Cross interactions

Why?

One of our hypotheses is that the two active arms are completely decoupled. Our main reason behind it is that the revolute joints don't transfer load between them and that the high gear ratio "blocks" every (small) disturbance on the load axle from reaching the motor axle.

This is a good first approximation because it allows us to ignore every cross-interactions between the two servo motors and design the controllers independently.

We can apply a more rigorous approach in the study of these effects before moving forward with other tasks. (Just in case the professor wants to be pedantic).

2-DOF Kinematics

Seen from the 2 load axles our system has only masses and moments of inertia, no potential energies or dissipations.

$$T = \frac{1}{2}\underline{\dot{y}}^T \left[m_{\rm ph} \right] \underline{\dot{y}}$$
 1.

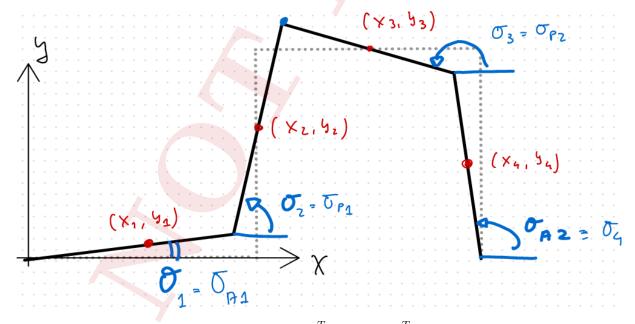
Where
$$[m_{ph}] = [m, m, J_l + r^2 J_r, m, m, J_l, m, m, J_l, m, m, J_l + r^2 J_r]^T$$

(n.b: J_l is the moment of inertia of the links at the center of gravity, do not use the Huygens–Steiner theorem or that other moment of inertia around the pivot)

(n.n.b: J_r is the moment of inertia of rotor moved on the load axle)

and
$$\dot{y} = [x_{11}, y_{11}, \theta_{11}, x_{12}, y_{12}, \theta_{12}, x_{13}, y_{13}, \theta_{13}, x_{14}, y_{14}, \theta_{14}]^T$$

is the vector of independent coordinates of the bodies according to this diagram:



We can describe $\underline{\dot{y}}$ in terms of our 2 dof $[q_1,q_2]^T=[\theta_{\rm A1},\theta_{\rm A2}]^T$ via a Jacobian matrix $[\Lambda_m]$: $\underline{\dot{y}}=[\Lambda_m]\underline{\dot{q}} \qquad \qquad 2.$

The new system will be:

$$T = \frac{1}{2}\underline{\dot{y}}^T \left[m_{\rm ph} \right] \underline{\dot{y}} = \frac{1}{2}\underline{\dot{q}}^T \left[m_0 \right] \underline{\dot{q}}$$
 3.

With $[m_0] = [\Lambda_m]^T [m_{\rm ph}] [\Lambda_m]$

The kinetic term of the Lagrangian equation becomes:

$$\frac{d}{dt} \left(\frac{\partial T}{\partial \underline{\dot{q}}} \right)^T - \left(\frac{\partial T}{\partial \underline{q}} \right)^T = [m_0] \underline{\ddot{q}}$$

$$4.$$

We can then calculate the work of the time dependent forces (our servo actuators):

$$\delta W = \delta \underline{y}_f^T \underline{f}_{\rm ph} = [\delta \theta_{\rm A1}, \delta \theta_{\rm A2}] \begin{bmatrix} \tau_1 \\ \tau_2 \end{bmatrix} = [\delta q_1, \delta q_2] \begin{bmatrix} \tau_1 \\ \tau_2 \end{bmatrix} = \delta \underline{q}^T \underline{f}_{\rm ph}$$
 5.

(In this case $[\Lambda_f]$ is simply the identity matrix)

$$\underline{f}(t) = \left[\Lambda_f\right]^T \underline{f}_{\rm ph} = \underline{f}_{\rm ph} \tag{6}$$

Our Lagrange equation becomes:

$$[m_0]\ddot{q} = f(t) \tag{7}$$

$$\begin{bmatrix} \tau_1 \\ \tau_2 \end{bmatrix} = \begin{pmatrix} m_{11} & m_{12} \\ m_{21} & m_{22} \end{pmatrix} \begin{bmatrix} \ddot{q_1} \\ \ddot{q_2} \end{bmatrix}$$
 8.

With these equations we can calculate the torque applied on the load axles when a specific angular acceleration occurs (or if we invert it, the necessary torque to have a desired acceleration on the load axles).

This is a good starting point to analyze eventual cross interactions between the two axles.

The humble Jacobian of Inertia

The system has 4 links (4x3 DOF = 12 DOF) and 5 revolute joints (each cosntraing 2 DOF) => -10 DOF): in total we have 2 DOF

Our Jacobian will be a 12x2 matrix

Our Jacobian will be a
$$12x2$$
 matrix
$$\begin{bmatrix} \lambda_{1,1} & \lambda_{1,2} \\ \lambda_{2,1} & \lambda_{2,2} \\ \lambda_{3,1} & \lambda_{3,2} \\ \lambda_{4,1} & \lambda_{4,2} \\ \lambda_{5,1} & \lambda_{5,2} \\ \lambda_{7,1} & \lambda_{7,2} \\ \lambda_{8,1} & \lambda_{8,2} \\ \lambda_{9,1} & \lambda_{9,2} \\ \lambda_{10,1} & \lambda_{10,2} \\ \lambda_{12,1} & \lambda_{12,2} \end{bmatrix} = \begin{bmatrix} -L\sin(\theta_{\text{Al}}) & 0 \\ +L\cos(\theta_{\text{Al}}) & 0 \\ 0 \\ \lambda_{4,1} & \lambda_{4,2} \\ \lambda_{5,1} & \lambda_{5,2} \\ \lambda_{6,1} & \lambda_{6,2} \\ \lambda_{7,1} & \lambda_{7,2} \\ \lambda_{8,1} & \lambda_{8,2} \\ \lambda_{9,1} & \lambda_{9,2} \\ 0 & -L\sin(\theta_{\text{A2}}) \\ 0 & 1 \end{bmatrix}$$
 The remaining terms needs to be calculate cumbersome by hand. I used the MATLAE

The remaining terms needs to be calculated keeping in mind the inverse kinematics, which is cumbersome by hand. I used the MATLAB Symbolic Math Toolbox. For this reason they are *slightly longer* and are left in the appendix for clarity.

With our Jacobian we can then calculate the generalized mass $[m_0]$ (again with the Symbolic Toolbox)

How decoupled are we?

$$\begin{bmatrix} \tau_1 \\ \tau_2 \end{bmatrix} = \begin{pmatrix} m_{11} & m_{12} \\ m_{21} & m_{22} \end{pmatrix} \begin{bmatrix} \ddot{q_1} \\ \ddot{q_2} \end{bmatrix}$$
 9.

Let's bring back the Lagrange equation and see what happens at the "resting position":

rgaf(0,pi/2,true)

$$[m_0]({\rm rest}) = \begin{pmatrix} 10.2287 & 0.0002 \\ 0.0002 & 10.2271 \end{pmatrix} \end{10}. \label{eq:m0}$$

So, to obtain $1\frac{\text{rad}}{s^2}$ of acceleration on the 1st active link we need 10.2287 Nm on the 1st load axle and 0.0002 Nm on the 2nd load axle (which when accounting for the r = 70 gear ratio results in 0.1461 Nm and 2.8571×10^{-6} on the motor axles respectively)

Dually, by inverting we have:

$$\begin{bmatrix} \ddot{q}_1 \\ \ddot{q}_2 \end{bmatrix} = [m_0]^{-1} \begin{bmatrix} \tau_1 \\ \tau_2 \end{bmatrix}$$
 11.

$$[m_0]^{-1}(\text{rest}) = \begin{pmatrix} 0.0978 & -0.0000 \\ -0.0000 & 0.0978 \end{pmatrix}$$
 12.

Which means that when applying 1Nm on the 1st active load axle we'll end up with $0.0978\frac{\text{rad}}{s^2}$ on the first active link and a negligible acceleration on the second load axle. **Great!**

Be aware that symbolically inverting $[m_0]$ is useless because we can just invert the matrix after the evaluation.

Relative gain array analysis

Relative gain array Article Talk Read Edit View history Tools >

From Wikipedia, the free encyclopedia

The **relative gain array** (RGA) is a classical widely-used [citation needed] method for determining the best input-output pairings for multivariable process control systems. [1] It has many practical open-loop and closed-loop control applications and is relevant to analyzing many fundamental steady-state closed-loop system properties such as stability and robustness. [2]

Standard control theory method to evaluate the decoupling (or not) of a MIMO system. I only have these slides in Italian, I'm sorry guys :(

- MATTICE DEI GURDAGNI RELANVI (RGA, RELATIVE GAN ARRAY)

- UTILE PER: VALUTARE IL GRADO DI INTERAZIONE

- SCEENERE I MIGNORI ACCOPPINIMENTI I/O

- PROTESI

1. G(s) AS. STABILE

2. det G(o) 70

PRODOTTO DI SCHUR

(ELEMENTO PER ELEMENTO)

RGA

A = G(o) O (G(o)^-1) MATTICE MXM

- SE A = I => INTERAZIONE DEBOLE

CON GLI ACCOPPIAMENT I {V; y; }

CASO M=2
$$G(\circ) = \begin{bmatrix} M_{11} & M_{12} \\ M_{21} & M_{22} \end{bmatrix} \qquad G(\circ) = \frac{1}{\det G(\circ)} \begin{bmatrix} M_{22} - M_{12} \\ -M_{21} & M_{11} \end{bmatrix}$$

$$\left(G(\circ)^{-1}\right)' = \frac{1}{\det G(\circ)} \begin{bmatrix} M_{22} - \mu_{21} \\ -\mu_{12} & \mu_{11} \end{bmatrix} \qquad \det G(\circ) = \mu_{11} \mu_{22} - \mu_{12} \mu_{21}$$

$$\Lambda = G(\circ) \bigcirc (G(\circ)^{-1})' = \frac{1}{\det G(\circ)} \begin{bmatrix} M_{11} M_{22} & -M_{12} \mu_{21} \\ -\mu_{12} \mu_{21} & M_{11} M_{22} \end{bmatrix}$$

$$Powerdo \lambda = \frac{M_{11} M_{22}}{\det G(\circ)} \Rightarrow \Lambda = \begin{bmatrix} \lambda & 1 - \lambda \\ 1 - \lambda & \lambda \end{bmatrix}$$

$$S \in \lambda = 1 \Rightarrow \Lambda = \Gamma_{2} \qquad M_{11} M_{12} M_{13} M_{13} M_{23} \Rightarrow \Lambda = \Gamma_{2} \qquad M_{14} M_{15} M_{15} M_{25} \Rightarrow \Lambda = \Gamma_{2} M_{15} M_{$$

