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The following are derivations of the output motions available in FAST for a 2-bladed turbine configuration. The motions for a 3-bladed turbine are very similar. Note that some of the motions are given multiple names in order to support variation among the user's preferences.

Blade 1 Tip Motions:

$OoPDefl1 = TipDxc1 = \left[\boldsymbol{r}^{QS1}\left(BldFlexL\right) - TipRad\boldsymbol{j}_3^{B1} \right] \cdot \boldsymbol{i}_1^{B1}$ Blade 1 OoP tip deflection (relative to rotor) (directed along the xc1-axis), (m)

$IPDefl1 = TipDyc1 = \left[\boldsymbol{r}^{QS1}\left(BldFlexL\right) - TipRad\boldsymbol{j}_3^{B1} \right] \cdot \boldsymbol{i}_2^{B1}$ Blade 1 IP tip deflection (relative to rotor) (directed along the yc1-axis), (m)

$TipDxb1 = \left[\boldsymbol{r}^{QS1}\left(BldFlexL\right) - TipRad\boldsymbol{j}_3^{B1} \right] \cdot \boldsymbol{j}_1^{B1}$ Blade 1 flapwise tip deflection (relative to rotor) (directed along the xb1-axis), (m)

$TipDyb1 = \left[\boldsymbol{r}^{QS1}\left(BldFlexL\right) - TipRad\boldsymbol{j}_3^{B1} \right] \cdot \boldsymbol{j}_2^{B1}$ Blade 1 edgewise tip deflection (relative to rotor) (directed along the yb1-axis), (m)

$TipDzc1 = TipDzb1 = \left[\boldsymbol{r}^{QS1}\left(BldFlexL\right) - TipRad\boldsymbol{j}_3^{B1} \right] \cdot \boldsymbol{i}_3^{B1} = \left[\boldsymbol{r}^{QS1}\left(BldFlexL\right) - TipRad\boldsymbol{j}_3^{B1} \right] \cdot \boldsymbol{j}_3^{B1}$ Blade 1 axial tip deflection (relative to rotor) (directed along the zc1-/zb1-axis), (m)

$TipALxb1 = {}^{E}\boldsymbol{a}^{S1}\left(BldFlexL\right) \cdot \boldsymbol{n}_1^{B1}\left(BldFlexL\right)$ Blade 1 flapwise tip acceleration (absolute) (directed along the xb1-axis), (m/sec^2)

$TipALyb1 = {}^{E}\boldsymbol{a}^{S1}\left(BldFlexL\right) \cdot \boldsymbol{n}_2^{B1}\left(BldFlexL\right)$ Blade 1 edgewise tip acceleration (absolute) (directed along the yb1-axis), (m/sec^2)

$TipALzb1 = {}^{E}\boldsymbol{a}^{S1}\left(BldFlexL\right) \cdot \boldsymbol{n}_3^{B1}\left(BldFlexL\right)$ Blade 1 axial tip acceleration (absolute) (directed along the zc1-/zb1-axis), (m/sec^2)

$RollDefl1 = TipRDxb1 = \left(\frac{180}{\pi} \right) {}^{H}\boldsymbol{\theta}^{M1}\left(BldFlexL\right) \cdot \boldsymbol{j}_1^{B1}$ Blade 1 roll tip deflection (relative to the undeflected position), (about the xb1-axis), (deg)

$PtchDefl1 = TipRDyb1 = \left(\frac{180}{\pi} \right) {}^{H}\boldsymbol{\theta}^{M1}\left(BldFlexL\right) \cdot \boldsymbol{j}_2^{B1}$ Blade 1 pitch tip deflection (relative to the undeflected position), (about the yb1-axis), (deg)

where: ${}^{H}\boldsymbol{\theta}^{M1}\left(BldFlexL\right) = {}^{E}\boldsymbol{\omega}_{\boldsymbol{B1F1}}^{\boldsymbol{M1}}\left(BldFlexL\right) q_{B1F1} + {}^{E}\boldsymbol{\omega}_{\boldsymbol{B1E1}}^{\boldsymbol{M1}}\left(BldFlexL\right) q_{B1E1} + {}^{E}\boldsymbol{\omega}_{\boldsymbol{B1F2}}^{\boldsymbol{M1}}\left(BldFlexL\right) q_{B1F2}$

