Einstein Boson Stars
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Version: ccz4 sf2 original
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Fields

gtd_xx, gtd_xy, gtd_xz, gtd_yy, gtd_yz, gtd_zz, Atd_xx, Atd_xy, Atd_xz, Atd_yy, Atd_yz, Atd_zz, $Gamh\_x$, $Gamh\_y$, $Gamh\_z$, $Betau\_x$, $Betau\_y$, $Betau\_z$, $Alpha$, chi, trK, $theta$, $phiR$, $pheR$, $phiI$, $pheI$, piR, peR, piI, peI

Spatial Coordinates

x, y, z

Time Coordinate

t

Parameters

Parameter	Type	Default value
chi_floor	REAL	0.0001
nstars	INT	1
amp_phi	REAL	0.000001
vx1	REAL	Not set
omega1	REAL	Not set
vx2	REAL	Not set
omega2	REAL	Not set
xcenter1	REAL	0
ycenter1	REAL	0
zcenter1	REAL	0
xcenter2	REAL	0
ycenter2	REAL	0
zcenter2	REAL	0
lambda_0	REAL	1
gtd_xx_asymptotic	REAL	1
gtd_xy_asymptotic	REAL	0
gtd_xz_asymptotic	REAL	0
gtd_yy_asymptotic	REAL	1
gtd_yz_asymptotic	REAL	0
gtd_zz_asymptotic	REAL	1
Atd_xx_asymptotic	REAL	0
Atd_xy_asymptotic	REAL	0
Atd_xz_asymptotic	REAL	0
Atd_yy_asymptotic	REAL	0
Atd_yz_asymptotic	REAL	0
Atd_zz_asymptotic	REAL	0
Gamh_x_asymptotic	REAL	0
Gamh_y_asymptotic	REAL	0
Gamh_z_asymptotic	REAL	0
Betau_x_asymptotic	REAL	02
Betau_y_asymptotic	REAL	0
Betau_z_asymptotic	REAL	0
Alpha_asymptotic	REAL	1
chi_asymptotic	REAL	1
trK_asymptotic	REAL	0

Auxiliary Fields

$phi2$

Auxiliary Variables

$decay\_factor$, $kappa\_cc$, $kappa\_z1$, $kappa\_z2$, $sfmass$, $feta$, chi_max, inv_chi, $detgtd$, $idetgtd$, gtu_xx, gtu_xy, gtu_xz, gtu_yy, gtu_yz, gtu_zz, $g4u\_tt$, $g4u\_tx$, $g4u\_ty$, $g4u\_tz$, $g4u\_xx$, $g4u\_xy$, $g4u\_xz$, $g4u\_yy$, $g4u\_yz$, $g4u\_zz$, d_phiR4d_t, d_phiR4d_x, d_phiR4d_y, d_phiR4d_z, d_phiR4u_t, d_phiR4u_x, d_phiR4u_y, d_phiR4u_z, d_phiI4d_t, d_phiI4d_x, d_phiI4d_y, d_phiI4d_z, d_phiI4u_t, d_phiI4u_x, d_phiI4u_y, d_phiI4u_z, d_pheR4d_t, d_pheR4d_x, d_pheR4d_y, d_pheR4d_z, d_pheR4u_t, d_pheR4u_x, d_pheR4u_y, d_pheR4u_z, d_pheI4d_t, d_pheI4d_x, d_pheI4d_y, d_pheI4d_z, d_pheI4u_t, d_pheI4u_x, d_pheI4u_y, d_pheI4u_z, $dphi4sq$, $dphe4sq$, $sfVi$, $sfVe$, $dVdphi2$, $dVdphe2$, $Tsfu\_tt$, $Tsfu\_tx$, $Tsfu\_ty$, $Tsfu\_tz$, $Tsfu\_xx$, $Tsfu\_xy$, $Tsfu\_xz$, $Tsfu\_yy$, $Tsfu\_yz$, $Tsfu\_zz$, Tu_tt, Tu_tx, Tu_ty, Tu_tz, Tu_xx, Tu_xy, Tu_xz, Tu_yy, Tu_yz, Tu_zz, rho_ADM, Jtd_ADM_x, Jtd_ADM_y, Jtd_ADM_z, $Betatd\_x$, $Betatd\_y$, $Betatd\_z$, $pTtd\_ADM\_xx$, $pTtd\_ADM\_xy$, $pTtd\_ADM\_xz$, $pTtd\_ADM\_yy$, $pTtd\_ADM\_yz$, $pTtd\_ADM\_zz$, tr_pT, $Atud\_xx$, $Atud\_xy$, $Atud\_xz$, $Atud\_yx$, $Atud\_yy$, $Atud\_yz$, $Atud\_zx$, $Atud\_zy$, $Atud\_zz$, $trAt$, Atu_xx, Atu_xy, Atu_xz, Atu_yy, Atu_yz, Atu_zz, Ctd_xxx, Ctd_xxy, Ctd_xxz, Ctd_xyy, Ctd_xyz, Ctd_xzz, Ctd_yxx, Ctd_yxy, Ctd_yxz, Ctd_yyy, Ctd_yyz, Ctd_yzz, Ctd_zxx, Ctd_zxy, Ctd_zxz, Ctd_zyy, Ctd_zyz, Ctd_zzz, Ct_xxx, Ct_xxy, Ct_xxz, Ct_xyy, Ct_xyz, Ct_xzz, Ct_yxx, Ct_yxy, Ct_yxz, Ct_yyy, Ct_yyz, Ct_yzz, Ct_zxx, Ct_zxy, Ct_zxz, Ct_zyy, Ct_zyz, Ct_zzz, div_Beta, $d\_div\_Beta\_x$, $d\_div\_Beta\_y$, $d\_div\_Beta\_z$, $Gamt\_x$, $Gamt\_y$, $Gamt\_z$, Zu_x, Zu_y, Zu_z, Rpd_xx, Rpd_xy, Rpd_xz, Rpd_yy, Rpd_yz, Rpd_zz, Rtd_xx, Rtd_xy, Rtd_xz, Rtd_yy, Rtd_yz, Rtd_zz, $Rscalar$, $Psi1\_xx$, $Psi1\_xy$, $Psi1\_xz$, $Psi1\_yy$, $Psi1\_yz$, $Psi1\_zz$, $trPsi1$, $Psi1TF\_xx$, $Psi1TF\_xy$, $Psi1TF\_xz$, $Psi1TF\_yy$, $Psi1TF\_yz$, $Psi1TF\_zz$

