 * \text{bb}_1 \\
& ^ 2 * \cos(\text{om} * t) ^ 2) * \cos(\text{om} * t) ^ 2 * g_ * m_b ^ 3 * \\
& \text{bb}_2 + (-0.4e1 * \text{aa} * \sin(\text{om} * t) ^ 2 * \text{bb}_1 ^ 2 + (-0.4e1 * \\
& \text{bb}_1 - 0.4e1 * \text{aa} * \text{bb}_1 ^ 2 * \cos(\text{om} * t)) * \cos(\text{om} * \\
& t)) * \cos(\text{om} * t) * g_ * m_b ^ 3 + ((0.4e1 * \sin(\text{om} * t) ^ 2 * \\
& \text{bb}_1 + 0.4e1 * \text{bb}_1 * \cos(\text{om} * t) ^ 2) * \cos(\text{om} * t) ^ 2 * \\
& \text{aa}_F ^ 2 * m_b ^ 3 * \text{bb}_2 ^ 2 + (0.4e1 + 0.4e1 * \sin(\text{om} * t) \\
& ^ 2 * \text{bb}_1 ^ 2 + 0.4e1 * \text{bb}_1 ^ 2 * \cos(\text{om} * t) ^ 2) * \cos \\
& (\text{om} * t) ^ 2 * \text{aa}_F ^ 2 * m_b ^ 3 * \text{bb}_2 + 0.4e1 * m_b ^ 3 * \\
& \text{bb}_1 * \cos(\text{om} * t) ^ 2 * \text{aa}_F ^ 2) * 1 + (((0.2e1 + 0.2e1 * \\
& \sin(\text{om} * t) ^ 2) * \sin(\text{om} * t) ^ 3 + ((0.2e1 + 0.4e1 * \sin \\
& (\text{om} * t) ^ 2) * \sin(\text{om} * t) + 0.2e1 * \sin(\text{om} * t) * \cos(\text{om} * \\
& t) ^ 2) * \cos(\text{om} * t) ^ 2) * \text{aa}_F * m_b ^ 3 * \text{bb}_2 ^ 2 + \\
& (-0.2e1 * \text{bb}_1 ^ 2 - 0.2e1 * \sin(\text{om} * t) ^ 2 * \text{bb}_1 ^ 2) * \\
& \sin(\text{om} * t) ^ 3 + ((-0.2e1 * \text{bb}_1 ^ 2 - 0.4e1 * \sin(\text{om} * t) \\
& ^ 2 * \text{bb}_1 ^ 2) * \sin(\text{om} * t) - 0.2e1 * \sin(\text{om} * t) * \cos(\text{om} * \\
& t) ^ 2 * \text{bb}_1 ^ 2) * \cos(\text{om} * t) ^ 2) * \text{aa}_F * m_b ^ 3) * \\
& 1 + ((0.2e1 * \sin(\text{om} * t) ^ 4 * \text{bb}_1 + (0.4e1 * \sin(\text{om} * t) \\
& ^ 2 * \text{bb}_1 + 0.2e1 * \text{bb}_1 * \cos(\text{om} * t) ^ 2) * \cos(\text{om} * t) ^ 2) * \\
& m_b ^ 3 * \text{bb}_2 ^ 2 + (0.2e1 * \sin(\text{om} * t) ^ 2 + 0.2e1 * \\
& \sin(\text{om} * t) ^ 4 * \text{bb}_1 ^ 2 + (0.4e1 * \sin(\text{om} * t) ^ 2 * \text{bb}_1 \\
& ^ 2 + 0.2e1 + 0.2e1 * \text{bb}_1 ^ 2 * \cos(\text{om} * t) ^ 2) * \cos(\text{om} * \\
& t) ^ 2 * m_b ^ 3 * \text{bb}_2 + (0.2e1 * \text{bb}_1 * \cos(\text{om} * t) ^ 2 + \\
& 0.2e1 * \sin(\text{om} * t) ^ 2 * \text{bb}_1) * m_b ^ 3) * 1 * \text{om}) * \text{om} + \\
& (((0.2e1 * \sin(\text{om} * t) ^ 6 * \text{bb}_1 + (-0.2e1 * \text{bb}_1 ^ 3 * \sin \\
& (\text{om} * t) ^ 4 + (-0.4e1 * \text{bb}_1 + 0.6e1 * \sin(\text{om} * t) ^ 2 * \\
& \text{bb}_1) * \sin(\text{om} * t) ^ 2 + (-0.4e1 * \text{bb}_1 ^ 3 * \sin(\text{om} * t) ^ 4
\end{aligned}$$

$$\begin{aligned}
& 2 - 0.4e1 * bb_1 + 0.6e1 * \sin(\text{om} * t) ^ 2 * bb_1 + (0.2e1 * \\
& bb_1 - 0.2e1 * bb_1 ^ 3) * \cos(\text{om} * t) ^ 2 * \cos(\text{om} * t) ^ 2 \\
& * \cos(\text{om} * t) ^ 2 * \cos(\text{om} * t) * aa_F ^ 2 * m_b ^ 3 + (\\
& (0.4e1 * \sin(\text{om} * t) ^ 2 * bb_1 + 0.4e1 * bb_1 ^ 3 * \sin(\text{om} \\
& * t) ^ 4 + (0.4e1 * bb_1 + 0.8e1 * bb_1 ^ 3 * \sin(\text{om} * t) ^ 2 + 0.4e1 * \\
& bb_1 ^ 3 * \cos(\text{om} * t) ^ 2) * \cos(\text{om} * t) ^ 2 * \cos(\text{om} * t) ^ 2 * \\
& \cos(\text{om} * t) ^ 2 * aa_F * m_b ^ 3 + (-0.2e1 * bb_1 ^ 3 * \sin(\text{om} * t) ^ 4 - 0.2e1 * \\
& \sin(\text{om} * t) ^ 4 * bb_1 + (-0.4e1 * \sin(\text{om} * t) ^ 2 * bb_1 ^ 3 * \sin(\text{om} * t) ^ 2 \\
& + (-0.2e1 * bb_1 - 0.2e1 * bb_1 ^ 3) * \cos(\text{om} * t) ^ 2 * \\
& \cos(\text{om} * t) ^ 2 * \cos(\text{om} * t) * m_b ^ 3 * bb_F_1) * bb_F_1 \\
& + (0.2e1 * \sin(\text{om} * t) ^ 2 + 0.2e1 * \sin(\text{om} * t) ^ 4 * bb_1 \\
& ^ 2 + (0.4e1 * \sin(\text{om} * t) ^ 2 * bb_1 ^ 2 + 0.2e1 + 0.2e1 * \\
& bb_1 ^ 2 * \cos(\text{om} * t) ^ 2) * \cos(\text{om} * t) ^ 2 * \cos(\text{om} * t) \\