$$TipClrnc1 = TwrClrnc1 = Tip2Twr1 = \begin{cases} \sqrt{\left[\boldsymbol{r}^{OS1}\left(BldFlexL\right) \cdot \boldsymbol{d}_1 \right]^2 + \left[\boldsymbol{r}^{OS1}\left(BldFlexL\right) \cdot \boldsymbol{d}_2 \right]^2 + \left[\boldsymbol{r}^{OS1}\left(BldFlexL\right) \cdot \boldsymbol{d}_3 \right]^2} & for\ \boldsymbol{r}^{OS1}\left(BldFlexL\right) \cdot \boldsymbol{d}_2 > 0 \\ \sqrt{\left[\boldsymbol{r}^{OS1}\left(BldFlexL\right) \cdot \boldsymbol{d}_1 \right]^2 + \left[\boldsymbol{r}^{OS1}\left(BldFlexL\right) \cdot \boldsymbol{d}_3 \right]^2} & otherwise \end{cases}$$

Blade 1 tip-to-tower clearance, (m)

where: $\boldsymbol{r}^{OS1}\left(BldFlexL\right) = \boldsymbol{r}^{OV} + \boldsymbol{r}^{VP} + \boldsymbol{r}^{PQ} + \boldsymbol{r}^{QS1}\left(BldFlexL\right)$

Blade 1 Local Span Motions:

$SpniALxb1 = {}^{E}\boldsymbol{a}^{S1}\left(R^{Span\,i}\right)\cdot \boldsymbol{n}_1^{B1}\left(R^{Span\,i}\right)$ Blade 1 local flapwise acceleration (absolute) of span station *i* (directed along the *local* xb1-axis) (*i* = 1,2,…,5), (m/sec^2)

$SpniALyb1 = {}^{E}\boldsymbol{a}^{S1}\left(R^{Span\,i}\right)\cdot \boldsymbol{n}_2^{B1}\left(R^{Span\,i}\right)$ Blade 1 local edgewise acceleration (absolute) of span station *i* (directed along the *local* yb1-axis) (*i* = 1,2,…,5), (m/sec^2)

$SpniALzb1 = {}^{E}\boldsymbol{a}^{S1}\left(R^{Span\,i}\right)\cdot \boldsymbol{n}_3^{B1}\left(R^{Span\,i}\right)$ Blade 1 axial acceleration (absolute) of span station *i* (directed along the zc1-/zb1-/*local* zb1-axis) (*i* = 1,2,…,5), (m/sec^2)

Blade 2 Tip Motions:

The output motions of blade 2 are similar to those of blade 1.

Blade Pitch Motions:

$BldPitch1 = PtchPMzc1 = PtchPMzb1 = \left(\frac{180}{\pi}\right) BlPitch(1)$ Blade 1 pitch angle (position) (positive towards feather / about the *minus* zc1-/*minus* zb1-axis), (deg)

$BldPitch2 = PtchPMzc2 = PtchPMzb2 = \left(\frac{180}{\pi}\right) BlPitch(2)$ Blade 2 pitch angle (position) (positive towards feather / about the *minus* zc2-/*minus* zb2-axis), (deg)

Teeter Motions:

$TeetDefl = RotTeetP = TeetPya = \left(\frac{180}{\pi}\right) q_{Teet}$ Rotor teeter angle (position) (about the ya-axis), (deg)

$RotTeetV = TeetVya = \left(\frac{180}{\pi}\right) \dot{q}_{Teet}$ Rotor teeter angular velocity (about the ya-axis), (deg/sec)

$RotTeetA = TeetAya = \left(\frac{180}{\pi}\right) \ddot{q}_{Teet}$ Rotor teeter angular acceleration (about the ya-axis), (deg/sec^2)

Shaft Motions:

$Azimuth = LSSTipP = LSSTipPxa = LSSTipPxs = MOD\left[\left(\frac{180}{\pi}\right)\left(q_{DrTr} + q_{GeAz}\right) + AzimB1Up + 90, 360\right]$ Rotor azimuth angle (position) (about the xa-/xs-axis), (deg)