Analysis Fields

$Rscalar$, $HamCon$, $MomCon\_x$, $MomCon\_y$, $MomCon\_z$, trA, $detgtm1$, M_ADM_surf, Jz_ADM_surf, $N\_Noetheri$, $N\_Noethere$, M_Komar, Jz_Komar, $psi4R$, $psi4I$, Z_x, Z_y, Z_z

Auxiliary Analysis Variables

$kappa\_cc$, $kappa\_z1$, $kappa\_z2$, $sfmass$, $feta$, inv_chi, $detgtd$, $idetgtd$, gtu_xx, gtu_xy, gtu_xz, gtu_yy, gtu_yz, gtu_zz, $g4d\_tt$, $g4d\_tx$, $g4d\_ty$, $g4d\_tz$, $g4d\_xx$, $g4d\_xy$, $g4d\_xz$, $g4d\_yy$, $g4d\_yz$, $g4d\_zz$, $g4u\_tt$, $g4u\_tx$, $g4u\_ty$, $g4u\_tz$, $g4u\_xx$, $g4u\_xy$, $g4u\_xz$, $g4u\_yy$, $g4u\_yz$, $g4u\_zz$, d_phiR4d_t, d_phiR4d_x, d_phiR4d_y, d_phiR4d_z, d_phiR4u_t, d_phiR4u_x, d_phiR4u_y, d_phiR4u_z, d_phiI4d_t, d_phiI4d_x, d_phiI4d_y, d_phiI4d_z, d_phiI4u_t, d_phiI4u_x, d_phiI4u_y, d_phiI4u_z, d_pheR4d_t, d_pheR4d_x, d_pheR4d_y, d_pheR4d_z, d_pheR4u_t, d_pheR4u_x, d_pheR4u_y, d_pheR4u_z, d_pheI4d_t, d_pheI4d_x, d_pheI4d_y, d_pheI4d_z, d_pheI4u_t, d_pheI4u_x, d_pheI4u_y, d_pheI4u_z, $dphi4sq$, $dphe4sq$, $sfVi$, $sfVe$, $Tsfu\_tt$, $Tsfu\_tx$, $Tsfu\_ty$, $Tsfu\_tz$, $Tsfu\_xx$, $Tsfu\_xy$, $Tsfu\_xz$, $Tsfu\_yy$, $Tsfu\_yz$, $Tsfu\_zz$, Tu_tt, Tu_tx, Tu_ty, Tu_tz, Tu_xx, Tu_xy, Tu_xz, Tu_yy, Tu_yz, Tu_zz, rho_ADM, Jtd_ADM_x, Jtd_ADM_y, Jtd_ADM_z, $Atud\_xx$, $Atud\_xy$, $Atud\_xz$, $Atud\_yx$, $Atud\_yy$, $Atud\_yz$, $Atud\_zx$, $Atud\_zy$, $Atud\_zz$, Atu_xx, Atu_xy, Atu_xz, Atu_yy, Atu_yz, Atu_zz, Ctd_xxx, Ctd_xxy, Ctd_xxz, Ctd_xyy, Ctd_xyz, Ctd_xzz, Ctd_yxx, Ctd_yxy, Ctd_yxz, Ctd_yyy, Ctd_yyz, Ctd_yzz, Ctd_zxx, Ctd_zxy, Ctd_zxz, Ctd_zyy, Ctd_zyz, Ctd_zzz, Ct_xxx, Ct_xxy, Ct_xxz, Ct_xyy, Ct_xyz, Ct_xzz, Ct_yxx, Ct_yxy, Ct_yxz, Ct_yyy, Ct_yyz, Ct_yzz, Ct_zxx, Ct_zxy, Ct_zxz, Ct_zyy, Ct_zyz, Ct_zzz, $Gamt\_x$, $Gamt\_y$, $Gamt\_z$, Zu_x, Zu_y, Zu_z, Rpd_xx, Rpd_xy, Rpd_xz, Rpd_yy, Rpd_yz, Rpd_zz,