& ^ 3 * aa_F ^ 2 * m_b ^ 3 * bb_2) * bb_2 ^ 2 + (0.2e1 * \sin(\text{om} * t) ^ 4 * bb_1 + (-0.2e1 * \\
& bb_1 ^ 3 * \sin(\text{om} * t) ^ 2 * bb_1 - 0.4e1 * bb_1 + (0.2e1 * \\
& bb_1 - 0.2e1 * bb_1 ^ 3) * \cos(\text{om} * t) ^ 2 * \cos(\text{om} * t) ^ 2 \\
& * \cos(\text{om} * t) * aa_F ^ 2 * m_b ^ 3 + ((0.4e1 * bb_1 ^ 3 * \sin(\text{om} * t) ^ 2 + 0.4e1 * \\
& bb_1 + 0.4e1 * bb_1 ^ 3 * \cos(\text{om} * t) ^ 2) * \cos(\text{om} * t) ^ 2 * \\
& aa_F * m_b ^ 3 + (-0.2e1 * bb_1 ^ 3 * \sin(\text{om} * t) ^ 2 - 0.2e1 * \\
& \sin(\text{om} * t) ^ 2 * bb_1 + (-0.2e1 * bb_1 ^ 3 * \cos(\text{om} * t) ^ 2) * \cos(\text{om} * t) * \\
& m_b ^ 3 * bb_F_1) * bb_F_1 + (-0.2e1 * \sin(\text{om} * t) ^ 4 - 0.2e1 * \sin(\text{om} * t) ^ 6 * bb_1 \\
& ^ 2 + ((0.4e1 * bb_1 ^ 2 - 0.6e1 * \sin(\text{om} * t) ^ 2 * bb_1 ^ 2) * \sin(\text{om} * t) ^ 2 \\
& - 0.4e1 * \sin(\text{om} * t) ^ 2 * bb_1 ^ 2 + 0.4e1 + (-0.2e1 + 0.4e1 * bb_1 ^ 2 - 0.6e1 * \\
& \sin(\text{om} * t) ^ 2 * bb_1 ^ 2 - 0.2e1 * bb_1 ^ 2 * \cos(\text{om} * t) ^ 2) * \cos(\text{om} * t) ^ 2 * \\
& \cos(\text{om} * t) * aa_F ^ 2 * m_b ^ 3 * bb_2 + ((0.4e1 * \sin(\text{om} * t) ^ 4 * bb_1 ^ 2 + 0.4e1 * \\
& \sin(\text{om} * t) ^ 2 * bb_1 ^ 2 + 0.4e1 * bb_1 ^ 2 * \cos(\text{om} * t) ^ 2) * \cos(\text{om} * t) ^ 2 * \\
& aa_F * m_b ^ 3 * bb_2 + (0.4e1 + 0.4e1 * \sin(\text{om} * t) ^ 2 * bb_1 ^ 2 + 0.4e1 * \\
& bb_1 ^ 2 * \cos(\text{om} * t) ^ 2) * \cos(\text{om} * t) ^ 2 * aa_F * m_b ^ 3 * \\
& bb_2 ^ 3 + (0.4e1 + 0.4e1 * \sin(\text{om} * t) ^ 2 * bb_1 ^ 2 + 0.4e1 * \\
& bb_1 ^ 2 * \cos(\text{om} * t) ^ 2) * \cos(\text{om} * t) ^ 2 * aa_F * m_b ^ 3 * \\
& m_b ^ 3 * bb_2 + ((0.2e1 * \sin(\text{om} * t) ^ 2 + 0.2e1 * \sin(\text{om} * t) ^ 4 * bb_1 ^ 2 + 0.2e1 * \\
& \sin(\text{om} * t) ^ 4 * bb_1 ^ 2 + 0.4e1 * \sin(\text{om} * t) ^ 2 * bb_1 ^ 2 + 0.2e1 + 0.2e1 * \\
& bb_1 ^ 2 * \cos(\text{om} * t) ^ 2) * \cos(\text{om} * t) ^ 2 * \cos(\text{om} * t) ^ 2 * \\
& \cos(\text{om} * t) * m_b ^ 3 * bb_2 ^ 3 + (0.2e1 * \sin(\text{om} * t) ^ 2 + 0.2e1 * \sin(\text{om} * t) ^ 4 * \\
& bb_1 ^ 2 + 0.2e1 * \sin(\text{om} * t) ^ 4 * bb_1 ^ 2 + 0.4e1 * \sin(\text{om} * t) ^ 2 * bb_1 ^ 2 + 0.2e1 + 0.2e1 * \\
& bb_1 ^ 2 * \cos(\text{om} * t) ^ 2) * \cos(\text{om} * t) ^ 2 * \cos(\text{om} * t) * m_b ^ 3 * bb_2
\end{aligned}$$

$$\begin{aligned}
& * bb_F_2) * bb_F_2 + (((0.6e1 * bb_1 ^ 2 - 0.2e1 * sin(om * t) ^ 2 * bb_1 ^ 2) * sin(om * t) ^ 5 + (-0.4e1 * sin(om * t) ^ 2 + 0.4e1) * sin(om * t) ^ 3 + ((0.12e2 * bb_1 ^ 2 - 0.6e1 * sin(om * t) ^ 2 * bb_1 ^ 2) * sin(om * t) ^ 3 + (0.4e1 - 0.8e1 * sin(om * t) ^ 2 * bb_1 ^ 2) * sin(om * t) + ((0.6e1 * bb_1 ^ 2 - 0.6e1 * sin(om * t) ^ 2 * bb_1 ^ 2) * sin(om * t) - 0.4e1 * sin(om * t) - 0.2e1 * sin(om * t) * cos(om * t) ^ 2 * bb_1 ^ 2) * cos(om * t) ^ 2) * cos(om * t) * aa_F * m_b ^ 3 + ((-0.2e1 * bb_1 ^ 2 + 0.2e1 * sin(om * t) ^ 2 * bb_1 ^ 2) * sin(om * t) ^ 5 + (-0.2e1 + 0.2e1 * sin(om * t) ^ 2 * sin(om * t) ^ 3 + ((-0.4e1 * bb_1 ^ 2 + 0.6e1 * sin(om * t) ^ 2 * bb_1 ^ 2) * sin(om * t) ^ 3 + (-0.2e1 + 0.4e1 * sin(om * t) ^ 2 * sin(om * t) + 0.2e1 * sin(om * t) * cos(om * t) ^ 2 * bb_1 ^ 2) * cos(om * t) ^ 2) * sin(om * t) + 0.2e1 * sin(om * t) + 0.2e1 * sin(om * t) * cos(om * t) ^ 2 * bb_1 ^ 2) * cos(om * t) ^ 2) * m_b ^ 3 * bb_F_1) * bb_2 ^ 2 + ((0.6e1 * bb_1 ^ 2 - 0.2e1 * sin(om * t) ^ 2 * bb_1 ^ 2) * sin(om * t) ^ 5 + (0.6e1 - 0.2e1 * sin(om * t) ^ 2 * sin(om * t) ^ 3 + ((0.12e2 * bb_1 ^ 2 - 0.6e1 * sin(om * t) ^ 2 * bb_1 ^ 2) * sin(om * t) ^ 3 + (0.6e1 - 0.4e1 * sin(om * t) ^ 2) * sin(om * t) + ((0.6e1 * bb_1 ^ 2 - 0.6e1 * sin(om * t) ^ 2 * bb_1 ^ 2) * sin(om * t) - 0.2e1 * sin(om * t) * cos(om * t) ^ 2 * bb_1 ^ 2) * cos(om * t) ^ 2) * cos(om * t) ^ 2) * cos(om * t) * aa_F * m_b ^ 3 * bb_2 ^ 2 + ((0.6e1 * bb_1 ^ 2 - 0.2e1 * sin(om * t) ^ 2 * bb_1 ^ 2) * sin(om * t) ^ 5 + (-0.4e1 * sin(om * t) ^ 2 + 0.4e1) * sin(om * t) + ((0.6e1 * bb_1 ^ 2 - 0.4e1 * sin(om * t) ^ 2 * bb_1 ^ 2) * sin(om * t) - 0.2e1 * sin(om * t) * cos(om * t) ^ 2 * bb_1 ^ 2) * cos(om * t) ^ 2) * cos(om * t) * aa_F * m_b ^ 3 + ((-0.2e1 * bb_1 ^ 2 + 0.2e1 * sin(om * t) ^ 2 * bb_1 ^ 2) * sin(om * t) ^ 3 + (-0.2e1 + 0.4e1 * sin(om * t) ^ 2 * bb_1 ^ 2) * sin(om * t) + 0.2e1 * sin(om * t) * cos(om * t) ^ 2 * bb_1 ^ 2) * sin(om * t) + 0.2e1 * sin(om * t) * cos(om * t) ^ 2 * bb_1 ^ 2) * cos(om * t) * aa_F * m_b ^ 3 + ((0.4e1 * bb_1 ^ 2 - 0.4e1 * sin(om * t) ^ 2 * bb_1 ^ 2) * sin(om * t) ^ 3 + (-0.4e1 * sin(om * t) ^ 2 + 0.4e1) * sin(om * t) + ((0.4e1 * bb_1 ^ 2 - 0.8e1 * sin(om * t) ^ 2 * bb_1 ^ 2) * sin(om * t) - 0.4e1 * sin(om * t) * cos(om * t) ^ 2 * bb_1 ^ 2) * cos(om * t) ^ 2) * cos(om * t) * aa_F * m_b ^ 3 + (((0.2e1 * bb_1 ^ 2 - 0.2e1 * sin(om * t) ^ 2 * bb_1 ^ 2) * sin(om * t)
\end{aligned}$$

$$\begin{aligned}
& ^5 + (0.2e1 - 0.2e1 * \sin(\text{om} * t) ^ 2) * \sin(\text{om} * t) ^ 3 + \\
& ((0.4e1 * \text{bb}_1 ^ 2 - 0.6e1 * \sin(\text{om} * t) ^ 2 * \text{bb}_1 ^ 2) * \\
& \sin(\text{om} * t) ^ 3 + (-0.4e1 * \sin(\text{om} * t) ^ 2 + 0.2e1) * \sin \\
& (\text{om} * t) + ((0.2e1 * \text{bb}_1 ^ 2 - 0.6e1 * \sin(\text{om} * t) ^ 2 * \\
& \text{bb}_1 ^ 2) * \sin(\text{om} * t) - 0.2e1 * \sin(\text{om} * t) - 0.2e1 * \sin \\
& (\text{om} * t) * \cos(\text{om} * t) ^ 2 * \text{bb}_1 ^ 2) * \cos(\text{om} * t) ^ 2 * \\
& \cos(\text{om} * t) ^ 2) * \text{m}_b ^ 3 * \text{bb}_2 ^ 2 + ((0.2e1 * \text{bb}_1 ^ 2 - \\
& 0.2e1 * \sin(\text{om} * t) ^ 2 * \text{bb}_1 ^ 2) * \sin(\text{om} * t) ^ 3 + \\
& (0.2e1 - 0.2e1 * \sin(\text{om} * t) ^ 2) * \sin(\text{om} * t) + ((0.2e1 * \\
& \text{bb}_1 ^ 2 - 0.4e1 * \sin(\text{om} * t) ^ 2 * \text{bb}_1 ^ 2) * \sin(\text{om} * t) \\
& - 0.2e1 * \sin(\text{om} * t) - 0.2e1 * \sin(\text{om} * t) * \cos(\text{om} * t) ^ \\
& 2 * \text{bb}_1 ^ 2) * \cos(\text{om} * t) ^ 2 * \text{m}_b ^ 3 * \text{bb}_F_2 + \\
& (-0.2e1 * \sin(\text{om} * t) ^ 4 * \text{bb}_1 + (-0.4e1 * \sin(\text{om} * t) ^ 2 * \\
& \text{bb}_1 - 0.2e1 * \text{bb}_1 * \cos(\text{om} * t) ^ 2) * \cos(\text{om} * t) ^ 2) \\
& * \cos(\text{om} * t) * \text{m}_b ^ 3 * \text{bb}_2 ^ 2 + (-0.2e1 * \sin(\text{om} * t) ^ \\
& 2 * \text{bb}_1 - 0.2e1 * \text{bb}_1 * \cos(\text{om} * t) ^ 2) * \cos(\text{om} * t) * \\
& \text{m}_b ^ 3 + (0.2e1 * \sin(\text{om} * t) ^ 2 + 0.2e1 * \sin(\text{om} * t) ^ 4 \\
& * \text{bb}_1 ^ 2 + (0.4e1 * \sin(\text{om} * t) ^ 2 * \text{bb}_1 ^ 2 + 0.2e1 + \\
& 0.2e1 * \text{bb}_1 ^ 2 * \cos(\text{om} * t) ^ 2) * \cos(\text{om} * t) ^ 2 * \cos \\
& (\text{om} * t) * \text{m}_b ^ 3 * \text{bb}_2) * \text{om}) * \text{om}) * \text{R}) * \text{R}) * \text{R}) * \\
& \text{R} + (0.256e3 * \text{m}_b * \sin(\text{om} * t) * \text{om} * \text{aa}_F * \cos(\text{om} * t) * \\
& \text{JB} ^ 2 + (-0.16e2 * \text{JB} * \text{m}_b ^ 2 * \text{bb}_1 * \text{aa}_F ^ 2 * \cos(\text{om} \\
& * t) ^ 3 + 0.16e2 * \text{m}_b ^ 2 * \text{bb}_2 * \cos(\text{om} * t) ^ 3 * \text{aa}_F \\
& ^ 2 * \text{JB} + ((0.64e2 * \sin(\text{om} * t) ^ 3 * \text{bb}_1 ^ 2 + (0.48e2 - \\