$RotSpeed = LSSTipV = LSSTipVxa = LSSTipVxs = \left(\frac{60}{2\pi}\right)\left(\dot{q}_{DrTr} + \dot{q}_{GeAz}\right)$ Rotor azimuth speed / angular velocity (about the xa-/xs-axis), (rpm)

$RotAccel = LSSTipA = LSSTipAxa = LSSTipAxs = \left(\frac{180}{\pi}\right)\left(\ddot{q}_{DrTr} + \ddot{q}_{GeAz}\right)$ Rotor azimuth angular acceleration (about the xa-/xs-axis), (deg/sec^2)

$LSSGagP = LSSGagPxa = LSSGagPxs = MOD\left[\left(\frac{180}{\pi}\right)q_{GeAz} + AzimB1Up + 90, 360\right]$ Low-speed shaft strain gage azimuth angle (position) (on the gearbox side of the low-speed shaft) (about the xa-/xs-axis), (deg)

$LSSGagV = LSSGagVxa = LSSGagVxs = \left(\frac{60}{2\pi}\right)\dot{q}_{GeAz}$ Low-speed shaft strain gage angular velocity (on the gearbox side of the low-speed shaft) (about the xa-/xs-axis), (rpm)

$LSSGagA = LSSGagAxa = LSSGagAxs = \left(\frac{180}{\pi}\right)\ddot{q}_{GeAz}$ Low-speed shaft strain gage angular acceleration (on the gearbox side of the low-speed shaft) (about the xa-/xs-axis), (deg/sec^2)

$HSShftV = \left(\frac{60}{2\pi}\right)GBRatio \cdot \dot{q}_{GeAz}$ High-speed shaft speed / angular velocity, (rpm)

$HSShftA = \left(\frac{180}{\pi}\right)GBRatio \cdot \ddot{q}_{GeAz}$ High-speed shaft angular acceleration, (deg/sec^2)

$TipSpdRat = TSR = \frac{\left(q_{DrTr} + q_{GeAz}\right)AvgNrmTpRd}{WindVxt}$ Tip speed ratio, (-)

<u>Nacelle IMU Motions:</u>

$NcIMUTVxs = {}^{E}\boldsymbol{v}^{IMU} \cdot \boldsymbol{c}_1$	Nacelle IMU translational velocity (directed along the xs-axis), (m/sec)
$NcIMUTVys = -{}^{E}\boldsymbol{v}^{IMU} \cdot \boldsymbol{c}_3$	Nacelle IMU translational velocity (directed along the ys-axis), (m/sec)
$NcIMUTVzs = {}^{E}\boldsymbol{v}^{IMU} \cdot \boldsymbol{c}_2$	Nacelle IMU translational velocity (directed along the zs-axis), (m/sec)
$NcIMUTAxs = {}^{E}\boldsymbol{a}^{IMU} \cdot \boldsymbol{c}_1$	Nacelle IMU translational acceleration (directed along the xs-axis), (m/sec^2)
$NcIMUTAys = -{}^{E}\boldsymbol{a}^{IMU} \cdot \boldsymbol{c}_3$	Nacelle IMU translational acceleration (directed along the ys-axis), (m/sec^2)
$NcIMUTAzs = {}^{E}\boldsymbol{a}^{IMU} \cdot \boldsymbol{c}_2$	Nacelle IMU translational acceleration (directed along the zs-axis), (m/sec^2)
$NcIMURVxs = \left(\frac{180}{\pi}\right) {}^{E}\boldsymbol{\omega}^{R} \cdot \boldsymbol{c}_1$	Nacelle IMU angular (rotational) velocity (about the xs-axis), (deg/sec)
$NcIMURVys = -\left(\frac{180}{\pi}\right) {}^{E}\boldsymbol{\omega}^{R} \cdot \boldsymbol{c}_3$	Nacelle IMU angular (rotational) velocity (about the ys-axis), (deg/sec)
$NcIMURVzs = \left(\frac{180}{\pi}\right) {}^{E}\boldsymbol{\omega}^{R} \cdot \boldsymbol{c}_2$	Nacelle IMU angular (rotational) velocity (about the zs-axis), (deg/sec)
$NcIMURAxs = \left(\frac{180}{\pi}\right) {}^{E}\boldsymbol{\alpha}^{R} \cdot \boldsymbol{c}_1$	Nacelle IMU angular (rotational) acceleration (about the xs-axis), (deg/sec^2)
$NcIMURAys = -\left(\frac{180}{\pi}\right) {}^{E}\boldsymbol{\alpha}^{R} \cdot \boldsymbol{c}_3$	Nacelle IMU angular (rotational) acceleration (about the ys-axis), (deg/sec^2)
$NcIMURAzs = \left(\frac{180}{\pi}\right) {}^{E}\boldsymbol{\alpha}^{R} \cdot \boldsymbol{c}_2$	Nacelle IMU angular (rotational) acceleration (about the zs-axis), (deg/sec^2)