Rtd_xx, Rtd_xy, Rtd_xz, Rtd_yy, Rtd_yz, Rtd_zz, uph_x, uph_y, uph_z, ur_x, ur_y, ur_z, $uthd\_x$, $uthd\_y$, $uthd\_z$, uth_x, uth_y, uth_z, $wphph$, vph_x, vph_y, vph_z, $wrph$, wrr, vr_x, vr_y, vr_z, $wthph$, $wthr$, $wthth$, vth_x, vth_y, vth_z, $dSigma\_x$, $dSigma\_y$, $dSigma\_z$, Td_tt, Td_tx, Td_ty, Td_tz, Td_xx, Td_xy, Td_xz, Td_yy, Td_yz, Td_zz, TT, $EWeyl\_xx$, $EWeyl\_xy$, $EWeyl\_xz$, $EWeyl\_yy$, $EWeyl\_yz$, $EWeyl\_zz$, Del_Kd_xxx, Del_Kd_xxy, Del_Kd_xxz, Del_Kd_yxx, Del_Kd_yxy, Del_Kd_yxz, Del_Kd_zxx, Del_Kd_zxy, Del_Kd_zxz, Del_Kd_xyy, Del_Kd_xyz, Del_Kd_yyy, Del_Kd_yyz, Del_Kd_zyy, Del_Kd_zyz, Del_Kd_xzz, Del_Kd_yzz, Del_Kd_zzz, $BWeyl\_xx$, $BWeyl\_xy$, $BWeyl\_xz$, $BWeyl\_yx$, $BWeyl\_yy$, $BWeyl\_yz$, $BWeyl\_zx$, $BWeyl\_zy$, $BWeyl\_zz$, mmR_xx, mmR_xy, mmR_xz, mmR_yy, mmR_yz, mmR_zz, mmI_xx, mmI_xy, mmI_xz, mmI_yy, mmI_yz, mmI_zz

Imported Models

ModelName

Region

main
Interior models
ModelName

Spatial Domain

Coordinate	Min	Max
x	-4	4
y	-4	4
z	-4	4

Initial Conditions

The condition is:

$$cgamma = \frac{1}{\sqrt{1 - vx1\ vx1}} \tag{1}$$

$$pos\_x = x - xcenter1 \tag{2}$$

$$pos\_y = y - ycenter1 \tag{3}$$

$$pos\_z = z - zcenter1 \tag{4}$$

$$r = \max\{\sqrt{cgamma\ cgamma\ pos\_x\ pos\_x + pos\_y\ pos\_y + pos\_z\ pos\_z}, 50.0001\}$$

$$psi\_p = 0 \tag{6}$$

$$\textbf{readFromFileQuintic}(1, 1, r, psi\_p, 0) \tag{7}$$

$$drpsi\_p = 0 \tag{8}$$

$$\textbf{readFromFileQuintic}(1, 1, r, drpsi\_p, 0) \tag{9}$$

$$alpha\_p = 0 \tag{10}$$

$$\textbf{readFromFileQuintic}(1, 1, r, alpha\_p, 0) \tag{11}$$

$$dralpha\_p = 0 \tag{12}$$

$$\textbf{readFromFileQuintic}(1, 1, r, dralpha\_p, 0) \tag{13}$$

$$phi\_p = 0 \tag{14}$$

$$\textbf{readFromFileQuintic}(1, 1, r, phi\_p, 0) \tag{15}$$

$$drphi\_p = 0 \tag{16}$$

$$\textbf{readFromFileQuintic}(1, 1, r, drphi\_p, 0) \tag{17}$$

$$B0 = cgamma \sqrt{1 - \frac{vx1^2\ alpha\_p^2}{psi\_p^4}} \tag{18}$$

The condition is applied when:

