EMSSL-syntax, rev2

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Angular momentum: `\AngMom{derivative-frame}{reference-point}{point}`
Example: `\AngMom{O}{P}{A}`
Output:

$$^{\bar{O}}_{P}\vec{h}_{A}$$

Acceleration: `\AcclVec{derivative-frame}{point}{with-respect-to}`
Example: `\AcclVec{O}{A}{Q}`
Output:

$$^{\bar{O}}\vec{a}_{A/Q}$$

Angular Acceleration: `\AngAccl{frame-1}{frame-2}`
Example: `\AngAccl{O}{B}`
Output:

$$^{\bar{O}}\vec{\alpha}^{\bar{B}}$$

Angular Velocity: `\AngAccl{frame-1}{frame-2}`
Example: `\AngAccl{O}{B}`
Output:

$$^{\bar{O}}\vec{\alpha}^{\bar{B}}$$

Cross two vectors: `\Cross{vector-1}{vector-2}`
Example: `\Cross{A}{B}`
Output:

$$A \times B$$

Cross product expression: `\CrossProd{frame}{a}{b}{c}{d}{e}{f}`
Example: `\CrossProd{frame}{a}{b}{c}{d}{e}{f}`
Output:

$$\begin{vmatrix} \overrightarrow{i}_{\bar{O}} & \overrightarrow{j}_{\bar{O}} & \overrightarrow{k}_{\bar{O}} \\ a & b & c \\ d & e & f \end{vmatrix}$$

Derivative: `\Deriv[order]{with-respect-to-variable}`
Example: `\Deriv[]{x}`
Output:

$$\frac{d}{dx}$$

Example: `\Deriv[3]{t}`

$$\frac{d^3}{dt^3}$$

Direction cosine matrix: `\DirectCosMat`
Example: `\DirectCosMat`
Output:

$$\begin{bmatrix} C_{11} & C_{12} & C_{13} \\ C_{21} & C_{22} & C_{23} \\ C_{31} & C_{32} & C_{33} \end{bmatrix}$$

Sum of external forces: \Fext
Example: \Fext
Output:

$$\sum \vec{F}_{ext}$$

Frame: \Frame{vector}{frame}
Example: \Frame{A}{B}
Output:

$$\{A\}_{\bar{B}}$$

Frame definition: \FrameDef{point}{frame}
Example: \FrameDef{Q}{O}
Output:

$$\overrightarrow{Q} = \{Q, \overrightarrow{i}_{\bar{O}}, \overrightarrow{j}_{\bar{O}}, \overrightarrow{k}_{\bar{O}}\}$$

Frame w/ derivative: \FrameDeriv[<order>]{<frame>}{<var>}{<fun>}
Inline version: \iFrameDeriv[<order>]{<frame>}{<var>}{<fun>}
Example: \FrameDeriv[2]{A}{r}{t}
Output:

$$^{\bar{A}}\frac{d^2}{dt^2}r$$

Inertia: \Inert{point}
Example: \Inert{A}
Output:

$$\tilde{I}_A$$

Inertia w/ frame: \InertF{point}{frame}
Example: \InertF{A}{B}
Output:

$$[\tilde{I}_A]_{\bar{B}}$$

Inertia tensor: \InertMat
Example: \InertMat
Output:

$$\begin{bmatrix} I_{xx} & I_{xy} & I_{xz} \\ I_{xy} & I_{yy} & I_{yz} \\ I_{xz} & I_{yz} & I_{zz} \end{bmatrix}$$

Lagrangian: \Lagr
Example: \Lagr
Output:

$$\mathcal{L}$$

Omega matrix: \OmegaMat
Example: \OmegaMat
Output:

$$\begin{bmatrix} 0 & -\omega_x & -\omega_y & -\omega_z \\ \omega_x & 0 & \omega_z & -\omega_y \\ \omega_y & -\omega_z & 0 & \omega_x \\ \omega_z & \omega_y & -\omega_x & 0 \end{bmatrix}$$

Partial derivative: \Partl[order]{with-respect-to-variable}
Example: \Partl[]{x}
Output:

$$\frac{\partial}{\partial x}$$

Example: `\Partl[3]{t}`
Output:

$$\frac{\partial^3}{\partial t^3}$$

Partial framed derivative: `\FramePartl[order]{frame}{with-respect-to-variable}`
Example: `\FramePartl[2]{A}{x}`
Output:

$$^{\bar{A}}\frac{\partial^2}{\partial x^2}$$

Position vector: `\PosVec{point}{with-respect-to-point}`
Example: `\PosVec{A}{Q}`
Output:

$$\vec{r}_{^A/_Q}$$

Quaternion angles: `\QuatAngle`
Example: `\QuatAngle`
Output:

$$\begin{aligned} q_0 &= cos(\tfrac{\phi}{2}) \\ q_1 &= a_x sin(\tfrac{\phi}{2}) \\ q_2 &= a_y sin(\tfrac{\phi}{2}) \\ q_3 &= a_z sin(\tfrac{\phi}{2}) \end{aligned}$$