<u>Rotor-Furl Motions:</u>

$RotFurl = RotFurlP = \left(\frac{180}{\pi}\right) q_{RFrl}$	Rotor-furl angle (position) (about the rotor-furl axis), (deg)
$RotFurlV = \left(\frac{180}{\pi}\right) \dot{q}_{RFrl}$	Rotor-furl angular velocity (about the rotor-furl axis), (deg/sec)
$RotFurlA = \left(\frac{180}{\pi}\right) \ddot{q}_{RFrl}$	Rotor-furl angular acceleration (about the rotor-furl axis), (deg/sec^2)

Yaw Motions:

$NacYaw = NacYawP = YawPzn = YawPzp = \left(\frac{180}{\pi}\right) q_{Yaw}$ Nacelle yaw angle (position) (about the zn-/zp-axis), (deg)

$NacYawV = YawVzn = YawVzp = \left(\frac{180}{\pi}\right) \dot{q}_{Yaw}$ Nacelle yaw angular velocity (about the zn-/zp-axis), (deg/sec)

$NacYawA = YawAzn = YawAzp = \left(\frac{180}{\pi}\right) \ddot{q}_{Yaw}$ Nacelle yaw angular acceleration (about the zn-/zp-axis), (deg/sec^2)

$NacYawErr = HorWndDir - NacYaw - YawBrRDzt - PtfmYaw$ Nacelle yaw error (about the zt-axis), (deg)

Tower-Top Motions:

$YawBrTDxp = \left[\boldsymbol{r}^{ZO} - \left(TowerHt + PtfmRef \right) \boldsymbol{a}_2 \right] \cdot \boldsymbol{b}_1$ Tower-top / yaw bearing translational deflection (relative to undeflected position) (directed along the xp-axis), (m)

$YawBrTDyp = -\left[\boldsymbol{r}^{ZO} - \left(TowerHt + PtfmRef \right) \boldsymbol{a}_2 \right] \cdot \boldsymbol{b}_3$ Tower-top / yaw bearing translational deflection (relative to undeflected position) (directed along the yp-axis), (m)

$YawBrTDzp = \left[\boldsymbol{r}^{ZO} - \left(TowerHt + PtfmRef \right) \boldsymbol{a}_2 \right] \cdot \boldsymbol{b}_2$ Tower-top / yaw bearing translational deflection (relative to undeflected position) (directed along the zp-axis), (m)

$TTDspFA = YawBrTDxt = \left[\boldsymbol{r}^{ZO} - \left(TowerHt + PtfmRef \right) \boldsymbol{a}_2 \right] \cdot \boldsymbol{a}_1$ Tower-top / yaw bearing fore-aft (translational) deflection (relative to undeflected position) (directed along the xt-axis), (m)

$TTDspSS = YawBrTDyt = -\left[\boldsymbol{r}^{ZO} - \left(TowerHt + PtfmRef \right) \boldsymbol{a}_2 \right] \cdot \boldsymbol{a}_3$ Tower-top / yaw bearing side-to-side (translational) deflection (relative to undeflected position) (directed along the yt-axis), (m)

$TTDspAx = YawBrTDzt = \left[\boldsymbol{r}^{ZO} - \left(TowerHt + PtfmRef \right) \boldsymbol{a}_2 \right] \cdot \boldsymbol{a}_2$ Tower-top / yaw bearing axial (translational) deflection (relative to undeflected position) (directed along the zt-axis), (m)