$$nstars = 2 \tag{82}$$

The condition is:

$$cgamma = \frac{1}{\sqrt{1 - vx2\ vx2}} \tag{83}$$

$$pos\_x = x - xcenter2 \tag{84}$$

$$pos\_y = y - ycenter2 \tag{85}$$

$$pos\_z = z - zcenter2 \tag{86}$$

$$r = \max\{\sqrt{cgamma\ cgamma\ pos\_x\ pos\_x + pos\_y\ pos\_y + pos\_z\ pos\_z}, 0.0001\} \tag{87}$$

$$psi\_p = 0 \tag{88}$$

$$\textbf{readFromFileQuintic}(1, 1, r, psi\_p, 0) \tag{89}$$

$$drpsi\_p = 0 \tag{90}$$

$$\textbf{readFromFileQuintic}(1, 1, r, drpsi\_p, 0) \tag{91}$$

$$alpha\_p = 0 \tag{92}$$

$$\textbf{readFromFileQuintic}(1, 1, r, alpha\_p, 0) \tag{93}$$

$$dralpha\_p = 0 \tag{94}$$

$$\textbf{readFromFileQuintic}(1, 1, r, dralpha\_p, 0) \tag{95}$$

$$phi\_p = 0 \tag{96}$$

$$\textbf{readFromFileQuintic}(1, 1, r, phi\_p, 0) \tag{97}$$

$$drphi\_p = 0 \tag{98}$$

$$\textbf{readFromFileQuintic}(1, 1, r, drphi\_p, 0) \tag{99}$$

$$\sqrt{vx2^2 + alpha\_p^2}$$

The condition is:

$$phi2 = (phiR\ phiR + phiI\ phiI + pheR\ pheR + pheI\ pheI) \tag{158}$$

Segment interactions

Interaction 1
Target segments: x-Lower, x-Upper, y-Lower, y-Upper, z-Lower, z-Upper

interaction

Analysis Field Equations

Analysis field equation

$$Rscalar = Op(x, y, z, t) \tag{159}$$

$$\begin{aligned} Op(x, y, z, t) = &+ (chi\ Rtd\_xx + Rpd\_xx)\ gtu\_xx + 2\ (chi\ Rtd\_xy + Rpd\_xy)\ gtu\_xy \\ &+ 2\ (chi\ Rtd\_xz + Rpd\_xz)\ gtu\_xz + (chi\ Rtd\_yy + Rpd\_yy)\ gtu\_yy \\ &+ 2\ (chi\ Rtd\_yz + Rpd\_yz)\ gtu\_yz + (chi\ Rtd\_zz + Rpd\_zz)\ gtu\_zz \end{aligned} \tag{160}$$

Analysis field equation

$$HamCon = Op(x, y, z, t) \tag{161}$$

$$\begin{aligned} Op(x, y, z, t) = &+ (-16\ \pi\ rho\_ADM) + (chi\ Rtd\_xx + Rpd\_xx)\ gtu\_xx \\ &+ 2\ (chi\ Rtd\_xy + Rpd\_xy)\ gtu\_xy + 2\ (chi\ Rtd\_xz + Rpd\_xz)\ gtu\_xz \\ &+ (chi\ Rtd\_yy + Rpd\_yy)\ gtu\_yy + 2\ (chi\ Rtd\_yz + Rpd\_yz)\ gtu\_yz \\ &+ (chi\ Rtd\_zz + Rpd\_zz)\ gtu\_zz + (-Atd\_xx\ Atu\_xx) \\ &+ (-2\ Atd\_xy\ Atu\_xy) + (-2\ Atd\_xz\ Atu\_xz) \\ &+ (-Atd\_yy\ Atu\_yy) + (-2\ Atd\_yz\ Atu\_yz) \\ &+ (-Atd\_zz\ Atu\_zz) + .666666666666667\ trK^2 \end{aligned} \tag{162}$$