Quaternion BCO matrix: `\QuatBCO`
Example: `\QuatBCO`
Output:

$$\begin{bmatrix} q_0^2+q_1^2-q_2^2-q_3^2 & 2(q_1q_2+q_0q_3) & 2(q_1q_3-q_0q_2) \\ 2(q_1q_2-q_0q_3) & q_0^2-q_1^2+q_2^2-q_3^2 & 2(q_2q_3+q_0q_1) \\ 2(q_1q_3+q_0q_2) & 2(q_2q_3-q_0q_1) & q_0-q_1^2-q_2^2+q_3^2 \end{bmatrix}$$

Quaternion definition: `\QuatDef{frame}`
Example: `\QuatDef{B}`
Output:

$$q_0 + q_1\overrightarrow{i}_{\bar{B}} + q_2\overrightarrow{j}_{\bar{B}} + q_3\overrightarrow{k}_{\bar{B}}$$

Quaternion derivative: `\QuatDot`
Example: `\QuatDot`
Output:

$$\begin{Bmatrix} \dot{q}_0 \\ \dot{q}_1 \\ \dot{q}_2 \\ \dot{q}_3 \end{Bmatrix} = \frac{1}{2}\begin{bmatrix} 0 & -\omega_x & -\omega_y & -\omega_z \\ \omega_x & 0 & \omega_z & -\omega_y \\ \omega_y & -\omega_z & 0 & \omega_x \\ \omega_z & \omega_y & -\omega_x & 0 \end{bmatrix}\begin{Bmatrix} q_0 \\ q_1 \\ q_2 \\ q_3 \end{Bmatrix}$$

Slanted fraction: `\Rfrac{numerator}{denominator}`
Example: `\Rfrac{A}{B}`
Output:

$$^A/_B$$

Rotation matrix form: `\Rotate{angle}{axis}`
Example: `\Rotate{\phi}{X}`
Output:

$$[R_X(\phi)]$$

Rotation matrix: `\RotateMat{frame-1}{frame-2}`
Example: `\RotateMat{B}{O}`
Output:

$$^{\bar{B}}[C]^{\bar{O}}$$

Rotation matrix derivative: `\RotateMatDot{frame-1}{frame-2}`
Example: `\RotateMatDot{B}{O}`
Output:

$$^{\bar{B}}[\dot{C}]^{\bar{O}}$$

Rotation matrix about X: `\RotateMatX{angle}`
Example: `\RotateMatX{\theta}`
Output:

$$\begin{bmatrix} 1 & 0 & 0 \\ 0 & cos(\theta) & sin(\theta) \\ 0 & -sin(\theta) & cos(\theta) \end{bmatrix}$$

Rotation matrix about Y: `\RotateMatY{angle}`
Example: `\RotateMatY{\theta}`
Output:

$$\begin{bmatrix} cos(\theta) & 0 & -sin(\theta) \\ 0 & 1 & 0 \\ sin(\theta) & 0 & cos(\theta) \end{bmatrix}$$

Rotation matrix about Z: `\RotateMatZ{angle}`
Example: `\RotateMatZ{\theta}`
Output:

$$\begin{bmatrix} cos(\theta) & sin(\theta) & 0 \\ -sin(\theta) & cos(\theta) & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

Sum of external torques: `\Text[point]`
Example: `\Text`
Output:

$$\sum \vec{\tau}$$

Example: `\Text[P]`
Output:

$$\sum \vec{\tau}_P$$

1st transport theorem: `\TransOne{frame-1}{frame-2}{vector}`
Inline version: `\iTransOne{frame-1}{frame-2}{vector}`
Example: `\TransOne{O}{B}{A}`
Output:

$$^{\bar{O}}\frac{d}{dt}A = {}^{\bar{B}}\frac{d}{dt}A + {}^{\bar{O}}\vec{\omega}^{\bar{B}} \times A$$

2nd transport theorem: `\TransTwo{frame-1}{frame-2}{vector}`
Inline version: `\iTransTwo{frame-1}{frame-2}{vector}`
Example: `\TransTwo{O}{B}{A}`
Output:

$$^{\bar{O}}\frac{d^2}{dt^2}A = {}^{\bar{B}}\frac{d^2}{dt^2}A + 2{}^{\bar{O}}\vec{\omega}^{\bar{B}} \times {}^{\bar{B}}\frac{d}{dt}A + {}^{\bar{O}}\vec{\alpha}^{\bar{B}} \times A + {}^{\bar{O}}\vec{\omega}^{\bar{B}} \times \left({}^{\bar{O}}\vec{\omega}^{\bar{B}} \times A\right)$$