$YawBrTAxp = {}^{E}\boldsymbol{a}^{O} \cdot \boldsymbol{b}_1$ Tower-top / yaw bearing translational acceleration (directed along the xp-axis), (m/sec^2)

$YawBrTAyp = -{}^{E}\boldsymbol{a}^{O} \cdot \boldsymbol{b}_3$ Tower-top / yaw bearing translational acceleration (directed along the yp-axis), (m/sec^2)

$YawBrTAzp = {}^{E}\boldsymbol{a}^{O} \cdot \boldsymbol{b}_2$ Tower-top / yaw bearing translational acceleration (directed along the zp-axis), (m/sec^2)

$TTDspRoll = YawBrRDxt = \left(\frac{180}{\pi}\right) {}^{X}\boldsymbol{\theta}^{B} \cdot \boldsymbol{a}_1$ Tower-top / yaw bearing roll deflection (relative to the undeflected position) (about the xt-axis), (deg)

$TTDspPtch = YawBrRDyt = -\left(\frac{180}{\pi}\right) {}^{X}\boldsymbol{\theta}^{B} \cdot \boldsymbol{a_3}$ Tower-top / yaw bearing pitch deflection (relative to the undeflected position) (about the yt-axis), (deg)

where: ${}^{X}\boldsymbol{\theta}^{B} = {}^{E}\boldsymbol{\omega}^{B}_{TFA1} q_{TFA1} + {}^{E}\boldsymbol{\omega}^{B}_{TSS1} q_{TSS1} + {}^{E}\boldsymbol{\omega}^{B}_{TFA2} q_{TFA2} + {}^{E}\boldsymbol{\omega}^{B}_{TSS2} q_{TSS2}$

$YawBrRVxp = \left(\frac{180}{\pi}\right) {}^{E}\boldsymbol{\omega}^{B} \cdot \boldsymbol{b_1}$ Tower-top / yaw bearing angular (rotational) velocity (about the xp-axis), (deg/sec)

$YawBrRVyp = -\left(\frac{180}{\pi}\right) {}^{E}\boldsymbol{\omega}^{B} \cdot \boldsymbol{b_3}$ Tower-top / yaw bearing angular (rotational) velocity (about the yp-axis), (deg/sec)

$YawBrRVzp = \left(\frac{180}{\pi}\right) {}^{E}\boldsymbol{\omega}^{B} \cdot \boldsymbol{b_2}$ Tower-top / yaw bearing angular (rotational) velocity (about the zp-axis), (deg/sec)

$YawBrRAxp = \left(\frac{180}{\pi}\right) {}^{E}\boldsymbol{\alpha}^{B} \cdot \boldsymbol{b_1}$ Tower-top / yaw bearing angular (rotational) acceleration (about the xp-axis), (deg/sec^2)

$YawBrRAyp = -\left(\frac{180}{\pi}\right) {}^{E}\boldsymbol{\alpha}^{B} \cdot \boldsymbol{b_3}$ Tower-top / yaw bearing angular (rotational) acceleration (about the yp-axis), (deg/sec^2)

$YawBrRAzp = \left(\frac{180}{\pi}\right) {}^{E}\boldsymbol{\alpha}^{B} \cdot \boldsymbol{b_2}$ Tower-top / yaw bearing angular (rotational) acceleration (about the zp-axis), (deg/sec^2)

<u>Tower Local Gage Motions:</u>

$TwHtiALxt = {}^{E}\boldsymbol{a}^{T}\left(H^{Node\,i}\right) \cdot \boldsymbol{t_1}\left(H^{Node\,i}\right)$ Tower local fore-aft translational acceleration (absolute) of node *i* (directed along the *local* xt-axis) (*i* = 1,2,…,5), (m/sec^2)

$TwHtiALyt = -{}^{E}\boldsymbol{a}^{T}\left(H^{Node\,i}\right) \cdot \boldsymbol{t_3}\left(H^{Node\,i}\right)$ Tower local side-to-side translational acceleration (absolute) of node *i* (directed along the *local* yt-axis) (*i* = 1,2,…,5), (m/sec^2)