Caso M=2 (SEQUE)

$$\Lambda = \begin{bmatrix} \lambda & 1-\lambda \\ 1-\lambda & \lambda \end{bmatrix} \qquad \overline{\Lambda} = \begin{bmatrix} 1-\lambda & \lambda \\ \lambda & 1-\lambda \end{bmatrix}$$

$$\Lambda = \begin{bmatrix} \lambda & 1-\lambda \\ 1-\lambda & \lambda \end{bmatrix} \qquad \overline{\Lambda} = \begin{bmatrix} 1-\lambda & \lambda \\ \lambda & 1-\lambda \end{bmatrix}$$

$$\Lambda = \begin{bmatrix} \lambda & 1-\lambda \\ 1-\lambda & \lambda \end{bmatrix} \qquad \overline{\Lambda} = \begin{bmatrix} 1-\lambda & \lambda \\ \lambda & 1-\lambda \end{bmatrix}$$

$$\Lambda = \begin{bmatrix} \lambda & 1-\lambda \\ \lambda & 1-\lambda \end{bmatrix}$$

$$\Lambda = \begin{bmatrix} \lambda & 1-\lambda \\ \lambda & 1-\lambda \end{bmatrix}$$

$$\Lambda = \begin{bmatrix} \lambda & 1-\lambda \\ \lambda & 1-\lambda \end{bmatrix}$$

$$\Lambda = \begin{bmatrix} \lambda & 1-\lambda \\ \lambda & 1-\lambda \end{bmatrix}$$

$$\Lambda = \begin{bmatrix} \lambda & 1-\lambda \\ \lambda & 1-\lambda \end{bmatrix}$$

$$\Lambda = \begin{bmatrix} \lambda & 1-\lambda \\ \lambda & 1-\lambda \end{bmatrix}$$

$$\Lambda = \begin{bmatrix} \lambda & 1-\lambda \\ \lambda & 1-\lambda \end{bmatrix}$$

$$\Lambda = \begin{bmatrix} \lambda & 1-\lambda \\ \lambda & 1-\lambda \end{bmatrix}$$

$$\Lambda = \begin{bmatrix} \lambda & 1-\lambda \\ \lambda & 1-\lambda \end{bmatrix}$$

$$\Lambda = \begin{bmatrix} \lambda & 1-\lambda \\ \lambda & 1-\lambda \end{bmatrix}$$

$$\Lambda = \begin{bmatrix} \lambda & 1-\lambda \\ \lambda & 1-\lambda \end{bmatrix}$$

$$\Lambda = \begin{bmatrix} \lambda & 1-\lambda \\ \lambda & 1-\lambda \end{bmatrix}$$

$$\Lambda = \begin{bmatrix} \lambda & 1-\lambda \\ \lambda & 1-\lambda \end{bmatrix}$$

$$\Lambda = \begin{bmatrix} \lambda & 1-\lambda \\ \lambda & 1-\lambda \end{bmatrix}$$

$$\Lambda = \begin{bmatrix} \lambda & 1-\lambda \\ \lambda & 1-\lambda \end{bmatrix}$$

$$\Lambda = \begin{bmatrix} \lambda & 1-\lambda \\ \lambda & 1-\lambda \end{bmatrix}$$

$$\Lambda = \begin{bmatrix} \lambda & 1-\lambda \\ \lambda & 1-\lambda \end{bmatrix}$$

$$\Lambda = \begin{bmatrix} \lambda & 1-\lambda \\ \lambda & 1-\lambda \end{bmatrix}$$

$$\Lambda = \begin{bmatrix} \lambda & 1-\lambda \\ \lambda & 1-\lambda \end{bmatrix}$$

$$\Lambda = \begin{bmatrix} \lambda & 1-\lambda \\ \lambda & 1-\lambda \end{bmatrix}$$

$$\Lambda = \begin{bmatrix} \lambda & 1-\lambda \\ \lambda & 1-\lambda \end{bmatrix}$$

$$\Lambda = \begin{bmatrix} \lambda & 1-\lambda \\ \lambda & 1-\lambda \end{bmatrix}$$

$$\Lambda = \begin{bmatrix} \lambda & 1-\lambda \\ \lambda & 1-\lambda \end{bmatrix}$$

$$\Lambda = \begin{bmatrix} \lambda & 1-\lambda \\ \lambda & 1-\lambda \end{bmatrix}$$

$$\Lambda = \begin{bmatrix} \lambda & 1-\lambda \\ \lambda & 1-\lambda \end{bmatrix}$$

$$\Lambda = \begin{bmatrix} \lambda & 1-\lambda \\ \lambda & 1-\lambda \end{bmatrix}$$

$$\Lambda = \begin{bmatrix} \lambda & 1-\lambda \\ \lambda & 1-\lambda \end{bmatrix}$$

$$\Lambda = \begin{bmatrix} \lambda & 1-\lambda \\ \lambda & 1-\lambda \end{bmatrix}$$

$$\Lambda = \begin{bmatrix} \lambda & 1-\lambda \\ \lambda & 1-\lambda \end{bmatrix}$$

$$\Lambda = \begin{bmatrix} \lambda & 1-\lambda \\ \lambda & 1-\lambda \end{bmatrix}$$

$$\Lambda = \begin{bmatrix} \lambda & 1-\lambda \\ \lambda & 1-\lambda \end{bmatrix}$$

$$\Lambda = \begin{bmatrix} \lambda & 1-\lambda \\ \lambda & 1-\lambda \end{bmatrix}$$

$$\Lambda = \begin{bmatrix} \lambda & 1-\lambda \\ \lambda & 1-\lambda \end{bmatrix}$$

$$\Lambda = \begin{bmatrix} \lambda & 1-\lambda \\ \lambda & 1-\lambda \end{bmatrix}$$

$$\Lambda = \begin{bmatrix} \lambda & 1-\lambda \\ \lambda & 1-\lambda \end{bmatrix}$$

$$\Lambda = \begin{bmatrix} \lambda & 1-\lambda \\ \lambda & 1-\lambda \end{bmatrix}$$

$$\Lambda = \begin{bmatrix} \lambda & 1-\lambda \\ \lambda & 1-\lambda \end{bmatrix}$$

$$\Lambda = \begin{bmatrix} \lambda & 1-\lambda \\ \lambda & 1-\lambda \end{bmatrix}$$

$$\Lambda = \begin{bmatrix} \lambda & 1-\lambda \\ \lambda & 1-\lambda \end{bmatrix}$$

$$\Lambda = \begin{bmatrix} \lambda & 1-\lambda \\ \lambda & 1-\lambda \end{bmatrix}$$

$$\Lambda = \begin{bmatrix} \lambda & 1-\lambda \\ \lambda & 1-\lambda \end{bmatrix}$$

$$\Lambda = \begin{bmatrix} \lambda & 1-\lambda \\ \lambda & 1-\lambda \end{bmatrix}$$

$$\Lambda = \begin{bmatrix} \lambda & 1-\lambda \\ \lambda & 1-\lambda \end{bmatrix}$$

$$\Lambda = \begin{bmatrix} \lambda & 1-\lambda \\ \lambda & 1-\lambda \end{bmatrix}$$

$$\Lambda = \begin{bmatrix} \lambda & 1-\lambda \\ \lambda & 1-\lambda \end{bmatrix}$$

$$\Lambda = \begin{bmatrix} \lambda & 1-\lambda \\ \lambda & 1-\lambda \end{bmatrix}$$

$$\Lambda = \begin{bmatrix} \lambda & 1-\lambda \\ \lambda & 1-\lambda \end{bmatrix}$$

$$\Lambda = \begin{bmatrix} \lambda & 1-\lambda \\ \lambda & 1-\lambda \end{bmatrix}$$

$$\Lambda = \begin{bmatrix} \lambda & 1-\lambda \\ \lambda & 1-\lambda \end{bmatrix}$$

$$\Lambda = \begin{bmatrix} \lambda & 1-\lambda \\ \lambda & 1-\lambda \end{bmatrix}$$

$$\Lambda = \begin{bmatrix} \lambda & 1-\lambda \\ \lambda & 1-\lambda \end{bmatrix}$$

$$\Lambda = \begin{bmatrix} \lambda & 1-\lambda \\ \lambda & 1-\lambda \end{bmatrix}$$

$$\Lambda = \begin{bmatrix} \lambda & 1-\lambda \\ \lambda & 1-\lambda \end{bmatrix}$$

$$\Lambda = \begin{bmatrix} \lambda & 1-\lambda \\ \lambda & 1-\lambda \end{bmatrix}$$

$$\Lambda = \begin{bmatrix} \lambda & 1-\lambda \\ \lambda & 1-\lambda \end{bmatrix}$$

$$\Lambda = \begin{bmatrix} \lambda & 1-\lambda \\ \lambda & 1-\lambda \end{bmatrix}$$

$$\Lambda = \begin{bmatrix} \lambda & 1-\lambda \\ \lambda & 1-\lambda \end{bmatrix}$$

$$\Lambda = \begin{bmatrix} \lambda & 1-\lambda \\ \lambda & 1-\lambda \end{bmatrix}$$

$$\Lambda = \begin{bmatrix} \lambda & 1-\lambda \\ \lambda & 1-\lambda \end{bmatrix}$$

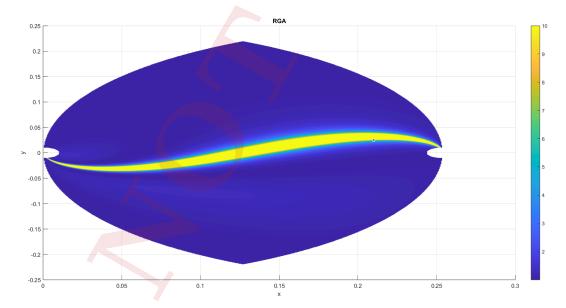
$$\Lambda = \begin{bmatrix} \lambda & 1-\lambda \\ \lambda & 1-\lambda \end{bmatrix}$$

$$\Lambda = \begin{bmatrix} \lambda & 1-\lambda \\ \lambda & 1-\lambda \end{bmatrix}$$

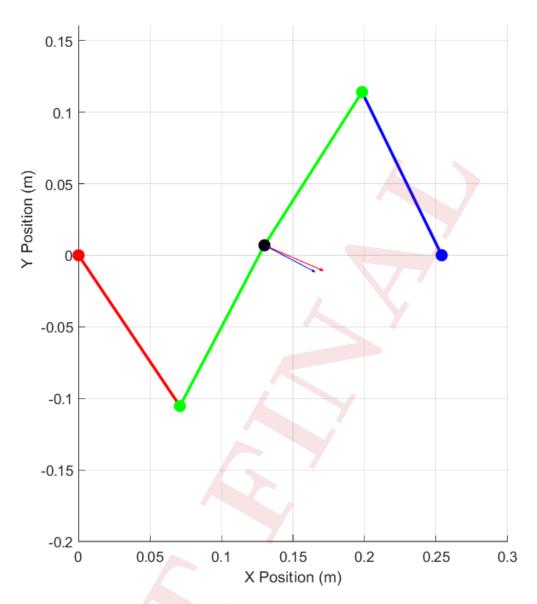
$$\Lambda = \begin{bmatrix} \lambda & 1-$$

Analysis Approach

Let's plot $\lambda_{\rm rga}$ on the Cartesian workspace. When $\lambda_{\rm rga} \approx 1$ it means we have high decoupling, otherwise we have cross-coupling between the active links:



We can see how we have good decoupling everywhere but in the singularity region, which is great and makes sense if you think about it:



When near the singularity, every torque applied on one axle is fully transferred to the other axle = high RGA!