Dyad: `\UnitDyad{unit-vector}{unit-vector}{frame}`
Example: `\UnitDyad{i}{k}{B}`
Output:

$$\vec{i}_{\bar{B}}\vec{k}_{\bar{B}}$$

Unit vector: `\UnitVec{vector}{frame}`
Example: `\UnitVec{i}{O}`
Output:

$$\vec{i}_{\bar{O}}$$

Left superscript frame: `\UpRight{frame}{quantity}`
Example: `\UpRight{O}{A}`
Output:

$$^{\bar{O}}A$$

Horizontal vector: `\VecExpressH{frame}{element-1}{element-2}{element-3}`
Example: `\VecExpressH{D}{a}{b}{c}`
Output:

$$\{a\vec{i}_{\bar{D}} + b\vec{j}_{\bar{D}} + c\vec{k}_{\bar{D}}\}$$

Vertical vector: `\VecExpressV{element-1}{element-2}{element-3}`
Example: `\VecExpressV{a}{b}{c}`
Output:

$$\begin{Bmatrix} a \\ b \\ c \end{Bmatrix}$$

4-element vertical vector: `\VecExpressVF{element-1}{element-2}{element-3}{element-4}`
Example: `\VecExpressVF{a}{b}{c}{d}`
Output:

$$\begin{Bmatrix} a \\ b \\ c \\ d \end{Bmatrix}$$

Velocity vector `\VelVec{derivative-frame}{point}{with-respect-to-point}`
Example: `\VelVec{O}{A}{Q}`
Output:

$$^{\bar{O}}\vec{v}_{A/_{Q}}$$

Angular velocity definition, X `\wX{frame-1}{frame-2}`
Example: `\wX{B}{O}`
Output:

$$\{0,0,1\}^{\bar{B}}[C]^{\bar{O}\bar{O}}[\dot{C}]^{\bar{B}}\begin{Bmatrix} 0 \\ 1 \\ 0 \end{Bmatrix}$$

Angular velocity definition, Y `\wY{frame-1}{frame-2}`
Example: `\wY{B}{O}`
Output:

$$\{1,0,0\}^{\bar{B}}[C]^{\bar{O}\bar{O}}[\dot{C}]^{\bar{B}}\begin{Bmatrix} 0 \\ 0 \\ 1 \end{Bmatrix}$$

Angular velocity definition, Z `\wZ{frame-1}{frame-2}`
Example: `\wZ{B}{O}`
Output:

$$\{0,1,0\}^{\bar{B}}[C]^{\bar{O}\bar{O}}[\dot{C}]^{\bar{B}}\begin{Bmatrix} 1 \\ 0 \\ 0 \end{Bmatrix}$$

The velocity vector $^{\bar{O}}\vec{v}_{A/_{O}}$ should be fine.

The transport theorem, rev2, is $\overset{\bar{O}}{\frac{d}{dt}}\vec{r}_{B/_{O}} = \overset{\bar{A}}{\frac{d}{dt}}\vec{r}_{B/_{O}} + {}^{\bar{O}}\vec{\omega}^{\bar{A}} \times \vec{r}_{B/_{O}}$
The transport theorem, rev3, is ${}^{\bar{O}}\frac{d}{dt}\vec{r}_{B/_{O}} = {}^{\bar{A}}\frac{d}{dt}\vec{r}_{B/_{O}} + {}^{\bar{O}}\vec{\omega}^{\bar{A}} \times \vec{r}_{B/_{O}}$

The transport theorem, rev2, is $\overset{\bar{O}}{\frac{d^2}{dt^2}}\vec{r}_{B/_{O}} = \overset{\bar{A}}{\frac{d^2}{dt^2}}\vec{r}_{B/_{O}} + 2{}^{\bar{O}}\vec{\omega}^{\bar{A}} \times \overset{\bar{A}}{\frac{d}{dt}}\vec{r}_{B/_{O}} + {}^{\bar{O}}\vec{\alpha}^{\bar{A}} \times \vec{r}_{B/_{O}} + {}^{\bar{O}}\vec{\omega}^{\bar{A}} \times \left({}^{\bar{O}}\vec{\omega}^{\bar{A}} \times \vec{r}_{B/_{O}}\right)$
The transport theorem, rev3, is ${}^{\bar{O}}\frac{d^2}{dt^2}\vec{r}_{B/_{O}} = {}^{\bar{A}}\frac{d^2}{dt^2}\vec{r}_{B/_{O}} + 2{}^{\bar{O}}\vec{\omega}^{\bar{A}} \times {}^{\bar{A}}\frac{d}{dt}\vec{r}_{B/_{O}} + {}^{\bar{O}}\vec{\alpha}^{\bar{A}} \times \vec{r}_{B/_{O}} + {}^{\bar{O}}\vec{\omega}^{\bar{A}} \times \left({}^{\bar{O}}\vec{\omega}^{\bar{A}} \times \vec{r}_{B/_{O}}\right)$