$TwHtiALzt = {}^{E}\boldsymbol{a}^{T}\left(H^{Node\,i}\right) \cdot \boldsymbol{t_2}\left(H^{Node\,i}\right)$ Tower local axial translational acceleration (absolute) of node *i* (directed along the *local* zt-axis) (*i* = 1,2,…,5), (m/sec^2)

Tail-Furl Motions:

$TailFurl = TailFurlP = \left(\frac{180}{\pi}\right) q_{TFrl}$	Tail-furl angle (position) (about the tail-furl axis), (deg)
$TailFurlV = \left(\frac{180}{\pi}\right) \dot{q}_{TFrl}$	Tail-furl angular velocity (about the tail-furl axis), (deg/sec)
$TailFurlA = \left(\frac{180}{\pi}\right) \ddot{q}_{TFrl}$	Tail-furl angular acceleration (about the tail-furl axis), (deg/sec^2)

Platform Motions:

$PtfmTDxt = \boldsymbol{r}^{\boldsymbol{Z}} \cdot \boldsymbol{a}_1$	Platform horizontal surge displacement (directed along the xt-axis), (m)
$PtfmTDyt = -\boldsymbol{r}^{\boldsymbol{Z}} \cdot \boldsymbol{a}_3$	Platform horizontal sway displacement (directed along the yt-axis), (m)
$PtfmTDzt = \boldsymbol{r}^{\boldsymbol{Z}} \cdot \boldsymbol{a}_2$	Platform vertical heave displacement (directed along the zt-axis), (m)
$PtfmSurge = PtfmTDxi = q_{Sg}$	Platform horizontal surge displacement (directed along the xi-axis), (m)
$PtfmSway = PtfmTDyi = q_{Sw}$	Platform horizontal sway displacement (directed along the yi-axis), (m)
$PtfmHeave = PtfmTDzi = q_{Hv}$	Platform vertical heave displacement (directed along the zi-axis), (m)
$PtfmTVxt = {}^{E}\boldsymbol{v}^{\boldsymbol{Z}} \cdot \boldsymbol{a}_1$	Platform horizontal surge velocity (directed along the xt-axis), (m/sec)
$PtfmTVyt = -{}^{E}\boldsymbol{v}^{\boldsymbol{Z}} \cdot \boldsymbol{a}_3$	Platform horizontal sway velocity (directed along the yt-axis), (m/sec)
$PtfmTVzt = {}^{E}\boldsymbol{v}^{\boldsymbol{Z}} \cdot \boldsymbol{a}_2$	Platform vertical heave velocity (directed along the zt-axis), (m/sec)
$PtfmTVxi = \dot{q}_{Sg}$	Platform horizontal surge velocity (directed along the xi-axis), (m/sec)
$PtfmTVyi = \dot{q}_{Sw}$	Platform horizontal sway velocity (directed along the yi-axis), (m/sec)
$PtfmTVzi = \dot{q}_{Hv}$	Platform vertical heave velocity (directed along the zi-axis), (m/sec)
$PtfmTAxt = {}^{E}\boldsymbol{a}^{\boldsymbol{Z}} \cdot \boldsymbol{a}_1$	Platform horizontal surge acceleration (directed along the xt-axis), (m/sec^2)
$PtfmTAyt = -{}^{E}\boldsymbol{a}^{\boldsymbol{Z}} \cdot \boldsymbol{a}_3$	Platform horizontal sway acceleration (directed along the yt-axis), (m/sec^2)
$PtfmTAzt = {}^{E}\boldsymbol{a}^{\boldsymbol{Z}} \cdot \boldsymbol{a}_2$	Platform vertical heave acceleration (directed along the zt-axis), (m/sec^2)
$PtfmTAxi = \ddot{q}_{Sg}$	Platform horizontal surge acceleration (directed along the xi-axis), (m/sec^2)
$PtfmTAyi = \ddot{q}_{Sw}$	Platform horizontal sway acceleration (directed along the yi-axis), (m/sec^2)
$PtfmTAzi = \ddot{q}_{Hv}$	Platform vertical heave acceleration (directed along the zi-axis), (m/sec^2)