Appendix

Jacobian terms

```
-(L^2*(\cos(ta2) - \cos(ta1) + 2)^2 + L^2*(\sin(ta1) - \sin(ta2))^2)/(4*L^2))^(1/2));
jac(7,1) = -L*sin(ta1) + (sin(angle(L*(sin(ta1) - sin(ta2))*(-1 - 1i)) +
acos((L^2*(cos(ta2) - cos(ta1) + 2)^2 + L^2*(sin(ta1) - sin(ta2))^2)^(1/2)/
 (2*L)))*(2*L^2*sin(ta1)*(cos(ta2) - cos(ta1) + 2) + 2*L^2*cos(ta1)*(sin(ta1))
\sin(ta2)))/(4*(L^2*(cos(ta2) - cos(ta1) + 2)^2 + L^2*(sin(ta1) - sin(ta2))^2)^(1/2)*(1
 -(L^2*(\cos(ta2) - \cos(ta1) + 2)^2 + L^2*(\sin(ta1) - \sin(ta2))^2)/(4*L^2))^(1/2)) -
 (\sin(\arg(L^*(\sin(ta)) - \sin(ta)))*(-1 - 1i)) - \arccos((L^2*(\cos(ta)) - \cos(ta)) +
2)^2 + L^2*(\sin(\tan 1) - \sin(\tan 2))^2)^(1/2)/(2*L)))*(2*L^2*\sin(\tan 1)*(\cos(\tan 2) - \cos(\tan 1))
+ 2) + 2*L^2*cos(ta1)*(sin(ta1) - sin(ta2))))/(8*(L^2*(cos(ta2) - cos(ta1) + 2)^2 + (cos(ta2) - cos(ta1)))/(8*(L^2*(cos(ta2) - cos(ta1)))/(8*(L^2*(cos(ta1) - cos(ta1)))/(8*(L^2*(cos(ta
L^2*(\sin(\tan 1) - \sin(\tan 2))^2)^(1/2)*(1 - (L^2*(\cos(\tan 2) - \cos(\tan 1) + 2)^2 + L^2*(\sin(\tan 1) + 2)^2)^2
 - sin(ta2))^2)/(4*L^2))^(1/2));
jac(8,1) = L*cos(tal) - (cos(angle(L*(sin(tal) - sin(ta2))*(-1 - 1i)))
acos((L^2*(cos(ta2) - cos(ta1) + 2)^2 + L^2*(sin(ta1) - sin(ta2))^2)^(1/2)/
 (2*L))*(2*L^2*sin(tal)*(cos(ta2) - cos(tal) + 2) + 2*L^2*cos(tal)*(sin(tal))
\sin(ta2)))/(4*(L^2*(cos(ta2) - cos(ta1) + 2)^2 + L^2*(sin(ta1) - sin(ta2))^2)^(1/2)*(1
 -(L^2*(cos(ta2) - cos(ta1) + 2)^2 + L^2*(sin(ta1) - sin(ta2))^2)/(4*L^2))^(1/2)) +
 (\cos(\operatorname{angle}(L^*(\sin(\tan 1) - \sin(\tan 2))^*(-1 - 1i)) - \cos((L^2*(\cos(\tan 2) - \cos(\tan 1) + \cos((\tan 2))^*)))
2)^2 + L^2*(\sin(\tan 1) - \sin(\tan 2))^2(1/2)/(2*L)))*(2*L^2*\sin(\tan 1)*(\cos(\tan 2) - \cos(\tan 1))
L^2*(\sin(\tan 1) - \sin(\tan 2))^2(1/2)*(1 - (L^2*(\cos(\tan 2) - \cos(\tan 1) + 2)^2 + L^2*(\sin(\tan 1) + 2)^2)
 - sin(ta2))^2)/(4*L^2))^(1/2));
jac(9,1) = (2*L^2*sin(ta1)*(cos(ta2) - cos(ta1) + 2) + 2*L^2*cos(ta1)*(sin(ta1) - cos(ta1) + 2) + 2*L^2*(cos(ta1) + + 2) +
\sin(ta2))/(4*L*(L^2*(\cos(ta2) - \cos(ta1) + 2)^2 + L^2*(\sin(ta1) - \sin(ta2))^2)^(1/2)*(1
 -(L^2*(\cos(ta2) - \cos(ta1) + 2)^2 + L^2*(\sin(ta1) - \sin(ta2))^2)/(4*L^2))^(1/2));
jac(4,2) = -(sin(angle(L*(sin(ta1) - sin(ta2))*(-1 - 1i)) + acos((L^2*(cos(ta2) - 1))*(-1 - 1i))) + acos((L^2*(cos(ta2) - 1))) + acos((L^2*(cos(ta2) - 1)))) + acos((L^2*(cos
cos(ta1) + 2)^2 + L^2*(sin(ta1) - sin(ta2))^2)^(1/2)/(2*L)))*(2*L^2*sin(ta2)*(cos(ta2))
 -\cos(\tan t) + 2 + 2*L^2*\cos(\tan t)*(\sin(\tan t) - \sin(\tan t)))/(8*(L^2*(\cos(\tan t) - \cos(\tan t)))
 + 2)^2 + L^2*(\sin(\tan 1) - \sin(\tan 2))^2(1/2)*(1 - (L^2*(\cos(\tan 2) - \cos(\tan 1) + 2)^2 +
L^2*(\sin(\tan 1) - \sin(\tan 2))^2)/(4*L^2))^(1/2));
\cos(\tan 1) + 2)^2 + L^2*(\sin(\tan 1) - \sin(\tan 2))^2)^(1/2)/(2*L)))*(2*L^2*\sin(\tan 2)*(\cos(\tan 2))^2
 -\cos(\tan 1) + 2 + 2*L^2*\cos(\tan 2)*(\sin(\tan 1) - \sin(\tan 2))))/(8*(L^2*(\cos(\tan 2) - \cos(\tan 1)))
+ 2)^2 + L^2*(\sin(\tan 1) - \sin(\tan 2))^2)^(1/2)*(1 - (L^2*(\cos(\tan 2) - \cos(\tan 1) + 2)^2 +
L^2*(\sin(\tan 1) - \sin(\tan 2))^2/(4*L^2))^(1/2));
 jac(6,2) = (2*L^2*sin(ta2)*(cos(ta2) - cos(ta1) + 2) + 2*L^2*cos(ta2)*(sin(ta1) - cos(ta2)*(sin(ta1) - cos(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(sin(ta2)*(s
\sin(ta2)))/(4*L*(L^2*(cos(ta2) - cos(ta1) + 2)^2 + L^2*(sin(ta1) - sin(ta2))^2)^(1/2)*(1
 -(L^2*(\cos(ta2) - \cos(ta1) + 2)^2 + L^2*(\sin(ta1) - \sin(ta2))^2)/(4*L^2))^(1/2));
\cos(\tan 1) + 2^2 + L^2*(\sin(\tan 1) - \sin(\tan 2))^2(1/2)/(2*L))*(2*L^2*\sin(\tan 2)*(\cos(\tan 2))
 -\cos(\tan 1) + 2 + 2*L^2*\cos(\tan 2)*(\sin(\tan 1) - \sin(\tan 2))))/(4*(L^2*(\cos(\tan 2) - \cos(\tan 1)))
+ 2)^2 + L^2*(\sin(\tan x) - \sin(\tan x))^2(1/2)*(1 - (L^2*(\cos(\tan x) - \cos(\tan x) + 2)^2 +
L^2*(\sin(\tan 1) - \sin(\tan 2))^2/(4*L^2))^(1/2)) + (\sin(\arg e(L*(\sin(\tan 1) - \sin(\tan 2))*(-1))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2)^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^
 -1i)) - acos((L<sup>2*</sup>(cos(ta2) - cos(ta1) + 2)<sup>2</sup> + L<sup>2*</sup>(sin(ta1) - sin(ta2))<sup>2</sup>)<sup>(1/2)</sup>/
 (2*L))*(2*L^2*sin(ta2)*(cos(ta2) - cos(ta1) + 2) + 2*L^2*cos(ta2)*(sin(ta1))
\sin(ta2)))/(8*(L^2*(cos(ta2) - cos(ta1) + 2)^2 + L^2*(sin(ta1) - sin(ta2))^2)^(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*
 -(L^2*(\cos(ta2) - \cos(ta1) + 2)^2 + L^2*(\sin(ta1) - \sin(ta2))^2)/(4*L^2))^(1/2));
cos(ta1) + 2)^2 + L^2*(sin(ta1) - sin(ta2))^2)^(1/2)/(2*L)))*(2*L^2*sin(ta2)*(cos(ta2))^2)^2
 -\cos(ta1) + 2) + 2*L^2*\cos(ta2)*(\sin(ta1) - \sin(ta2))))/(4*(L^2*(\cos(ta2) - \cos(ta1)))
```

 $+ 2)^2 + L^2*(\sin(ta1) - \sin(ta2))^2)^{(1/2)}*(1 - (L^2*(\cos(ta2) - \cos(ta1) + 2)^2 + L^2*(\sin(ta1) - \sin(ta2))^2)^{(1/2)}*(1 - (\cos(angle(L*(\sin(ta1) - \sin(ta2))^*(-1 - 1i)) - acos((L^2*(\cos(ta2) - \cos(ta1) + 2)^2 + L^2*(\sin(ta1) - \sin(ta2))^2)^{(1/2)}/(2*L)))^{(2*L)}*(\cos(ta2) - \cos(ta1) + 2)^2 + L^2*(\sin(ta1) - \sin(ta2))^2)^{(1/2)}/(2*L)))^{(2*L^2*\sin(ta2)*(\cos(ta2) - \cos(ta1) + 2)^2 + L^2*(\sin(ta1) - \sin(ta2))^2)^{(1/2)}*(1 - (L^2*(\cos(ta2) - \cos(ta1) + 2)^2 + L^2*(\sin(ta1) - \sin(ta2))^2)^{(1/2)}*(1 - (L^2*(\cos(ta2) - \cos(ta1) + 2)^2 + L^2*(\sin(ta1) - \sin(ta2))^2)^{(1/2)}*(1 - \sin(ta2))^{(1/2)}*(1 - (L^2*(\cos(ta2) - \cos(ta1) + 2)^2 + L^2*(\sin(ta1) - \sin(ta2))^2)^{(1/2)}*(1 - (L^2*(\cos(ta2) - \cos(ta1) + 2)^2 + L^2*(\sin(ta1) - \sin(ta2))^2)^{(1/2)}*(1 - (L^2*(\cos(ta2) - \cos(ta1) + 2)^2 + L^2*(\sin(ta1) - \sin(ta2))^2)^{(1/2)}*(1 - (L^2*(\cos(ta2) - \cos(ta1) + 2)^2 + L^2*(\sin(ta1) - \sin(ta2))^2)^{(1/2)}*(1 - (L^2*(\cos(ta2) - \cos(ta1) + 2)^2 + L^2*(\sin(ta1) - \sin(ta2))^2)^{(1/2)}*(1 - (L^2*(\cos(ta2) - \cos(ta1) + 2)^2 + L^2*(\sin(ta1) - \sin(ta2))^2)^{(1/2)}*(1 - (L^2*(\cos(ta2) - \cos(ta1) + 2)^2 + L^2*(\sin(ta1) - \sin(ta2))^2)^{(1/2)}*(1 - (L^2*(\cos(ta2) - \cos(ta1) + 2)^2 + L^2*(\sin(ta1) - \sin(ta2))^2)^{(1/2)}*(1 - (L^2*(\cos(ta2) - \cos(ta1) + 2)^2 + L^2*(\sin(ta1) - \sin(ta2))^2)^{(1/2)}*(1 - (L^2*(\cos(ta2) - \cos(ta1) + 2)^2 + L^2*(\sin(ta1) - \sin(ta2))^2)^{(1/2)}*(1 - (L^2*(\cos(ta2) - \cos(ta1) + 2)^2 + L^2*(\sin(ta1) - \sin(ta2))^2)^2)^{(1/2)}*(1 - (L^2*(\cos(ta2) - \cos(ta1) + 2)^2 + L^2*(\sin(ta1) - \sin(ta2))^2)^2)^2$