& 0.16e2 * \sin(\text{om} * t) ^ 2) * \sin(\text{om} * t) + (0.64e2 * \sin(\text{om} * \\
& t) * \text{bb}_1 ^ 2 - 0.16e2 * \sin(\text{om} * t)) * \cos(\text{om} * t) ^ 2) * \\
& \cos(\text{om} * t) * \text{aa}_F * \text{m}_b ^ 2 * \text{JB} + (0.64e2 * \sin(\text{om} * t) ^ \\
& 3 + 0.64e2 * \sin(\text{om} * t) * \cos(\text{om} * t) ^ 2) * \cos(\text{om} * t) * \\
& \text{aa}_F * \text{m}_b ^ 2 * \text{JB} * \text{bb}_2 ^ 2 + ((0.48e2 - 0.16e2 * \sin(\text{om} \\
& * t) ^ 2) * \sin(\text{om} * t) - 0.16e2 * \sin(\text{om} * t) * \cos(\text{om} * t) \\
& ^ 2) * \cos(\text{om} * t) * \text{aa}_F * \text{m}_b ^ 2 * \text{JB} + ((-0.16e2 * \sin \\
& (\text{om} * t) ^ 2 * \text{bb}_1 - 0.16e2 * \text{bb}_1 * \cos(\text{om} * t) ^ 2) * \cos \\
& (\text{om} * t) * \text{m}_b ^ 2 * \text{JB} + (0.16e2 * \sin(\text{om} * t) ^ 2 + 0.16e2 \\
& * \cos(\text{om} * t) ^ 2) * \cos(\text{om} * t) * \text{m}_b ^ 2 * \text{JB} * \text{bb}_2) * \\
& \text{om}) * \text{om} + ((-0.4e1 * \sin(\text{om} * t) ^ 2 * \text{bb}_1 - 0.4e1 * \text{bb}_1 \\
& * \cos(\text{om} * t) ^ 2) * \cos(\text{om} * t) ^ 3 * \text{aa}_F ^ 2 * \text{m}_b ^ 3 * \\
& \text{bb}_2 ^ 2 + (0.4e1 + 0.4e1 * \sin(\text{om} * t) ^ 2 * \text{bb}_1 ^ 2 + \\
& 0.4e1 * \text{bb}_1 ^ 2 * \cos(\text{om} * t) ^ 2) * \cos(\text{om} * t) ^ 3 * \text{aa}_F \\
& ^ 2 * \text{m}_b ^ 3 * \text{bb}_2 - 0.4e1 * \text{m}_b ^ 3 * \text{bb}_1 * \text{aa}_F ^ 2 * \\
& \cos(\text{om} * t) ^ 3 + ((0.16e2 * \sin(\text{om} * t) ^ 5 * \text{bb}_1 ^ 2 + \\
& (0.12e2 - 0.4e1 * \sin(\text{om} * t) ^ 2) * \sin(\text{om} * t) ^ 3 + \\
& (0.32e2 * \sin(\text{om} * t) ^ 3 * \text{bb}_1 ^ 2 + (0.12e2 - 0.8e1 * \sin
\end{aligned}$$

$$\begin{aligned}
& (\text{om} * \text{t})^2 * \sin(\text{om} * \text{t}) + (0.16e2 * \sin(\text{om} * \text{t}) * \text{bb_1}^2 - 0.4e1 * \sin(\text{om} * \text{t})) * \cos(\text{om} * \text{t})^2 * \cos(\text{om} * \text{t})^2 * \cos(\text{om} * \text{t}) * \text{aa_F} * \text{m_b}^3 * \text{bb_2}^2 + ((0.12e2 * \text{bb_1}^2 - 0.4e1 * \sin(\text{om} * \text{t})^2 * \text{bb_1}^2) * \sin(\text{om} * \text{t})^3 + (0.8e1 - 0.8e1 * \sin(\text{om} * \text{t})^2 * \sin(\text{om} * \text{t})^2 * \sin(\text{om} * \text{t}) + (0.12e2 * \text{bb_1}^2 - 0.8e1 * \sin(\text{om} * \text{t})^2 * \sin(\text{om} * \text{t})^2 * \sin(\text{om} * \text{t}) - 0.4e1 * \sin(\text{om} * \text{t}) * \cos(\text{om} * \text{t})^2 * \cos(\text{om} * \text{t})^2 * \cos(\text{om} * \text{t}) * \text{aa_F} * \text{m_b}^3 + ((-0.4e1 * \sin(\text{om} * \text{t})^4 * \text{bb_1} + (-0.8e1 * \sin(\text{om} * \text{t})^2 * \text{bb_1} - 0.4e1 * \text{bb_1} * \cos(\text{om} * \text{t})^2 * \cos(\text{om} * \text{t})^2 * \cos(\text{om} * \text{t}) * \text{m_b}^3 * \text{bb_2}^2 + (0.4e1 * \sin(\text{om} * \text{t})^4 * \text{bb_1}^2 + 0.4e1 * \sin(\text{om} * \text{t})^2 + (0.4e1 + 0.8e1 * \sin(\text{om} * \text{t})^2 * \text{bb_1}^2 + 0.4e1 * \cos(\text{om} * \text{t})^2 * \cos(\text{om} * \text{t})^2 * \cos(\text{om} * \text{t}) * \text{m_b}^3 * \text{bb_2} + (-0.4e1 * \sin(\text{om} * \text{t})^2 * \text{bb_1} - 0.4e1 * \text{bb_1} * \cos(\text{om} * \text{t})^2 * \cos(\text{om} * \text{t}) * \text{m_b}^3 * \text{om}) * \text{R}^2 * \text{R}^2 * \text{e} * \text{e}) / ((0.256e3 * \text{JT} + 0.256e3 * \text{JB} * \text{bb_1}^2 * \sin(\text{om} * \text{t})^2 * \text{JB}^2 + 0.256e3 * \text{JB}^3 * \sin(\text{om} * \text{t})^2 * \text{bb_2}^2 + (0.128e3 * \text{m_b} + 0.16e2 * \text{m_t}) * \text{JB}^2 * \text{l}^2 + (((0.64e2 * \sin(\text{om} * \text{t})^2 * \text{bb_1}^2 + 0.64e2 * \text{bb_1}^2 * \cos(\text{om} * \text{t})^2 + 0.64e2) * \text{JT} * \text{m_b} + ((0.64e2 + 0.64e2 * \text{bb_1}^2) * \text{bb_1}^2 * \sin(\text{om} * \text{t})^4 + 0.64e2 * \sin(\text{om} * \text{t})^2 * \text{bb_1}^2 * \sin(\text{om} * \text{t})^2 * \cos(\text{om} * \text{t})^2 * \text{m_b} * \text{JB}) * \text{JB} + (((0.64e2 * \sin(\text{om} * \text{t})^2 + 0.64e2 * \cos(\text{om} * \text{t})^2 * \text{JT} * \text{m_b} + ((0.64e2 + 0.128e3 * \text{bb_1}^2) * \sin(\text{om} * \text{t})^4 + 0.64e2 * \sin(\text{om} * \text{t})^2 * \cos(\text{om} * \text{t})^2 * \text{m_b} * \text{JB} + (0.64e2 * \sin(\text{om} * \text{t})^4 * \text{bb_1}^2 * \cos(\text{om} * \text{t})^2 * \text{m_b} * \text{JB}^2 + (0.64e2 * \text{m_b} * \text{JT} + 0.64e2 * \text{m_b} * \text{bb_1}^2 * \sin(\text{om} * \text{t})^2 * \text{bb_2}^2 + (0.64e2 * \text{m_b} * \text{JB} + 0.64e2 * \text{m_b} * \text{JB}^2 * \text{bb_1}^2 * \sin(\text{om} * \text{t})^2 * \text{bb_2}^2 + ((0.4e1 + 0.4e1 * \sin(\text{om} * \text{t})^2 * \text{bb_1}^2 + 0.4e1 * \text{bb_1}^2 * \cos(\text{om} * \text{t})^2 * \text{m_t} + (0.16e2 + 0.32e2 * \text{bb_1}^2 * \cos(\text{om} * \text{t})^2 * \text{m_b} * \text{m_b} * \text{JB} + ((0.4e1 * \sin(\text{om} * \text{t})^2 + 0.4e1 * \cos(\text{om} * \text{t})^2 * \text{m_t} + (0.32e2 * \cos(\text{om} * \text{t})^2 + 0.32e2 * \sin(\text{om} * \text{t})^2 * \text{m_b} * \text{m_b} * \text{JB} * \text{bb_2}^2 + (0.4e1 * \text{m_t} + 0.16e2 * \text{m_b}) * \text{m_b} * \text{JB}) * \text{l}^2 + ((0.16e2 * \sin(\text{om} * \text{t})^6 * \text{bb_1}^4 + 0.16e2 * \sin(\text{om} * \text{t})^4 * \text{bb_1}^2 + (0.16e2 * \sin(\text{om} * \text{t})^2 * \text{bb_1}^4 + 0.32e2 * \sin(\text{om} * \text{t})^4 * \text{bb_1}^2 + 0.16e2 * \cos(\text{om} * \text{t})^4 * \text{bb_1}^2)
\end{aligned}$$

$$\begin{aligned}
& t)^2 * bb_1^4 * \sin(\omega * t)^2 * \cos(\omega * t)^2 * \\
& m_b^2 * JB + ((0.16e2 * \sin(\omega * t)^2 + 0.16e2 * \sin(\omega * t)^4 * bb_1^2 + (0.16e2 + 0.32e2 * \sin(\omega * t)^2 * bb_1^2 + 0.16e2 * bb_1^2 * \cos(\omega * t)^2) * \cos(\omega * t)^2 * JT * m_b^2 + ((0.32e2 + 0.16e2 * bb_1^2) * \\
& bb_1^2 * \sin(\omega * t)^6 + (0.16e2 + 0.16e2 * bb_1^2) * \sin(\omega * t)^4 + ((0.64e2 + 0.32e2 * bb_1^2) * bb_1^2 * \sin(\omega * t)^4 + (0.16e2 + 0.16e2 * bb_1^2) * bb_1^2 * \sin(\omega * t)^2 * \\
& \cos(\omega * t)^2) * \cos(\omega * t)^2 * m_b^2 * JB + ((0.16e2 + 0.16e2 * bb_1^2) * \sin(\omega * t)^6 + 0.16e2 * \\
& \sin(\omega * t)^4 + ((0.32e2 + 0.32e2 * bb_1^2) * \sin(\omega * t)^2 + (0.16e2 + 0.16e2 * bb_1^2) * \\
& \sin(\omega * t)^2 * \cos(\omega * t)^2 * \cos(\omega * t)^2) * m_b^2 * JB * bb_2^2 * bb_2^2 + (0.16e2 + 0.16e2 * \\
& \sin(\omega * t)^2 * bb_1^2 * bb_1^2 * \cos(\omega * t)^2) * JT * m_b^2 + ((0.16e2 + 0.16e2 * bb_1^2) * \\
& bb_1^2 * \sin(\omega * t)^2 * bb_1^2 * \cos(\omega * t)^2) * \cos(\omega * t)^2 * m_b^2 * \\
& \sin(\omega * t)^2 * bb_1^2 * \sin(\omega * t)^2 * \cos(\omega * t)^2 * m_b^2 * JB + ((0.16e2 + 0.16e2 * bb_1^2) * \\
& \sin(\omega * t)^4 * bb_1^2 * \sin(\omega * t)^2 * \cos(\omega * t)^2) * m_b^2 * \\
& \sin(\omega * t)^2 * \cos(\omega * t)^2 * m_t + (0.8e1 * \sin(\omega * t)^4 * bb_1^2 * 0.4e1 * \sin(\omega * t)^2 + \\
& (0.4e1 + 0.16e2 * \sin(\omega * t)^2 * bb_1^2 * 0.8e1 * bb_1^2 * \cos(\omega * t)^2 * \cos(\omega * t)^2) * m_b * m_b \\