$PtfmRoll = PtfmRDxi = \left(\frac{180}{\pi}\right) q_R$	Platform roll tilt displacement (about the xi-axis), (deg)
$PtfmPitch = PtfmRDyi = \left(\frac{180}{\pi}\right) q_P$	Platform pitch tilt displacement (about the yi-axis), (deg)
$PtfmYaw = PtfmRDzi = \left(\frac{180}{\pi}\right) q_Y$	Platform yaw displacement (about the zi-axis), (deg)
$PtfmRVxt = \left(\frac{180}{\pi}\right) {}^E\boldsymbol{\omega}^X \cdot \boldsymbol{a}_1$	Platform roll tilt velocity (about the xt-axis), (deg/sec)
$PtfmRVyt = -\left(\frac{180}{\pi}\right) {}^E\boldsymbol{\omega}^X \cdot \boldsymbol{a}_3$	Platform pitch tilt velocity (about the yt-axis), (deg/sec)
$PtfmRVzt = \left(\frac{180}{\pi}\right) {}^E\boldsymbol{\omega}^X \cdot \boldsymbol{a}_2$	Platform yaw velocity (about the zt-axis), (deg/sec)
$PtfmRVxi = \left(\frac{180}{\pi}\right) \dot{q}_R$	Platform roll tilt velocity (about the xi-axis), (deg/sec)
$PtfmRVyi = \left(\frac{180}{\pi}\right) \dot{q}_P$	Platform pitch tilt velocity (about the yi-axis), (deg/sec)
$PtfmRVzi = \left(\frac{180}{\pi}\right) \dot{q}_Y$	Platform yaw velocity (about the zi-axis), (deg/sec)
$PtfmRAxt = \left(\frac{180}{\pi}\right) {}^E\boldsymbol{\alpha}^X \cdot \boldsymbol{a}_1$	Platform roll tilt acceleration (about the xt-axis), (deg/sec^2)
$PtfmRAyt = -\left(\frac{180}{\pi}\right) {}^E\boldsymbol{\alpha}^X \cdot \boldsymbol{a}_3$	Platform pitch tilt acceleration (about the yt-axis), (deg/sec^2)
$PtfmRAzt = \left(\frac{180}{\pi}\right) {}^E\boldsymbol{\alpha}^X \cdot \boldsymbol{a}_2$	Platform yaw acceleration (about the zt-axis), (deg/sec^2)
$PtfmRAxi = \left(\frac{180}{\pi}\right) \ddot{q}_R$	Platform roll tilt acceleration (about the xi-axis), (deg/sec^2)
$PtfmRAyi = \left(\frac{180}{\pi}\right) \ddot{q}_P$	Platform pitch tilt acceleration (about the yi-axis), (deg/sec^2)

$PtfmRAzi = \left(\frac{180}{\pi}\right)\ddot{q}_Y$ Platform yaw acceleration (about the zi-axis), (deg/sec^2)

Tail-Furl Motions:

$TFinAlpha = \left(\frac{180}{\pi}\right)TFinAOA$ Tail fin angle of attack, (deg)

$TFinCLift = TFinCL$ Tail fin lift coefficient, (-)

$TFinCDrag = TFinCD$ Tail fin drag coefficient, (-)

$TFinDnPrs = TFinQ$ Tail fin dynamic pressure, (Pa)

$TFinCPFx = TFinKFx / 1{,}000$ Tail fin tangential force, (kN)

$TFinCPFy = TFinKFy / 1{,}000$ Tail fin normal force, (kN)

Wind Motions:

$WindVxi = uWind$ Nominal hub-height wind velocity (directed along the xi-axis), (m/s)

$WindVyi = vWind$ Cross-wind hub-height velocity (directed along the yi-axis), (m/s)

$WindVzi = wWind$ Vertical hub-height wind velocity (directed along the zi-axis), (m/s)

$TotWindV = \sqrt{WindVxi^2 + WindVyi^2 + WindVzi^2}$ Total hub-height wind velocity magnitude, (m/s)

$HorWindV = \sqrt{WindVxi^2 + WindVyi^2}$ Horizontal hub-height wind velocity magnitude (in the xi-/yi-plane), (m/s)

$HorWndDir$ Horizontal hub-height wind direction (about the zi-axis), (deg)

$VerWndDir$ Vertical hub-height wind direction (about an axis orthogonal to the zi-axis and the horizontal wind vector), (deg)