Generalized Mass

mm(1,1) = Ja + M*(L*cos(tal) - (cos(angle(L*(sin(tal) - sin(ta2))*(-1 - 1i))) $+ a\cos((L^2*(\cos(ta2) - \cos(ta1) + 2)^2 + L^2*(\sin(ta1) - \sin(ta2))^2)^{(1/2)}$ $(2*L)))*(2*L^2*sin(ta1)*(cos(ta2) - cos(ta1) + 2) + 2*L^2*cos(ta1)*(sin(ta1))$ $\sin(\tan 2)))/(4*(L^2*(\cos(\tan 2) - \cos(\tan 1) + 2)^2 + L^2*(\sin(\tan 1) - \sin(\tan 2))^2)^(1/2)*(1$ $-(L^2*(\cos(ta2) - \cos(ta1) + 2)^2 + L^2*(\sin(ta1) - \sin(ta2))^2)/(4*L^2))^{(1/2)}$ $(\cos(angle(L*(sin(tal) - sin(ta2))*(-1 - 1i)) - acos((L^2*(cos(ta2)))*(-1 - 1i)))$ $cos(ta1) + 2)^2 + L^2*(sin(ta1) - sin(ta2))^2)^(1/2)/(2*L)))*(2*L^2*sin(ta1)*(cos(ta2))^2)^2$ $cos(ta1) + 2) + 2*L^2*cos(ta1)*(sin(ta1) - sin(ta2))))/(8*(L^2*(cos(ta2))))$ $\cos(\tan 1) + 2)^2 + L^2*(\sin(\tan 1) - \sin(\tan 2))^2)^(1/2)*(1 - (L^2*(\cos(\tan 2))^2)^2)^2$ $\cos(\tan t) + 2)^2 + L^2*(\sin(\tan t) - \sin(\tan t))^2/(4*L^2))^(1/2)))*(L*cos(tal)$ $(\cos(\sin(a\cos((L^2*(\cos(ta2) - \cos(ta1) + 2)^2 + L^2*(\sin(ta1) - \sin(ta2))^2)^{(1/2)})$ (2*L)) + angle(L*(sin(ta1) - sin(ta2))*(- 1 - 1i)))*(2*L^2*sin(ta1)*(cos(ta2)) $cos(ta1) + 2) + 2*L^2*cos(ta1)*(sin(ta1) - sin(ta2))))/(4*conj((1 - (L^2*(cos(ta2)))))/(4*conj((1 - (L^2*(cos(ta2))))/(4*conj((1 - (L^2*(cos(ta2)))))/(4*conj((1 - (L^2*(cos(ta2))))/(4*conj((1 - (L^2*(cos(ta2))))/(4*conj((1 - (L^2*(cos(ta2)))))/(4*conj($ $-\cos(\tan t) + 2^2 + L^2*(\sin(\tan t) - \sin(\tan t)^2/(4*L^2)^{(1/2)}*(L^2*(\cos(\tan t) - \cos(\tan t))^2/(4*L^2))^2$ $cos(ta1) + 2)^2 + L^2*(sin(ta1) - sin(ta2))^2)^(1/2)) + (cos(conj(acos((L^2*(cos(ta2))^2)^2)^2)^2)^2)^2$ $-\cos(ta1) + 2)^2 + L^2*(\sin(ta1) - \sin(ta2))^2(1/2)/(2*L))) - angle(L*(sin(ta1))^2)^2(1/2)/(2*L)))$ $\sin(\tan 2)$ *(- 1 - 1i)))*(2*L^2*sin(\ta1)*(\cos(\ta2)) cos(tal) $2*L^2*cos(ta1)*(sin(ta1) - sin(ta2))))/(8*conj((1 - (L^2*(cos(ta2) - cos(ta1) + (a2))))/(8*conj((1 - (b2*(cos(ta2) - cos(ta2) + (a2)))/(8*conj((1 - (b2*(cos(ta2) - (a2)))/(8*c$ $2)^2 + L^2*(\sin(\tan x) - \sin(\tan x))^2/(4*L^2))^(1/2))*(L^2*(\cos(\tan x) - \cos(\tan x) + 2)^2$ $+ L^2*(\sin(ta1) - \sin(ta2))^2)^(1/2))) + M*(L*cos(ta1) - (cos(angle(L*(sin(ta1)))^2)^2)^2)^2$ $sin(ta2))*(-1 - 1i)) + acos((L^2*(cos(ta2) - cos(ta1) + 2)^2)$ $L^2*(\sin(ta1) - \sin(ta2))^2)^(1/2)/(2*L)))*(2*L^2*\sin(ta1)*(\cos(ta2) - \cos(ta1) +$ $2) + 2*L^2*cos(ta1)*(sin(ta1) - sin(ta2))))/(8*(L^2*(cos(ta2) - cos(ta1) + 2)^2 +$ $L^2*(\sin(\tan 1) - \sin(\tan 2))^2(1/2)*(1 - (L^2*(\cos(\tan 2) - \cos(\tan 1) + 2)^2 + L^2*(\sin(\tan 1) + 2)^2)$ $-\sin(ta2))^2/(4*L^2))^(1/2))*(L*cos(ta1) - (cos(conj(acos((L^2*(cos(ta2) - cos(ta1))))))))$ $+ 2)^2 + L^2*(\sin(ta1) - \sin(ta2))^2)^(1/2)/(2*L))) + angle(L*(sin(ta1) - sin(ta2))*((1 - 1i))*(2*L^2*sin(ta1)*(cos(ta2) - cos(ta1) + 2) + 2*L^2*cos(ta1)*(sin(ta1))*(2*L^2*sin(ta1)*(cos(ta2) - cos(ta1) + 2) + 2*L^2*cos(ta1)*(sin(ta1))*(2*L^2*sin(ta1)*(cos(ta2) - cos(ta1) + 2) + 2*L^2*cos(ta1)*(sin(ta1))*(cos(ta2) - cos(ta1) + 2) + 2*L^2*cos(ta1)*(sin(ta1))*(cos(ta2) - cos(ta1) + 2) + 2*L^2*cos(ta1)*(sin(ta1))*(cos(ta2) - cos(ta1) + 2) + 2*L^2*cos(ta1)*(cos(ta2) - cos(ta1))*(cos(ta2) - cos(ta2))*(cos(ta2) - cos(ta2))*($ $\sin(ta2))))/(8*conj((1 - (L^2*(cos(ta2) - cos(ta1) + 2)^2 + L^2*(sin(ta1)))))$ $\sin(ta2)^2/(4*L^2)^(1/2)*(L^2*(cos(ta2) - cos(ta1) + 2)^2 + L^2*(sin(ta1))$ $\sin(\tan 2)$)^2)^(1/2))) + $(L^2*M*\cos(\tan 1)^2)/4 + (L^2*M*\sin(\tan 1)^2)/4 - M*(L*\sin(\tan 1)^2)/4$ $-(\sin(\arg(L^*(\sin(ta)) - \sin(ta)))^*(-1 - 1i)) + \arccos((L^2*(\cos(ta)) - \cos(ta))$ $+ 2)^2 + L^2*(\sin(\tan 1) - \sin(\tan 2))^2)^(1/2)/(2*L)))*(2*L^2*\sin(\tan 1)*(\cos(\tan 2))^2)^2$ $cos(tal) + 2) + 2*L^2*cos(tal)*(sin(tal) - sin(ta2))))/(4*(L^2*(cos(ta2) - cos(tal)))$ $2)^2 + L^2*(\sin(ta1) - \sin(ta2))^2)^(1/2)*(1 - (L^2*(\cos(ta2) - \cos(ta1)))^2)^2$ $+ 2)^2 + L^2*(\sin(ta1) - \sin(ta2))^2)/(4*L^2))^(1/2)) + (\sin(angle(L*(sin(ta1))^2))^2)/(4*L^2))^2$ sin(ta2))*(- 1 - 1i)) - $acos((L^2*(cos(ta2) - cos(ta1) + 2)^2)$ $L^2*(\sin(ta1) - \sin(ta2))^2)^(1/2)/(2*L)))*(2*L^2*\sin(ta1)*(\cos(ta2) - \cos(ta1) + \cos(ta1))^2)^2$ $2) + 2*L^2*cos(ta1)*(sin(ta1) - sin(ta2))))/(8*(L^2*(cos(ta2) - cos(ta1) + 2)^2 + (cos(ta1) + cos(ta1) + cos$ $L^2*(\sin(ta1) - \sin(ta2))^2)^(1/2)*(1 - (L^2*(\cos(ta2) - \cos(ta1) + 2)^2 + L^2*(\sin(ta1) + 2)^2)^2$ $\sin(\tan 2)^2/(4*L^2)^(1/2))*(-L*\sin(\tan 1) + (\sin(\cos 1/2*(\cos(\tan 2))^2)^2/(4*L^2))^2/(4*L^2))*(-L*\sin(\tan 1) + (\sin(\cos 1/2*(\cos(\tan 2))^2/(4*L^2))^2/(4*L^2))*(-L*\sin(\tan 1) + (\sin(\cos 1/2*(\cos(\tan 2))^2/(4*L^2))^2/(4*L^2))*(-L*\sin(\tan 1) + (\sin(\cos 1/2*(\cos(\tan 1))^2/(4*L^2))^2/(4*L^2))*(-L*\sin(\tan 1) + (\sin(\cos 1/2*(\cos(\tan 1))^2/(4*L^2))^2/(4*L^2))*(-L*\sin(\cos 1/2*(\cos(\tan 1))^2/(4*L^2))^2/(4*L^2))*(-L*\sin(\cos((\tan 1))^2/(4*L^2))^2/(4*L^2))*(-L*\sin((\tan 1))^2/(4*L^2))*(-L*\sin((\tan 1))^2/(4*L^2))^2/(4*L^2))*(-L*\sin((\tan 1))^2/(4*L^2))*(-L*\sin((\tan 1))^2/(4*L^2))*(-L*\cos((\tan 1))^2/(4*L^2))*(-L*\cos((\tan 1))^2/(4*L^2))*(-L*\cos((\tan 1))^2/(4*L^2))*(-L*\cos((\tan 1))^2/(4*L^2))*(-L*\cos((\tan 1))^2/(4*L^2))*(-L*\cos((\tan 1))^2/(4*L^2))*(-L*\cos((\tan 1))^2/(4*L^2))*(-L*\cos((\tan 1))^2/(4*L^2)*(-L*\cos((\tan 1))^2/(4*L^2))*(-L*\cos((\tan 1))^2/(4*L^2))*(-L*\cos((\tan 1))^2/(4*L^2))*(-L*\cos((\tan 1))^2/(4*L^2))*(-L*\cos((\tan 1))^2/(4*L^2))*(-L*\cos((\tan 1))^2/(4*L^2))*(-L*\cos((\tan 1))^2/(4*L^2)*(-L*\cos((\tan 1))^2/(4*L^2)*(-L*\cos((\tan 1))^2/(4*L^2)*(-L*o((\tan 1))^2/(4*L^2)*(\cos(\tan 1) + 2$)² + L²*($\sin(\tan 1) - \sin(\tan 2)$)²)^(1/2)/(2*L))) - $angle(L*(\sin(\tan 1))$ $\sin(\tan 2)$ *(- 1 - 1i)))*(2*L^2*sin(ta1)*(cos(ta2) - cos(ta1) + 2) + $2*L^2*cos(ta1)*(sin(ta1) - sin(ta2))))/(8*conj((1 - (L^2*(cos(ta2) - cos(ta1) + 2)^2))/(8*conj(ta1$ $+ L^2*(\sin(ta1) - \sin(ta2))^2)/(4*L^2))^(1/2))*(L^2*(\cos(ta2) - \cos(ta1) + 2)^2 + (\cos(ta1) + \cos(ta1))^2)$