& ^2 * bb_2^2 + ((\sin(\omega * t)^2 * bb_1^2 * 0.1e1 + bb_1^2 * \cos(\omega * t)^2 * \cos(\omega * t)^2) * m_t + \\
& (0.4e1 * \sin(\omega * t)^2 * bb_1^2 * 0.4e1 * bb_1^2 * \cos(\omega * t)^2 * \cos(\omega * t)^2) * m_b * m_b \\
& ^2 * 1^2 + (((0.4e1 * \sin(\omega * t)^6 * bb_1^2 * 0.4e1 * \sin(\omega * t)^8 * bb_1^4 + \\
& (0.8e1 * \sin(\omega * t)^4 * bb_1^2 * 0.12e2 * \sin(\omega * t)^6 * bb_1^4 + (0.4e1 * \\
& \sin(\omega * t)^2 * bb_1^2 * 0.12e2 * \sin(\omega * t)^4 * bb_1^4 + 0.4e1 * \\
& \cos(\omega * t)^4 * bb_1^2 * 0.4e1 * \cos(\omega * t)^2 * \cos(\omega * t)^2) * m_b^3 + (0.4e1 * \\
& \sin(\omega * t)^8 * bb_1^2 * 0.4e1 * \sin(\omega * t)^6 * bb_1^4 + (0.8e1 * \sin(\omega * t)^4 * bb_1^2 * 0.12e2 * \\
& \sin(\omega * t)^2 * bb_1^2 * 0.12e2 * \sin(\omega * t)^4 * bb_1^4 + 0.4e1 * \\
& \cos(\omega * t)^2 * \cos(\omega * t)^2 * m_b^3 * bb_2^2 + (0.4e1 * \sin(\omega * t)^2 * bb_1^2 * 0.4e1 * \\
& \sin(\omega * t)^2 * bb_1^2 * \cos(\omega * t)^2 * \cos(\omega * t)^2) * m_b^3 * bb_2^2
\end{aligned}$$

```

^ 2) * bb_2 ^ 2 + (0.4e1 * sin(om * t) ^ 6 * bb_1 ^ 4 +
0.4e1 * sin(om * t) ^ 4 * bb_1 ^ 2 + (0.4e1 * sin(om * t) ^
2 * bb_1 ^ 2 + 0.8e1 * sin(om * t) ^ 4 * bb_1 ^ 4 + 0.4e1 *
cos(om * t) ^ 2 * bb_1 ^ 4 * sin(om * t) ^ 2) * cos(om * t)
^ 2) * m_b ^ 3 + (0.4e1 * sin(om * t) ^ 6 * bb_1 ^ 2 + 0.4e1
* sin(om * t) ^ 4 + (0.8e1 * sin(om * t) ^ 4 * bb_1 ^ 2 +
0.4e1 * sin(om * t) ^ 2 + 0.4e1 * sin(om * t) ^ 2 * bb_1 ^ 2
* cos(om * t) ^ 2) * cos(om * t) ^ 2) * m_b ^ 3 * bb_2 ^ 2)
* R ^ 2) * R ^ 2) * R ^ 2 + (((0.16e2 * sin(om * t) ^ 2 +
0.16e2 * cos(om * t) ^ 2) * cos(om * t) * m_b ^ 3 * bb_2 ^ 2
+ (-0.16e2 * sin(om * t) ^ 2 * bb_1 ^ 2 - 0.16e2 * bb_1 ^ 2
* cos(om * t) ^ 2) * cos(om * t) * m_b ^ 3) * l * R ^ 4 +
(0.512e3 * JB ^ 2 * m_b * cos(om * t) ^ 2 + ((0.64e2 +
0.128e3 * sin(om * t) ^ 2 * bb_1 ^ 2 + 0.128e3 * bb_1 ^ 2 *
cos(om * t) ^ 2) * cos(om * t) ^ 2 * m_b ^ 2 * JB + (0.128e3
* sin(om * t) ^ 2 + 0.128e3 * cos(om * t) ^ 2) * cos(om * t)
^ 2 * m_b ^ 2 * JB * bb_2 ^ 2 + 0.64e2 * m_b ^ 2 * JB * cos
(om * t) ^ 2 + ((0.16e2 * sin(om * t) ^ 2 + 0.32e2 * sin(om
* t) ^ 4 * bb_1 ^ 2 + (0.16e2 + 0.64e2 * sin(om * t) ^ 2 *
bb_1 ^ 2 + 0.32e2 * bb_1 ^ 2 * cos(om * t) ^ 2) * cos(om *
t) ^ 2) * cos(om * t) ^ 2 * m_b ^ 3 * bb_2 ^ 2 + (0.16e2 *
sin(om * t) ^ 2 * bb_1 ^ 2 + 0.16e2 * bb_1 ^ 2 * cos(om * t)
^ 2) * cos(om * t) ^ 2 * m_b ^ 3) * R ^ 2) * R ^ 2) * e) *
e);

```

▼ beta_1

```

> Matlab(bb_FF_1, resultname="bb_FF_1");
bb_FF_1 = -0.1e1 * (-0.4e1 * JB * aa_FF * cos(om * t) + m_b
* R ^ 2 * sin(om * t) * om * cos(bb_1) ^ 2 * cos(om * t) ^ 2
* aa_F - 0.2e1 * m_b * R ^ 2 * aa_F ^ 2 * sin(om * t) ^ 2 *
sin(bb_1) * cos(bb_1) * cos(om * t) ^ 2 + m_b * R ^ 2 * sin
(om * t) ^ 3 * om * cos(bb_1) ^ 2 * aa_F + 0.2e1 * m_b * R *
e * sin(om * t) ^ 3 * om * aa_F * cos(bb_1) - 0.1e1 * m_b *
R ^ 2 * cos(bb_1) ^ 2 * aa_FF * cos(om * t) + R * m_b * l *
aa_FF * cos(bb_1) - 0.1e1 * m_b * R ^ 2 * cos(om * t) ^ 3 *
sin(bb_1) ^ 2 * aa_FF - 0.2e1 * m_b * aa_FF * cos(om * t) *
R * cos(bb_1) * e + 0.2e1 * m_b * R * e * sin(om * t) * om *
cos(bb_1) * cos(om * t) ^ 2 * aa_F + m_b * R ^ 2 * sin(bb_1)
* aa_F ^ 2 * cos(om * t) ^ 2 * cos(bb_1) - 0.4e1 * JB * aa_F
* sin(om * t) * sin(bb_1) ^ 2 * om - 0.1e1 * m_b * R * sin

```

```

(bb_1) * l * aa_F ^ 2 * cos(om * t) + 0.2e1 * m_b * R * sin
(bb_1) * e * cos(om * t) ^ 2 * aa_F ^ 2 + m_b * R ^ 2 * sin
(om * t) ^ 2 * om ^ 2 * cos(bb_1) * sin(bb_1) + 0.2e1 * m_b