 $L^2*(\sin(\tan 1) - \sin(\tan 2))^2(1/2)) + (\sin(\cos((L^2*(\cos(\tan 2) - \cos(\tan 1) +$ $2)^2 + L^2*(\sin(\tan) - \sin(\tan))^2(1/2)/(2*L)) + angle(L*(\sin(\tan) - \sin(\tan))*(-2)$ $1 - 1i))*(2*L^2*sin(ta1)*(cos(ta2) - cos(ta1) + 2) + 2*L^2*cos(ta1)*(sin(ta1))*(2*L^2*sin(ta1)*(cos(ta2) - cos(ta1) + 2) + 2*L^2*cos(ta1)*(sin(ta1))*(2*L^2*sin(ta1)*(cos(ta2) - cos(ta1) + 2) + 2*L^2*cos(ta1)*(sin(ta1))*(cos(ta2) - cos(ta1) + 2) + 2*L^2*cos(ta1)*(sin(ta1))*(cos(ta2) - cos(ta1) + 2) + 2*L^2*cos(ta1)*(cos(ta2) - cos(ta1))*(cos(ta2) - cos(ta2))*(cos(ta2) -$ $\sin(ta2))^2/(4*L^2))^(1/2))*(L^2*(cos(ta2) - cos(ta1) + 2)^2 + L^2*(sin(ta1) - cos(ta1))^2$ $\sin(ta2))^2(1/2))$ + $M*(L*\sin(ta1) - (\sin(angle(L*(sin(ta1) - sin(ta2))*(-1 - sin$ 1i) + $acos((L^2*(cos(ta2) - cos(ta1) + 2)^2 + L^2*(sin(ta1) - sin(ta2))^2)^(1/2)/$ $(2*L))*(2*L^2*sin(ta1)*(cos(ta2) - cos(ta1) + 2) + 2*L^2*cos(ta1)*(sin(ta1))*(cos(ta1) + 2) + 2*L^2*cos(ta1)*(cos(ta1))*(cos(ta1) + 2) + 2*L^2*cos(ta1)*(cos(ta1))*$ $\sin(\tan 2)))/(8*(L^2*(\cos(\tan 2) - \cos(\tan 1) + 2)^2 + L^2*(\sin(\tan 1) - \sin(\tan 2))^2)^(1/2)*(1$ $-\cos(ta1) + 2)^2 + L^2*(\sin(ta1))$ $(L^2*(cos(ta2))$ sin(ta2))^2)/ $+ L^2*(\sin(\tan 1) - \sin(\tan 2))^2)^{(1/2)/(2*L))) + angle(L*(\sin(\tan 1) - \sin(\tan 2))^*(-\cos(\tan 1))^2)^2$ 1 - 1i))* $(2*L^2*sin(ta1)*(cos(ta2) - cos(ta1) + 2) + 2*L^2*cos(ta1)*(sin(ta1))$ $-\sin(ta2))))/(8*conj((1 - (L^2*(cos(ta2) - cos(ta1) + 2)^2 + L^2*(sin(ta1)))))$ $-\sin(ta2))^2/(4*L^2))^(1/2))*(L^2*(cos(ta2) - cos(ta1) + 2)^2 + L^2*(sin(ta1))$ $\sin(ta^2)^2(1/2)$ + $(Jp*(2*L^2*sin(ta^2)*(cos(ta^2)) - cos(ta^2))$ + 2) + $2*L^2*cos(ta1)*(sin(ta1) - sin(ta2)))^2)/(8*L^2*conj((1 - (L^2*(cos(ta2) - cos(ta1) + (sin(ta2)))^2))/(8*L^2*conj((1 - (L^2*(cos(ta2) - cos(ta1) + (sin(ta2)))^2))/(8*L^2*conj((1 - (L^2*(cos(ta2) - cos(ta2) + (sin(ta2)))^2))/(8*L^2*(cos(ta2) - cos(ta2) + (sin(ta2)))^2)/(8*L^2*(cos(ta2) - cos(ta2)))/(8*L^2*(cos(ta2) - cos(ta2) + (sin(ta2)))/(8*L^2*(cos(ta2) - cos(ta2) + (sin(ta2)))/(8*L^2*(cos(ta2) - cos(ta2))/(8*L^2*(cos(ta2) - cos(ta2) - cos(ta2))/(8*L^2*(cos(ta2) - cos(ta2) - cos(ta2))/(8*L^2*(cos(ta2) - cos(ta2) - cos($ $2)^2 + L^2*(\sin(\tan 1) - \sin(\tan 2))^2)/(4*L^2))^(1/2))*(L^2*(\cos(\tan 2) - \cos(\tan 1) + 2)^2 + L^2*(\sin(\tan 1) - \sin(\tan 2))^2)/(4*L^2))^2$ $L^2*(\sin(\tan 1) - \sin(\tan 2))^2*(1 - (L^2*(\cos(\tan 2) - \cos(\tan 1) + 2)^2 + L^2*(\sin(\tan 1) - \cos(\tan 1))^2)^2$ $\sin(ta2))^2/(4*L^2)^(1/2);$

 $\cos(\tan 1) + 2$ ² + L²*($\sin(\tan 1) - \sin(\tan 2)$)²(1/2)/(2*L)))*(2*L²*sin(ta2)*($\cos(\tan 2)$) $cos(ta1) + 2) + 2*L^2*cos(ta2)*(sin(ta1) - sin(ta2))))/(4*(L^2*(cos(ta2))))$ $\cos(\tan 1) + 2$ ² + $L^2*(\sin(\tan 1) - \sin(\tan 2)$ ²)^{(1/2)*(1 - ($L^2*(\cos(\tan 2) - \cos(\tan 1)$)} $+ 2)^2 + L^2*(\sin(ta1) - \sin(ta2))^2)/(4*L^2))^(1/2)) - (\sin(angle(L*(sin(ta1)))^2)/(4*L^2))^2 + L^2*(\sin(ta1))^2 + L^2*(\sin(ta1))^2$ sin(ta2))*(- 1 - 1i)) - $acos((L^2*(cos(ta2) - cos(ta1) + 2)^2)$ $L^2*(\sin(ta1) - \sin(ta2))^2(1/2)/(2*L)))*(2*L^2*\sin(ta2)*(\cos(ta2) - \cos(ta1) + \cos(ta1))*(2*L^2*\sin(ta2))*($ $2) + 2*L^2*cos(ta2)*(sin(ta1) - sin(ta2))))/(8*(L^2*(cos(ta2) - cos(ta1) + 2)^2 + cos(ta2))/(8*(L^2*(cos(ta2) - cos(ta2) + cos(ta2) + cos(ta2))/(8*(L^2*(cos(ta2) - cos(ta2) + cos(ta2) + cos(ta2) + cos(ta2))/(8*(L^2*(cos(ta2) - cos(ta2) + cos(t$ $L^2*(\sin(ta1) - \sin(ta2))^2(1/2)*(1 - (L^2*(\cos(ta2) - \cos(ta1) + 2)^2 + L^2*(\sin(ta1))^2)$ $\sin(\tan 2)^2/(4*L^2)^2/(4*L^2)^2/(1/2))$ + $(\sin(\cos((L^2*(\cos(\tan 2))^2)^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))$ $cos(tal) + 2)^2 + L^2*(sin(tal) - sin(ta2))^2)^(1/2)/(2*L))) - angle(L*(sin(tal))^2)^2$ $\sin(\tan 2)$ *(- 1 - 1i)))*(2*L^2*sin(ta1)*(cos(ta2) - cos(ta1) + 2) + $2*L^2*cos(ta1)*(sin(ta1) - sin(ta2))))/(8*conj((1 - (L^2*(cos(ta2) - cos(ta1) + 2)^2))/(8*conj(ta1$ $+ L^2*(\sin(\tan 1) - \sin(\tan 2))^2/(4*L^2))^(1/2))*(L^2*(\cos(\tan 2) - \cos(\tan 1) + 2)^2 +$ $L^2*(\sin(ta1) - \sin(ta2))^2)^(1/2)) + (\sin(\cos((L^2*(\cos(ta2) - \cos(ta1) + \cos(ta2)))^2)^2)^2)^2)^2$ $2)^2 + L^2*(\sin(ta1) - \sin(ta2))^2)^(1/2)/(2*L))) + angle(L*(\sin(ta1) - \sin(ta2))*(-1/2)/(2*L))) + angle(L*(\sin(ta1) - \cos(ta1))) + angle(L*(ta1) - angle(L*(ta1)$ $(1 - 1i))*(2*L^2*sin(ta1)*(cos(ta2) - cos(ta1) + 2) + 2*L^2*cos(ta1)*(sin(ta1))*(2*L^2*sin(ta1)*(cos(ta2) - cos(ta1) + 2) + 2*L^2*cos(ta1)*(sin(ta1))*(cos(ta2) - cos(ta1) + 2) + 2*L^2*cos(ta1)*(sin(ta1))*(cos(ta1) + 2) + 2*L^2*cos(ta1)*(sin(ta1))*(cos(ta1) + 2) + 2*L^2*cos(ta1)*(cos(ta1))*(cos(ta1) + 2) + 2*L^2*cos(ta1)*(cos(ta1))*(cos($ $\sin(\tan 2)))/(4*\cos j((1 - (L^2*(\cos(\tan 2) - \cos(\tan 1) + 2)^2 + L^2*(\sin(\tan 1)$ $\sin(\tan 2)^2/(4*L^2)^(1/2)$ (L^2*(cos(ta2) - cos(ta1) + 2)^2 + L^2*(sin(ta1)) $sin(ta2))^2(1/2)) + M*((cos(angle(L*(sin(ta1) - sin(ta2))*(- 1 - 1i)) +$ $acos((L^2*(cos(ta2) - cos(ta1) + 2)^2 + L^2*(sin(ta1) - sin(ta2))^2)^(1/2)/$ $(2*L))*(2*L^2*sin(ta2)*(cos(ta2) - cos(ta1) + 2) + 2*L^2*cos(ta2)*(sin(ta1))$ $\sin(ta2))))/(4*(L^2*(cos(ta2) - cos(ta1) + 2)^2 + L^2*(sin(ta1) - sin(ta2))^2)^(1/2)*(1/2)$ $-(L^2*(\cos(ta2) - \cos(ta1) + 2)^2 + L^2*(\sin(ta1) - \sin(ta2))^2)/(4*L^2))^{(1/2)}$ $(\cos(\text{angle}(L^*(\sin(\text{tal}) - \sin(\text{ta2}))^*(-1 - 1i)) - \cos((L^2*(\cos(\text{ta2})))^*(-1 - 1i)))$ $\cos(\tan 1) + 2$ ² + L²* $(\sin(\tan 1) - \sin(\tan 2)$)²(1/2)/(2*L)))*(2*L²* $\sin(\tan 2)$ * $(\cos(\tan 2)$ $-\cos(ta1) + 2) + 2*L^2*\cos(ta2)*(\sin(ta1) - \sin(ta2))))/(8*(L^2*(\cos(ta2))))$ $cos(tal) + 2)^2 + L^2*(sin(tal) - sin(ta2))^2)^(1/2)*(1 - (L^2*(cos(ta2)))^2)^2$

```
cos(ta1) + 2)^2 + L^2*(sin(ta1) - sin(ta2))^2)/(4*L^2))^(1/2)))*(L*cos(ta1)
   (\cos(\sin(a\cos((L^2*(\cos(ta2) - \cos(ta1) + 2)^2 + L^2*(\sin(ta1) - \sin(ta2))^2)^{(1/2)})
   (2*L))) + angle(L*(sin(ta1) - sin(ta2))*(-1 - 1i)))*(2*L^2*sin(ta1)*(cos(ta2) - 1i)))*(2*L^2*sin(ta1)*(cos
  cos(tal) + 2) + 2*L^2*cos(tal)*(sin(tal) - sin(ta2))))/(4*conj((1 - (L^2*(cos(ta2) - cos(tal) + 2))))/(4*conj((1 - (L^2*(cos(tal) + 2)))))/(4*conj((1 - (L^2*(cos(tal) + 2))))/(4*conj((1 - (L^2*(cos(tal) + 2)))/(4*conj((1 - (L^2*(
  \cos(\tan 1) + 2<sup>2</sup> + L^2*(\sin(\tan 1) - \sin(\tan 2))<sup>2</sup>/(4*L^2))<sup>2</sup>(1/2))*(L^2*(\cos(\tan 2) - \cos(\tan 1))
  + 2)^2 + L^2*(\sin(ta1) - \sin(ta2))^2)^(1/2)) + (\cos(\cos((L^2*(\cos(ta2) - \cos(ta1)))^2)^2)^2)^2 + L^2*(\sin(ta1) - \sin(ta2))^2)^2)^2
  + 2)^2 + L^2*(\sin(ta1) - \sin(ta2))^2)^(1/2)/(2*L))) - angle(L*(sin(ta1) - sin(ta2))*(-
  (1 - 1i))*(2*L^2*sin(ta1)*(cos(ta2) - cos(ta1) + 2) + 2*L^2*cos(ta1)*(sin(ta1))*(2*L^2*sin(ta1)*(cos(ta2) - cos(ta1) + 2) + 2*L^2*cos(ta1)*(sin(ta1))*(2*L^2*sin(ta1)*(cos(ta2) - cos(ta1) + 2) + 2*L^2*cos(ta1)*(sin(ta1))*(cos(ta2) - cos(ta1) + 2) + 2*L^2*cos(ta1)*(sin(ta1))*(cos(ta2) - cos(ta1) + 2) + 2*L^2*cos(ta1)*(cos(ta2) - cos(ta1))*(cos(ta2) - cos(ta2))*(cos(ta2) -
                        \sin(ta2))))/(8*conj((1 - (L^2*(cos(ta2) - cos(ta1) + 2)^2 + L^2*(sin(ta1)))))
                       \sin(\tan 2)^2/(4*L^2)^(1/2)^*(L^2*(\cos(\tan 2) - \cos(\tan 1) + 2)^2 + L^2*(\sin(\tan 1)
                         \sin(ta2))^2(1/2)) + (M*\cos(angle(L*(sin(ta1) - sin(ta2))*(-1 - 1i)) +
 acos((L^2*(cos(ta2) - cos(ta1) + 2)^2 + L^2*(sin(ta1) - sin(ta2))^2)^(1/2)/
   (2*L))*(2*L^2*sin(ta2)*(cos(ta2) - cos(ta1) + 2) + 2*L^2*cos(ta2)*(sin(ta1))
                           -\cos(ta1) + 2)^2 +
L^2*(\sin(\tan 1) - \sin(\tan 2))^2(1/2)/(2*L))) + angle(L*(\sin(\tan 1) - \sin(\tan 2))*(-1)
                            1i))*(2*L^2*sin(ta1)*(cos(ta2) - cos(ta1) + 2) + 2*L^2*cos(ta1)*(sin(ta1))*(2*L^2*sin(ta1)*(cos(ta2) - cos(ta1) + 2) + 2*L^2*cos(ta1)*(sin(ta1))*(2*L^2*sin(ta1)*(cos(ta2) - cos(ta1) + 2) + 2*L^2*cos(ta1)*(sin(ta1))*(cos(ta2) - cos(ta1) + 2) + 2*L^2*cos(ta1)*(sin(ta1))*(cos(ta2) - cos(ta1) + 2) + 2*L^2*cos(ta1)*(cos(ta2) - cos(ta1))*(cos(ta2) - cos(ta2) - cos(ta2))*(cos(ta2) - cos(ta2))*(cos(ta2) - cos(ta2))*(cos(ta2) - cos(ta2))*(cos(
                           \sin(ta2))))/(8*conj((1 - (L^2*(cos(ta2) - cos(ta1) + 2)^2 + L^2*(sin(ta1)))))
                        \sin(\tan 2)^2/(4*L^2)^2/(4*L^2)^2/(1/2)^*(L^2*(\cos(\tan 2) - \cos(\tan 1) + 2)^2 + L^2*(\sin(\tan 1) + 2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^2/(1/2)^
                           \sin(ta2)^2(1/2))/(8*(L^2*(cos(ta2) - cos(ta1) + 2)^2 + L^2*(sin(ta1) + 2)^2)
  \sin(ta2))^2(1/2)^*(1 - (L^2*(cos(ta2) - cos(ta1) + 2)^2 + L^2*(sin(ta1))^2)^2(1/2)^*(1 - (L^2*(cos(ta2) - cos(ta1) + 2)^2 + L^2*(sin(ta1))^2)^2(1/2)^*(1 - (L^2*(cos(ta2) - cos(ta1) + 2)^2)^2 + L^2*(sin(ta1))^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/2)^2(1/
  \sin(ta2))^2/(4*L^2)^(1/2) + (M*\sin(angle(L*(sin(ta1) - sin(ta2))*(-1 - 1i))
  + a\cos((L^2*(\cos(ta2) - \cos(ta1) + 2)^2 + L^2*(\sin(ta1) - \sin(ta2))^2)^{(1/2)}
  (2*L)))*(2*L^2*sin(ta2)*(cos(ta2) - cos(ta1) + 2) + 2*L^2*cos(ta2)*(sin(ta1))
                         \sin(\tan 2))*(L*sin(ta1) - (sin(conj(acos((L^2*(cos(ta2) - cos(ta1) + 2)^2 +
L^2*(\sin(ta1) - \sin(ta2))^2)^(1/2)/(2*L))) + angle(L*(\sin(ta1) - \sin(ta2))*(-1))
                           1i))*(2*L^2*sin(ta1)*(cos(ta2) - cos(ta1) + 2) + 2*L^2*cos(ta1)*(sin(ta1))*(2*L^2*sin(ta1)*(cos(ta2) - cos(ta1) + 2) + 2*L^2*cos(ta1)*(sin(ta1))*(2*L^2*sin(ta1)*(cos(ta2) - cos(ta1) + 2) + 2*L^2*cos(ta1)*(sin(ta1))*(cos(ta2) - cos(ta1) + 2) + 2*L^2*cos(ta1)*(sin(ta1))*(cos(ta2) - cos(ta1) + 2) + 2*L^2*cos(ta1)*(cos(ta2) - cos(ta1))*(cos(ta2) - cos(ta1))*(cos(ta1))*(cos(
                         \sin(ta2)))/(8*conj((1 - (L^2*(cos(ta2) - cos(ta1) + 2)^2 + L^2*(sin(ta1))))
                       \sin(\tan 2)^2/(4*L^2)^2/(4*L^2)^2/(2*(\cos(\tan 2) - \cos(\tan 1) + 2)^2 + L^2*(\sin(\tan 1) \sin(\tan 2))^2/(1/2))))/(8*(L^2*(\cos(\tan 2) - \cos(\tan 1) + 2)^2 + L^2*(\sin(\tan 1) - \cos(\tan 1) + 2)^2 + L^2*(\sin(\tan 1) - \cos(\tan 1) + 2)^2 + L^2*(\sin(\tan 1) +
  \sin(ta2)^2(1/2)*(1 - (L^2*(cos(ta2) - cos(ta1) + 2)^2 + L^2*(sin(ta1) - co
  \sin(\tan 2)^2/(4*L^2)^2/(1/2) - (Jp*(2*L^2*\sin(\tan 1)*(\cos(\tan 2)) - \cos(\tan 1) + 2) +
 2*L^2*cos(ta1)*(sin(ta1) - sin(ta2)))*(2*L^2*sin(ta2)*(cos(ta2) - cos(ta1) + 2) +
 2*L^2*cos(ta2)*(sin(ta1) - sin(ta2))))/(8*L^2*conj((1 - (L^2*(cos(ta2) - cos(ta1) + (a2)))))/(8*L^2*conj((1 - (b2))))/(8*L^2*conj((1 - (b2)))/(8*L^2*conj((1 - (b2)
2)^2 + L^2*(\sin(\tan 1 - \sin(\tan 2))^2)/(4*L^2))^*(1/2))*(L^2*(\cos(\tan 2) - \cos(\tan 1) + 2)^2 + L^2*(\sin(\tan 1) + \cos(\tan 2))^2
L^2*(\sin(\tan 1) - \sin(\tan 2))^2*(1 - (L^2*(\cos(\tan 2) - \cos(\tan 1) + 2)^2 + L^2*(\sin(\tan 1) - \cos(\tan 1))^2)^2
 \sin(ta2)^2/(4*L^2)^(1/2);
```