* R * e * sin(om * t) ^ 2 * om ^ 2 * sin(bb_1) - 0.1e1 * m_b
* R ^ 2 * sin(bb_1) ^ 2 * sin(om * t) ^ 2 * aa_FF * cos(om *
t) + 0.4e1 * JB * cos(bb_1) ^ 2 * aa_F * sin(om * t) * om +
m_b * R ^ 2 * cos(om * t) ^ 2 * om ^ 2 * cos(bb_1) * sin
(bb_1) + 0.2e1 * m_b * R * e * cos(om * t) ^ 2 * om ^ 2 *
sin(bb_1) + 0.2e1 * m_b * g_ * R * sin(bb_1) * cos(om * t) *
cos(aa) - 0.2e1 * m_b * g_ * R * cos(bb_1) * sin(aa) + 0.4e1
* kb * bb_1 + 0.2e1 * m_b * aa_F * sin(om * t) * om * R *
cos(bb_1) * e + m_b * R ^ 2 * cos(om * t) ^ 2 * sin(bb_1) *
cos(bb_1) * bb_F_1 ^ 2 + 0.4e1 * JB * om ^ 2 * cos(bb_1) *
sin(bb_1) + 0.4e1 * JB * aa_F * sin(om * t) * om - 0.4e1 *
aa_F ^ 2 * sin(om * t) ^ 2 * sin(bb_1) * JB * cos(bb_1) -
0.1e1 * m_b * R ^ 2 * aa_F ^ 2 * sin(om * t) ^ 4 * sin(bb_1)
* cos(bb_1) + m_b * R ^ 2 * cos(bb_1) ^ 2 * aa_F * sin(om *
t) * om - 0.1e1 * m_b * R ^ 2 * cos(bb_1) * sin(bb_1) *
bb_F_1 ^ 2 + m_b * R ^ 2 * sin(bb_1) * sin(om * t) ^ 2 * cos
(bb_1) * bb_F_1 ^ 2 - 0.1e1 * m_b * R ^ 2 * cos(om * t) ^ 4
* sin(bb_1) * aa_F ^ 2 * cos(bb_1)) / (0.4e1 * JB + R ^ 2 *
m_b * sin(om * t) ^ 2 * sin(bb_1) ^ 2 + R ^ 2 * m_b * cos
(bb_1) ^ 2 + R ^ 2 * m_b * cos(om * t) ^ 2 * sin(bb_1) ^ 2);
> Matlab(eq_mo_beta1_FF_lin, resultname="bb_FF_1_lin");
bb_FF_1_lin = -0.1e1 * (-0.4e1 * JB * aa_FF * cos(om * t) +
R * m_b * l * aa_FF + 0.4e1 * kb * bb_1 - 0.1e1 * m_b * R ^
2 * aa_FF * cos(om * t) + 0.8e1 * JB * aa_F * sin(om * t) *
om - 0.2e1 * m_b * R ^ 2 * aa_F ^ 2 * sin(om * t) ^ 2 * bb_1
* cos(om * t) ^ 2 + m_b * R ^ 2 * sin(om * t) ^ 3 * om *
aa_F + 0.2e1 * m_b * g_ * R * bb_1 * cos(om * t) - 0.1e1 *
m_b * R ^ 2 * aa_F ^ 2 * sin(om * t) ^ 4 * bb_1 - 0.4e1 * JB
* aa_F * sin(om * t) * bb_1 ^ 2 * om - 0.4e1 * aa_F ^ 2 *
sin(om * t) ^ 2 * bb_1 * JB + 0.2e1 * m_b * R * e * sin(om *
t) ^ 3 * om * aa_F - 0.2e1 * m_b * aa_FF * cos(om * t) * R *
e - 0.1e1 * m_b * R ^ 2 * cos(om * t) ^ 3 * bb_1 ^ 2 * aa_FF
- 0.1e1 * m_b * R ^ 2 * bb_1 * bb_F_1 ^ 2 + 0.2e1 * m_b * R
* e * sin(om * t) ^ 2 * om ^ 2 * bb_1 + m_b * R ^ 2 * bb_1 *
aa_F ^ 2 * cos(om * t) ^ 2 + 0.2e1 * m_b * aa_F * sin(om *
t) * om * R * e + m_b * R ^ 2 * cos(om * t) ^ 2 * bb_1 *
bb_F_1 ^ 2 - 0.1e1 * m_b * R ^ 2 * cos(om * t) ^ 4 * bb_1 *
aa_F ^ 2 + m_b * R ^ 2 * bb_1 * sin(om * t) ^ 2 * bb_F_1 ^ 2
+ 0.2e1 * m_b * R * e * cos(om * t) ^ 2 * om ^ 2 * bb_1 -

```

```

0.1e1 * m_b * R * bb_1 * l * aa_F ^ 2 * cos(om * t) + m_b *
R ^ 2 * sin(om * t) ^ 2 * om ^ 2 * bb_1 + 0.2e1 * m_b * R *
e * sin(om * t) * om * cos(om * t) ^ 2 * aa_F - 0.2e1 * m_b
* g_ * R * aa + m_b * R ^ 2 * sin(om * t) * om * cos(om * t)
^ 2 * aa_F + 0.2e1 * m_b * R * bb_1 * e * cos(om * t) ^ 2 *
aa_F ^ 2 + 0.4e1 * JB * om ^ 2 * bb_1 - 0.1e1 * m_b * R ^ 2
* bb_1 ^ 2 * sin(om * t) ^ 2 * aa_FF * cos(om * t) + m_b * R
^ 2 * cos(om * t) ^ 2 * om ^ 2 * bb_1 + m_b * R ^ 2 * aa_F *
sin(om * t) * om) / (0.4e1 * JB + R ^ 2 * m_b * sin(om * t)
^ 2 * bb_1 ^ 2 + R ^ 2 * m_b + R ^ 2 * m_b * cos(om * t) ^ 2
* bb_1 ^ 2);

```

▼ beta_2

```

> Matlab(bb_FF_2, resultname="bb_FF_2");
bb_FF_2 = -0.1e1 * (0.4e1 * JB * aa_FF * cos(om * t) - 0.4e1
* JB * aa_F * sin(om * t) * om - 0.2e1 * m_b * aa_F * sin(om
* t) * om * R * cos(bb_2) * e - 0.1e1 * m_b * R ^ 2 * cos
(bb_2) * sin(bb_2) * bb_F_2 ^ 2 + m_b * R ^ 2 * sin(bb_2) *
aa_F ^ 2 * cos(om * t) ^ 2 * cos(bb_2) - 0.1e1 * m_b * R ^ 2
* aa_F ^ 2 * sin(om * t) ^ 4 * sin(bb_2) * cos(bb_2) - 0.2e1
* m_b * R ^ 2 * aa_F ^ 2 * sin(om * t) ^ 2 * sin(bb_2) * cos