 $M*((\sin(\cos((L^2*(\cos(ta2) - \cos(ta1) + 2)^2 + L^2*(\sin(ta1)))))))$ $\sin(ta2)^2(1/2)(2*L))$ - angle(L*(sin(ta1) - sin(ta2))*(- $1i)))*(2*L^2*sin(ta2)*(cos(ta2) - cos(ta1) + 2) + 2*L^2*cos(ta2)*(sin(ta1))$ $\sin(ta2))))/(8*conj((1 - (L^2*(cos(ta2) - cos(ta1) + 2)^2 + L^2*(sin(ta1)))))$ $\sin(ta2))^2/(4*L^2))^(1/2))*(L^2*(cos(ta2) - cos(ta1) + 2)^2 + L^2*(sin(ta1))^2$ $\sin(\tan 2)$)²)^{(1/2})) + ($\sin(\cos((L^2*(\cos(\tan 2) - \cos(\tan 1) + 2))^2$) $L^2*(\sin(\tan 1) - \sin(\tan 2))^2(1/2)/(2*L))) + angle(L*(\sin(\tan 1) - \sin(\tan 2))*(-\cos(\tan 1))$ $1i))*(2*L^2*sin(ta2)*(cos(ta2) - cos(ta1) + 2) + 2*L^2*cos(ta2)*(sin(ta1))$ $\sin(ta2)))/(4*conj((1 - (L^2*(cos(ta2) - cos(ta1) + 2)^2 + L^2*(sin(ta1)))))$ $\sin(ta2)^2/(4*L^2)^(1/2)*(L^2*(cos(ta2) - cos(ta1) + 2)^2 + L^2*(sin(ta1) - cos(ta1) + 2)^4$ $sin(ta2))^2(1/2))*(L*sin(ta1) - (sin(angle(L*(sin(ta1) - sin(ta2))*(- 1 - 1i)))*(- 1 - 1i))*(- 1i))*(- 1 - 1i))*(- 1i))*(- 1i))*(- 1i))*(- 1i))*(- 1i))*(- 1i))*$ $+ a\cos((L^2*(\cos(ta2) - \cos(ta1) + 2)^2 + L^2*(\sin(ta1) - \sin(ta2))^2)^{(1/2)}$ $(2*L)))*(2*L^2*sin(ta1)*(cos(ta2) - cos(ta1) + 2) + 2*L^2*cos(ta1)*(sin(ta1))*(cos(ta2) - cos(ta1) + 2) + 2*L^2*cos(ta1)*(cos(ta2) - cos(ta1))*(cos(ta2) - cos(ta1))*(cos(ta1))*(cos(ta1))*(cos(ta1)$ $\sin(\tan 2)))/(4*(L^2*(\cos(\tan 2) - \cos(\tan 1) + 2)^2 + L^2*(\sin(\tan 1) - \sin(\tan 2))^2)^(1/2)*(1/2)^2$ $-(L^2*(\cos(ta2) - \cos(ta1) + 2)^2 + L^2*(\sin(ta1) - \sin(ta2))^2)/(4*L^2))^(1/2)) +$ $(\sin(angle(L^*(sin(ta1) - sin(ta2))^*(-1 - 1i)) - acos((L^2*(cos(ta2) - cos(ta1) + 1i))))$ $2)^2 + L^2*(\sin(\tan 1) - \sin(\tan 2))^2)^(1/2)/(2*L)))*(2*L^2*\sin(\tan 1)*(\cos(\tan 2) - \cos(\tan 1))$

```
+ 2) + 2*L^2*cos(ta1)*(sin(ta1) - sin(ta2))))/(8*(L^2*(cos(ta2) - cos(ta1) + 2)^2 +
 L^2*(\sin(\tan 1) - \sin(\tan 2))^2(1/2)*(1 - (L^2*(\cos(\tan 2) - \cos(\tan 1) + 2)^2 + L^2*(\sin(\tan 1) + 2)^2)
  -\sin(ta2))^2/(4*L^2)^(1/2)) + M*((cos(conj(acos((L^2*(cos(ta2) - cos(ta1) + 2)^2))^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2)^2/(4*L^2))^2/(4*L^2)^2/(4*L^2))^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/
 + L^2*(\sin(\tan 1) - \sin(\tan 2))^2)^{(1/2)/(2*L))) + angle(L*(\sin(\tan 1) - \sin(\tan 2))^*(-\cos(\tan 1))^2)^2
 1 - 1i))*(2*L^2*sin(ta2)*(cos(ta2) - cos(ta1) + 2) + 2*L^2*cos(ta2)*(sin(ta1))
  -\sin(ta2))))/(4*conj((1 - (L^2*(cos(ta2) - cos(ta1) + 2)^2 + L^2*(sin(ta1)))))
                      \sin(\tan 2)^2/(4*L^2)^2/(4*L^2) (1/2))*(L^2*(cos(ta2) - cos(ta1) + 2)^2 + L^2*(sin(ta1))
                           \sin(\tan 2))<sup>2</sup>)<sup>(1/2)</sup> - (\cos(\cos(\tan 2) - \cos(\tan 2)) - \cos(\tan 2) + 2)<sup>2</sup>
L^2*(\sin(ta1) - \sin(ta2))^2)^(1/2)/(2*L))) - angle(L*(\sin(ta1) - \sin(ta2))*(-1/2)^2
                      1i))*(2*L^2*sin(ta2)*(cos(ta2) - cos(ta1) + 2) + 2*L^2*cos(ta2)*(sin(ta1))*(2*L^2*sin(ta2)*(cos(ta2) - cos(ta1) + 2) + 2*L^2*cos(ta2)*(sin(ta1))*(2*L^2*sin(ta2)*(cos(ta2) - cos(ta1) + 2) + 2*L^2*cos(ta2)*(sin(ta1))*(2*L^2*cos(ta2))*(sin(ta1))*(2*L^2*cos(ta2))*(sin(ta1))*(2*L^2*cos(ta2))*(sin(ta1))*(2*L^2*cos(ta2))*(sin(ta1))*(2*L^2*cos(ta2))*(sin(ta1))*(2*L^2*cos(ta2))*(sin(ta1))*(2*L^2*cos(ta2))*(sin(ta1))*(2*L^2*cos(ta2))*(sin(ta1))*(2*L^2*cos(ta2))*(sin(ta1))*(2*L^2*cos(ta2))*(sin(ta1))*(2*L^2*cos(ta2))*(sin(ta1))*(2*L^2*cos(ta2))*(sin(ta1))*(2*L^2*cos(ta2))*(sin(ta1))*(2*L^2*cos(ta2))*(sin(ta1))*(2*L^2*cos(ta2))*(sin(ta1))*(2*L^2*cos(ta2))*(sin(ta1))*(2*L^2*cos(ta2))*(sin(ta1))*(2*L^2*cos(ta2))*(sin(ta1))*(2*L^2*cos(ta2))*(sin(ta1))*(2*L^2*cos(ta2))*(sin(ta1))*(2*L^2*cos(ta2))*(sin(ta1))*(2*L^2*cos(ta2))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(si
 \sin(ta2)))/(8*conj((1 - (L^2*(cos(ta2) - cos(ta1) + 2)^2 + L^2*(sin(ta1))))
 \sin(\tan 2)^2/(4*L^2)^(1/2)^*(L^2*(\cos(\tan 2) - \cos(\tan 1) + 2)^2 + L^2*(\sin(\tan 1)
  \sin(ta2)^2(1/2))*(L*\cos(ta1) - (\cos(angle(L*(sin(ta1) - sin(ta2))*(-1 - 1i)))*(-1 - 1i))
 + a\cos((L^2*(\cos(ta2) - \cos(ta1) + 2)^2 + L^2*(\sin(ta1) - \sin(ta2))^2)^{(1/2)}
  (2*L))*(2*L^2*sin(ta1)*(cos(ta2) - cos(ta1) + 2) + 2*L^2*cos(ta1)*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1)
  \sin(ta2)))/(4*(L^2*(cos(ta2) - cos(ta1) + 2)^2 + L^2*(sin(ta1) - sin(ta2))^2)^(1/2)*(1
  -(L^2*(\cos(ta2) - \cos(ta1) + 2)^2 + L^2*(\sin(ta1) - \sin(ta2))^2)/(4*L^2))^(1/2)) +
  (\cos(\text{angle}(L^*(\sin(\text{ta1}) - \sin(\text{ta2}))^*(-1 - 1i)) - \cos((L^2^*(\cos(\text{ta2}) - \cos(\text{ta1}) +
 2)^2 + L^2*(\sin(\tan 1) - \sin(\tan 2))^2)^(1/2)/(2*L)))*(2*L^2*\sin(\tan 1)*(\cos(\tan 2) - \cos(\tan 1))
 + 2) + 2*L^2*cos(ta1)*(sin(ta1) - sin(ta2))))/(8*(L^2*(cos(ta2) - cos(ta1) + 2)^2 + (cos(ta2) - cos(ta1)))/(8*(L^2*(cos(ta2) - cos(ta1)))/(8*(L^2*(cos(ta1) - cos(ta1)))/(8*(cos(ta1) - cos(ta1)))/(8*(cos(ta1) - cos(ta1))/(8*(cos(ta1) - cos(ta1))/(6*(cos(ta1) - cos(ta1)
L^2*(\sin(\tan 1) - \sin(\tan 2))^2(1/2)*(1 - (L^2*(\cos(\tan 2) - \cos(\tan 1) + 2)^2 + L^2*(\sin(\tan 1) + 2)^2)
  -\sin(ta2))^2/(4*L^2))^(1/2)) + (M*cos(conj(acos((L^2*(cos(ta2) - cos(ta1) + 2)^2))^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2))^2/(4*L^2)^2/(4*L^2))^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2/(4*L^2)^2
 + \ L^2*(\sin(ta1) \ - \ \sin(ta2))^2)^(1/2)/(2*L))) \ + \ angle(L*(\sin(ta1) \ - \ \sin(ta2))^*(-1/2)/(2*L))) \ + \ angle(L*(\sin(ta1) \ - \ \sin(ta1))^*(-1/2)/(2*L))) \ + \ angle(L*(\sin(ta1) \ - \ \sin(ta1))^*(-1/2)/(2*L)) \ + \ angle(L*(\sin(ta1) \ -
 1 - 1i)))*(2*L^2*sin(ta2)*(cos(ta2) - cos(ta1) + 2) + 2*L^2*cos(ta2)*(sin(ta1) + 2) + 2*L^2*cos(ta2)*(sin(ta2) + 2) + 2*L^2*cos(ta2) 
  -\sin(ta2))*(L*cos(ta1) - (cos(angle(L*(sin(ta1) - sin(ta2))*(- 1 - 1i)) +
 acos((L^2*(cos(ta2) - cos(ta1) + 2)^2 + L^2*(sin(ta1) - sin(ta2))^2)^(1/2)/
  (2*L))*(2*L^2*sin(ta1)*(cos(ta2) - cos(ta1) + 2) + 2*L^2*cos(ta1)*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1))*(sin(ta1)
  \sin(ta2))))/(8*(L^2*(cos(ta2) - cos(ta1) + 2)^2 + L^2*(sin(ta1) - sin(ta2))^2)^(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)*(1/2)
  -(L^2*(\cos(ta2) - \cos(ta1) + 2)^2 + L^2*(\sin(ta1) - \sin(ta2))^2)/(4*L^2))^(1/2))))/
  (8*conj((1 - (L^2*(cos(ta2) - cos(ta1) + 2)^2 + L^2*(sin(ta1) - sin(ta2))^2))
   (4*L^2)^{(1/2)}*(L^2*(\cos(ta2) - \cos(ta1) + 2)^2 + L^2*(\sin(ta1) - \sin(ta2))^2)^{(1/2)} +
   (M*sin(conj(acos((L^2*(cos(ta2) - cos(ta1) + 2)^2 + L^2*(sin(ta1) - sin(ta2))^2)^(1/2)/
  (2*L))) + angle(L*(sin(ta1) - sin(ta2))*(-1 - 1i)))*(2*L^2*sin(ta2)*(cos(ta2))*(-1 - 1i)))*(2*L^2*sin(ta2)*(cos(ta2))*(-1 - 1i)))*(-1 - 1i))(-1 - 1i)))*(-1 - 1i)))*(-1 - 1i))(-1 - 1i))
                                                                                                                                                                                                             2*L^2*\cos(ta2)*(\sin(ta1) - \sin(ta2)))*(L*\sin(ta1)
                                                                                                    + 2) +
                             cos(ta1)
  (\sin(angle(L^*(sin(ta1) - sin(ta2))^*(-1 - 1i)) + acos((L^2*(cos(ta2) - cos(ta1) + 1i))) + acos((L^2*(cos(ta2) - cos(ta1) + 1i))))
 2)^2 + L^2*(\sin(\tan 1) - \sin(\tan 2))^2)^(1/2)/(2*L)))*(2*L^2*\sin(\tan 1)*(\cos(\tan 2) - \cos(\tan 1))
 + 2) + 2*L^2*cos(tal)*(sin(tal) - sin(ta2))))/(8*(L^2*(cos(ta2) - cos(tal) + 2)^2
 + L^2*(\sin(\tan 1) - \sin(\tan 2))^2)^(1/2)*(1 - (L^2*(\cos(\tan 2) - \cos(\tan 1) + 2)^2 +
L^2*(\sin(\tan 1) - \sin(\tan 2))^2/(4*L^2))^(1/2)))/(8*\cos((1 - (L^2*(\cos(\tan 2) - \cos(\tan 1))))/(4*L^2)))/(4*L^2)))/(4*L^2))/(4*L^2))/(4*L^2))/(4*L^2))/(4*L^2))/(4*L^2))/(4*L^2))/(4*L^2))/(4*L^2))/(4*L^2))/(4*L^2))/(4*L^2))/(4*L^2))/(4*L^2))/(4*L^2))/(4*L^2))/(4*L^2))/(4*L^2))/(4*L^2))/(4*L^2))/(4*L^2))/(4*L^2))/(4*L^2))/(4*L^2))/(4*L^2))/(4*L^2))/(4*L^2))/(4*L^2))/(4*L^2))/(4*L^2))/(4*L^2))/(4*L^2))/(4*L^2))/(4*L^2))/(4*L^2))/(4*L^2))/(4*L^2))/(4*L^2))/(4*L^2))/(4*L^2))/(4*L^2))/(4*L^2))/(4*L^2))/(4*L^2))/(4*L^2))/(4*L^2))/(4*L^2))/(4*L^2))/(4*L^2))/(4*L^2))/(4*L^2))/(4*L^2))/(4*L^2))/(4*L^2))/(4*L^2))/(4*L^2))/(4*L^2))/(4*L^2))/(4*L^2))/(4*L^2))/(4*L^2))/(4*L^2))/(4*L^2))/(4*L^2)/(4*L^2))/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L^2)/(4*L
 + 2)^2 + L^2*(\sin(\tan 1) - \sin(\tan 2))^2)/(4*L^2))^(1/2))*(L^2*(\cos(\tan 2) - \cos(\tan 1) + 2)^2
 + L^2*(\sin(\tan 1) - \sin(\tan 2))^2(1/2)) - (Jp*(2*L^2*\sin(\tan 1)*(\cos(\tan 2) - \cos(\tan 1) + 2)
 + 2*L^2*cos(ta1)*(sin(ta1) - sin(ta2)))*(2*L^2*sin(ta2)*(cos(ta2) - cos(ta1) + 2) +
 2*L^2*cos(ta2)*(sin(ta1) - sin(ta2))))/(8*L^2*conj((1 - (L^2*(cos(ta2) - cos(ta1) + (a2)))))/(8*L^2*conj((1 - (b2))))/(8*L^2*conj((1 - (b2)))/(8*L^2*conj((1 - (b2)))
2)^2 + L^2*(\sin(ta1) - \sin(ta2))^2)/(4*L^2))^(1/2))*(L^2*(\cos(ta2) - \cos(ta1) + 2)^2 + L^2*(\sin(ta1) - \sin(ta2))^2)/(4*L^2))^2
L^2*(\sin(\tan 1) - \sin(\tan 2))^2*(1 - (L^2*(\cos(\tan 2) - \cos(\tan 1) + 2)^2 + L^2*(\sin(\tan 1) - \cos(\tan 1))^2)^2
\sin(ta2))^2/(4*L^2)^(1/2);
```

```
 mm(2,2) = Ja + M*((cos(angle(L*(sin(ta1) - sin(ta2))*(-1 - 1i)) + acos((L^2*(cos(ta2) - cos(ta1) + 2)^2 + L^2*(sin(ta1) - sin(ta2))^2)^(1/2)/(2*L)))*(2*L^2*sin(ta2)*(cos(ta2) - cos(ta1) + 2) + 2*L^2*cos(ta2)*(sin(ta1) - sin(ta2))))/(4*(L^2*(cos(ta2) - cos(ta1) + 2)^2 + L^2*(sin(ta1) - sin(ta2))^2)^(1/2)*(1 - (L^2*(cos(ta2) - cos(ta1) + 2)^2 + L^2*(sin(ta1) - sin(ta2))^2)/(4*L^2))^(1/2)) - (cos(angle(L*(sin(ta1) - sin(ta2))*(-1 - 1i)) - acos((L^2*(cos(ta2) - cos(ta1) + 2)^2 + 1)^2) + (cos(ta2))^2 + (cos(ta2))
```

 $L^2*(\sin(\tan 1) - \sin(\tan 2))^2(1/2)/(2*L)))*(2*L^2*\sin(\tan 2)*(\cos(\tan 2) - \cos(\tan 1) + \cos(\tan 1))*(2*L^2*\sin(\tan 2))*(2*L^2*\sin(\tan 2))*(2*L^2*\sin(a))*(2*L^2*(2*L^2*(a))*(2*L^2*(a))*(2*L^2*(a))*(2*L^2*(a))*(2*L^2*($ $2) + 2*L^2*cos(ta2)*(sin(ta1) - sin(ta2))))/(8*(L^2*(cos(ta2) - cos(ta1) + 2)^2 +$ $L^2*(\sin(ta1) - \sin(ta2))^2)^(1/2)*(1 - (L^2*(\cos(ta2) - \cos(ta1) + 2)^2 + L^2*(\sin(ta1) + 2)^2)^2$ $\sin(ta2))^2/(4*L^2)^(1/2))*((\cos(\cos((L^2*(\cos(ta2) - \cos(ta1) + 2)^2)$ $+ L^2*(\sin(ta1) - \sin(ta2))^2)^(1/2)/(2*L))) + angle(L*(\sin(ta1) - \sin(ta2))*(-1/2)^2)^2$ 1 - 1i))* $(2*L^2*sin(ta2)*(cos(ta2) - cos(ta1) + 2) + 2*L^2*cos(ta2)*(sin(ta1))$ $-\sin(ta^2)))/(4*conj((1 - (L^2*(cos(ta^2) - cos(ta^1) + 2)^2 + L^2*(sin(ta^1)))))$ $\sin(ta2)^2/(4*L^2)^2/(4*L^2)^2$ + $L^2*(\cos(ta2) - \cos(ta1) + 2)^2 + L^2*(\sin(ta1))^2$ $\sin(\tan 2)^2(1/2)$ - $(\cos(\cos((a\cos((L^2*(\cos(\tan 2) - \cos(\tan 1) + 2)^2 +$ $L^2*(\sin(ta1) - \sin(ta2))^2)^(1/2)/(2*L))) - angle(L*(\sin(ta1) - \sin(ta2))*(1i))*(2*L^2*sin(ta2)*(cos(ta2) - cos(ta1) + 2) + 2*L^2*cos(ta2)*(sin(ta1))$ $\sin(\tan 2)))/(8*\cos((1 - (L^2*(\cos(\tan 2) - \cos(\tan 1) + 2)^2 + L^2*(\sin(\tan 1)$ $\sin(ta2))^2/(4*L^2))^(1/2))*(L^2*(cos(ta2) - cos(ta1) + 2)^2 + L^2*(sin(ta1))$ $\sin(\tan 2)^2(1/2)$ + $(L^2*M*\cos(\tan 2)^2)/4$ + $M*((\sin(\cos((L^2*(\cos(\tan 2))^2))/4))/4$ $cos(ta1) + 2)^2 + L^2*(sin(ta1) - sin(ta2))^2)^(1/2)/(2*L))) - angle(L*(sin(ta1))^2)^2$ $\sin(\tan 2)$ *(- 1 - 1i)))*(2*L^2*sin(ta2)*(cos(ta2) - cos(ta1) + 2) $2*L^2*cos(ta2)*(sin(ta1) - sin(ta2))))/(8*conj((1 - (L^2*(cos(ta2) - cos(ta1) + 2)^2))/(8*conj(ta2)))/(8*conj(ta2))/(8*conj(ta$ $+ L^2*(\sin(\tan 1) - \sin(\tan 2))^2)/(4*L^2))^(1/2))*(L^2*(\cos(\tan 2) - \cos(\tan 1) + 2)^2 +$ $L^2*(\sin(\tan 1) - \sin(\tan 2))^2)^(1/2)) + (\sin(\cos((L^2*(\cos(\tan 2) - \cos(\tan 1) + \cos((\tan 2)))^2))^2)^2)^2)^2$ $2)^2 + L^2*(\sin(\tan) - \sin(\tan))^2(1/2)/(2*L)) + angle(L*(\sin(\tan) - \sin(\tan))*(-2)$ $(1 - 1i))*(2*L^2*sin(ta2)*(cos(ta2) - cos(ta1) + 2) + 2*L^2*cos(ta2)*(sin(ta1))*(2*L^2*sin(ta2)*(cos(ta2) - cos(ta1) + 2) + 2*L^2*cos(ta2)*(sin(ta1) + 2*$ $\sin(ta2)))/(4*conj((1 - (L^2*(cos(ta2) - cos(ta1) + 2)^2 + L^2*(sin(ta1))))$ $\sin(\tan 2)$)^2)/(4*L^2))^(1/2))*(L^2*($\cos(\tan 2)$ - $\cos(\tan 1)$ + 2)^2 + L^2*($\sin(\tan 1)$ sin(ta2))^2)^(1/2)))*(($\sin(angle(L*(\sin(\tan 1) - \sin(\tan 2))*(-1 - 1i))$ + $acos((L^2*(cos(ta2) - cos(ta1) + 2)^2 + L^2*(sin(ta1) - sin(ta2))^2)^(1/2)/$ $(2*L))*(2*L^2*sin(ta2)*(cos(ta2) - cos(ta1) + 2) + 2*L^2*cos(ta2)*(sin(ta1))$ $\sin(ta2)))/(4*(L^2*(cos(ta2) - cos(ta1) + 2)^2 + L^2*(sin(ta1) - sin(ta2))^2)^(1/2)*(1/2)^2$ $-(L^2*(\cos(ta2) - \cos(ta1) + 2)^2 + L^2*(\sin(ta1) - \sin(ta2))^2)/(4*L^2))^(1/2))$ $(\sin(angle(L*(sin(ta1) - sin(ta2))*(-1 - 1i)) - acos((L^2*(cos(ta2) - cos(ta1) + 1i))))$ $2)^2 + L^2*(\sin(\tan 1) - \sin(\tan 2))^2)^(1/2)/(2*L)))*(2*L^2*\sin(\tan 2)*(\cos(\tan 2) - \cos(\tan 1))$ $+ 2) + 2*L^2*cos(ta2)*(sin(ta1) - sin(ta2))))/(8*(L^2*(cos(ta2) - cos(ta1) + 2)^2 + (cos(ta2) + cos(ta2)))/(8*(L^2*(cos(ta2) - cos(ta1) + cos(ta2))))/(8*(L^2*(cos(ta2) - cos(ta2) - cos(ta2)))/(8*(L^2*(cos(ta2) - cos(ta2) - cos(ta2) - cos(ta2)))/(8*(L^2*(cos(ta2) - cos(ta2) - cos(ta2) - cos(ta2)))/(8*(L^2*(cos(ta2) - cos(ta2) - cos$ $L^2*(\sin(\tan 1) - \sin(\tan 2))^2(1/2)*(1 - (L^2*(\cos(\tan 2) - \cos(\tan 1) + 2)^2 + L^2*(\sin(\tan 1) + 2)^2)$ $-\sin(ta2))^2/(4*L^2))^(1/2)) + (L^2*M*sin(ta2)^2)/4 + (Jp*(2*L^2*sin(ta2)*(cos(ta2)))/4 + (Jp*(2*L^2*sin(ta2))/4 + (Jp*(2$ $cos(ta1) + 2) + 2*L^2*cos(ta2)*(sin(ta1) - sin(ta2)))^2)/(8*L^2*conj((1 - sin(ta2)))^2)$ (L^2*(cos(ta2) cos(tal) + 2)^2 + L^2*(sin(tal) - $(4*L^2))^(1/2))*(L^2*(cos(ta2) - cos(ta1) + 2)^2 + L^2*(sin(ta1) - sin(ta2))^2)*(1)$ $-(L^2*(\cos(ta2) - \cos(ta1) + 2)^2 + L^2*(\sin(ta1) - \sin(ta2))^2)/(4*L^2))^(1/2)) +$ $(M*cos(angle(L*(sin(ta1) - sin(ta2))*(-1 - 1i)) + acos((L^2*(cos(ta2) - cos(ta1))))$ $+ 2)^2 + L^2*(\sin(\tan 1) - \sin(\tan 2))^2)^{(1/2)/(2*L)))*\cos(\cos((L^2*(\cos(\tan 2) - \cos(\tan 2)))^2)^2)^2$ $cos(tal) + 2)^2 + L^2*(sin(tal) - sin(ta2))^2)^(1/2)/(2*L))) + angle(L*(sin(tal))^2)^2$ $\sin(\tan 2)$ *(- 1 - 1i)))*(2*L^2* $\sin(\tan 2)$ *($\cos(\tan 2)$ - $\cos(\tan 1)$ + 2) $2*L^2*cos(ta2)*(sin(ta1) - sin(ta2)))^2)/(64*conj((1 - (L^2*(cos(ta2) - cos(ta1)))^2)/(64*conj((1 - (L^2*(cos(ta2) - cos(ta1)))^2)/(64*conj((1 - (L^2*(cos(ta2) - cos(ta1)))^2)/(64*conj((1 - (L^2*(cos(ta2) - cos(ta1)))^2)/(64*conj((1 - (L^2*(cos(ta2) - cos(ta1))))^2)/(64*conj((1 - (L^2*(cos(ta2) - cos(ta1))))^2)/(64*conj((1 - (L^2*(cos(ta2) - cos(ta1))))))))$ $+ 2)^2 + L^2*(\sin(ta1) - \sin(ta2))^2)/(4*L^2))^(1/2))*(L^2*(\cos(ta2) - \cos(ta1) + 2)^2 + L^2*(\sin(ta1) - \sin(ta2))^2)*(1 - (L^2*(\cos(ta2) - \cos(ta1) + 2)^2) + L^2*(\sin(ta1) - \sin(ta2))^2)*(1 - (L^2*(\cos(ta2) - \cos(ta1) + 2)^2) + L^2*(\sin(ta1) - \sin(ta2))^2)*(1 - (L^2*(\cos(ta2) - \cos(ta1) + 2)^2) + L^2*(\sin(ta1) - \sin(ta2))^2)*(1 - (L^2*(\cos(ta2) - \cos(ta1) + 2)^2) + L^2*(\sin(ta1) - \sin(ta2))^2)*(1 - (L^2*(\cos(ta2) - \cos(ta1) + 2)^2) + L^2*(\sin(ta1) - \cos(ta1) + 2)^2) + L^2*(\sin(ta1) - \sin(ta2))^2)*(1 - (L^2*(\cos(ta2) - \cos(ta1) + 2)^2) + L^2*(\sin(ta1) - \sin(ta2))^2) + L^2*(\cos(ta2) - \cos(ta1) + 2)^2) + L^2*(\sin(ta1) - \sin(ta2))^2) + L^2*(\cos(ta2) - \cos(ta1) + 2)^2) + L^2*(\cos(ta1) - 2)^2) +$ $2)^2 + L^2*(\sin(\tan 1) - \sin(\tan 2))^2/(4*L^2))^(1/2)) + (M*\sin(\arg e(L*(\sin(\tan 1) - \sin(\tan 2)))^2)/(4*L^2))^2$ $\sin(\tan 2)$ *(- 1 - 1i)) + $a\cos((L^2*(\cos(\tan 2) - \cos(\tan 1) + 2)^2 + L^2*(\sin(\tan 1)$ $\sin(\tan 2)^2(1/2)/(2*L))$ *sin(conj(acos((L^2*(cos(ta2) - cos(ta1) + 2)^2 + $L^2*(\sin(ta1) - \sin(ta2))^2(1/2)/(2*L))) + angle(L*(\sin(ta1) - \sin(ta2))*(-1)$ $1i))*(2*L^2*sin(ta2)*(cos(ta2) - cos(ta1) + 2) + 2*L^2*cos(ta2)*(sin(ta1))$ $\sin(\tan 2))^2/(64*\cos((1 - (L^2*(\cos(\tan 2) - \cos(\tan 1) + 2)^2 + L^2*(\sin(\tan 1) + \cos((\cos 1) + \cos 1))^2))$ $\sin(\tan 2)^2/(4*L^2)^2/(4*L^2)^2/(1/2)^*(L^2*(\cos(\tan 2) - \cos(\tan 1) + 2)^2 + L^2*(\sin(\tan 1) + 2)^2$ $\sin(ta2)^2$ *(1 - (L^2*(cos(ta2) - cos(ta1) + 2)^2 + L^2*(sin(ta1) - sin(ta2))^2)/ (4*L^2))^(1/2));