(om * t) ^ 2 * cos(bb_2) - 0.1e1 * m_b * R ^ 2 * sin(om * t)
^ 3 * om * cos(bb_2) ^ 2 * aa_F - 0.1e1 * m_b * R ^ 2 * sin
(om * t) * om * cos(bb_2) ^ 2 * aa_F * cos(om * t) ^ 2 -
0.2e1 * m_b * R * e * sin(om * t) ^ 3 * om * aa_F * cos
(bb_2) - 0.2e1 * m_b * R * e * sin(om * t) * om * aa_F * cos
(om * t) ^ 2 * cos(bb_2) - 0.4e1 * JB * sin(om * t) * om *
aa_F * cos(bb_2) ^ 2 - 0.4e1 * aa_F ^ 2 * sin(om * t) ^ 2 *
sin(bb_2) * JB * cos(bb_2) + 0.2e1 * m_b * R * e * cos(om *
t) ^ 2 * om ^ 2 * sin(bb_2) + m_b * R ^ 2 * sin(om * t) ^ 2
* om ^ 2 * cos(bb_2) * sin(bb_2) + 0.2e1 * m_b * R * e * sin
(om * t) ^ 2 * om ^ 2 * sin(bb_2) - 0.2e1 * m_b * g_ * R *
sin(bb_2) * cos(om * t) * cos(aa) - 0.2e1 * m_b * g_ * R *
cos(bb_2) * sin(aa) + m_b * R ^ 2 * aa_FF * sin(bb_2) ^ 2 *
cos(om * t) ^ 3 + m_b * R ^ 2 * aa_FF * sin(bb_2) ^ 2 * cos
(om * t) * sin(om * t) ^ 2 + 0.2e1 * m_b * aa_FF * cos(om *
t) * R * cos(bb_2) * e + R * m_b * l * aa_FF * cos(bb_2) +
m_b * R * sin(bb_2) * l * aa_F ^ 2 * cos(om * t) + 0.2e1 *
m_b * R * sin(bb_2) * e * cos(om * t) ^ 2 * aa_F ^ 2 + m_b *
R ^ 2 * sin(om * t) ^ 2 * sin(bb_2) * cos(bb_2) * bb_F_2 ^ 2
+ m_b * R ^ 2 * cos(om * t) * aa_FF * cos(bb_2) ^ 2 + m_b *
R ^ 2 * cos(om * t) ^ 2 * sin(bb_2) * cos(bb_2) * bb_F_2 ^ 2

```

```

+ m_b * R ^ 2 * cos(om * t) ^ 2 * om ^ 2 * cos(bb_2) * sin
(bb_2) - 0.1e1 * m_b * R ^ 2 * sin(om * t) * om * aa_F * cos
(bb_2) ^ 2 + 0.4e1 * JB * aa_F * sin(om * t) * sin(bb_2) ^ 2
* om + 0.4e1 * kb * bb_2 - 0.1e1 * m_b * R ^ 2 * aa_F ^ 2 *
cos(om * t) ^ 4 * sin(bb_2) * cos(bb_2) + 0.4e1 * JB * om ^
2 * cos(bb_2) * sin(bb_2)) / (0.4e1 * JB + R ^ 2 * m_b * cos
(om * t) ^ 2 * sin(bb_2) ^ 2 + R ^ 2 * m_b * sin(om * t) ^ 2
* sin(bb_2) ^ 2 + R ^ 2 * m_b * cos(bb_2) ^ 2);

> Matlab(eq_mo_beta2_FF_lin, resultname="bb_FF_2_lin");
bb_FF_2_lin = -0.1e1 * (0.4e1 * JB * aa_FF * cos(om * t) + R
* m_b * l * aa_FF + m_b * R ^ 2 * aa_FF * cos(om * t) -
0.8e1 * JB * aa_F * sin(om * t) * om - 0.1e1 * m_b * R ^ 2 *
sin(om * t) ^ 3 * om * aa_F - 0.2e1 * m_b * R * e * sin(om *
t) ^ 3 * om * aa_F + 0.2e1 * m_b * aa_FF * cos(om * t) * R *
e - 0.1e1 * m_b * R ^ 2 * bb_2 * bb_F_2 ^ 2 + m_b * R ^ 2 *
bb_2 * aa_F ^ 2 * cos(om * t) ^ 2 - 0.1e1 * m_b * R ^ 2 *
aa_F ^ 2 * sin(om * t) ^ 4 * bb_2 - 0.4e1 * aa_F ^ 2 * sin
(om * t) ^ 2 * bb_2 * JB + 0.2e1 * m_b * R * e * cos(om * t)
^ 2 * om ^ 2 * bb_2 + m_b * R ^ 2 * sin(om * t) ^ 2 * om ^ 2
* bb_2 + 0.2e1 * m_b * R * e * sin(om * t) ^ 2 * om ^ 2 *
bb_2 - 0.2e1 * m_b * g_ * R * bb_2 * cos(om * t) + m_b * R ^
2 * aa_FF * bb_2 ^ 2 * cos(om * t) ^ 3 + m_b * R * bb_2 * l
* aa_F ^ 2 * cos(om * t) + 0.2e1 * m_b * R * bb_2 * e * cos
(om * t) ^ 2 * aa_F ^ 2 + m_b * R ^ 2 * sin(om * t) ^ 2 *
bb_2 * bb_F_2 ^ 2 + m_b * R ^ 2 * cos(om * t) ^ 2 * bb_2 *
bb_F_2 ^ 2 + m_b * R ^ 2 * cos(om * t) ^ 2 * om ^ 2 * bb_2 +
0.4e1 * JB * aa_F * sin(om * t) * bb_2 ^ 2 * om - 0.1e1 *
m_b * R ^ 2 * aa_F ^ 2 * cos(om * t) ^ 4 * bb_2 + 0.4e1 * kb
* bb_2 - 0.2e1 * m_b * aa_F * sin(om * t) * om * R * e -
0.2e1 * m_b * R * e * sin(om * t) * om * cos(om * t) ^ 2 *
aa_F - 0.2e1 * m_b * g_ * R * aa - 0.1e1 * m_b * R ^ 2 *
sin(om * t) * om * cos(om * t) ^ 2 * aa_F + m_b * R ^ 2 *
aa_FF * bb_2 ^ 2 * cos(om * t) * sin(om * t) ^ 2 + 0.4e1 * JB * om
^ 2 * bb_2 - 0.1e1 * m_b * R ^ 2 * aa_F * sin(om * t) * om -
0.2e1 * m_b * R ^ 2 * aa_F ^ 2 * sin(om * t) ^ 2 * bb_2 *
cos(om * t) ^ 2) / (0.4e1 * JB + R ^ 2 * m_b * cos(om * t) ^
2 * bb_2 ^ 2 + R ^ 2 * m_b * sin(om * t) ^ 2 * bb_2 ^ 2 + R
^ 2 * m_b);

```