Analysis field equation

$$MomCon\_x = Op(x, y, z, t) \tag{163}$$

$$\begin{aligned} Op(x, y, z, t) = & -1.500000000000000\ inv\_chi\ Atud\_zx\ \partial_z chi \\ & - 8\ \pi\ Jtd\_ADM\_x\ inv\_chi \\ & - 1.500000000000000\ inv\_chi\ Atud\_xx\ \partial_x chi \\ & - 1.500000000000000\ inv\_chi\ Atud\_yx\ \partial_y chi + gtu\_xx\ \partial_x Atd\_xx \\ & + gtu\_xy\ \partial_x Atd\_xy + gtu\_xz\ \partial_x Atd\_xz + gtu\_xy\ \partial_y Atd\_xx \\ & + gtu\_yy\ \partial_y Atd\_xy + gtu\_yz\ \partial_y Atd\_xz + gtu\_xz\ \partial_z Atd\_xx \\ & + gtu\_yz\ \partial_z Atd\_xy + gtu\_zz\ \partial_z Atd\_xz - Ct\_xxx\ Atud\_xx \\ & - Ct\_xxy\ Atud\_yx - Ct\_xxz\ Atud\_zx - Ct\_yxx\ Atud\_xy \\ & - Ct\_yxy\ Atud\_yy - Ct\_yxz\ Atud\_zy - Ct\_zxx\ Atud\_xz \\ & - Ct\_zxy\ Atud\_yz - Ct\_zxz\ Atud\_zz - Gamt\_x\ Atd\_xx \\ & - Gamt\_y\ Atd\_xy - Gamt\_z\ Atd\_xz - .6666666666666667\ \partial_x trK \end{aligned} \tag{164}$$

Analysis field equation

$$MomCon\_y = Op(x, y, z, t) \tag{165}$$

$$\begin{aligned} Op(x, y, z, t) = & -1.500000000000000\ inv\_chi\ Atud\_xy\ \partial_x chi \\ & - 1.500000000000000\ inv\_chi\ Atud\_zy\ \partial_z chi \\ & - 1.500000000000000\ inv\_chi\ Atud\_yy\ \partial_y chi \\ & - 8\ \pi\ Jtd\_ADM\_y\ inv\_chi + gtu\_xx\ \partial_x Atd\_xy \\ & + gtu\_xy\ \partial_x Atd\_yy + gtu\_xz\ \partial_x Atd\_yz + gtu\_xy\ \partial_y Atd\_xy \\ & + gtu\_yy\ \partial_y Atd\_yy + gtu\_yz\ \partial_y Atd\_yz + gtu\_xz\ \partial_z Atd\_xy \\ & + gtu\_yz\ \partial_z Atd\_yy + gtu\_zz\ \partial_z Atd\_yz - Ct\_xxy\ Atud\_xx \\ & - Ct\_xyy\ Atud\_yx - Ct\_xyz\ Atud\_zx - Ct\_yxy\ Atud\_xy \\ & - Ct\_yyy\ Atud\_yy - Ct\_yyz\ Atud\_zy - Ct\_zxy\ Atud\_xz \\ & - Ct\_zyy\ Atud\_yz - Ct\_zyz\ Atud\_zz - Gamt\_x\ Atd\_xy \\ & - Gamt\_y\ Atd\_yy - Gamt\_z\ Atd\_yz - .6666666666666667\ \partial_y trK \end{aligned} \tag{166}$$

Analysis field equation

$$MomCon\_z = Op(x, y, z, t) \tag{167}$$

$$\begin{aligned} Op(x, y, z, t) = & -Ct\_zxz\ Atud\_xz - Ct\_zyz\ Atud\_yz - Ct\_zzz\ Atud\_zz \\ & - Gamt\_x\ Atd\_xz - Gamt\_y\ Atd\_yz - Gamt\_z\ Atd\_zz \\ & - 1.500000000000000\ inv\_chi\ Atud\_xz\ \partial_x chi \\ & - 1.500000000000000\ inv\_chi\ Atud\_yz\ \partial_y chi \\ & - 1.500000000000000\ inv\_chi\ Atud\_zz\ \partial_z chi \\ & - 8\ \pi\ Jtd\_ADM\_z\ inv\_chi + gtu\_xx\ \partial_x Atd\_xz \\ & + gtu\_xy\ \partial_x Atd\_yz + gtu\_xz\ \partial_x Atd\_zz + gtu\_xy\ \partial_y Atd\_xz \\ & + gtu\_yy\ \partial_y Atd\_yz + gtu\_yz\ \partial_y Atd\_zz + gtu\_xz\ \partial_z Atd\_xz \\ & + gtu\_yz\ \partial_z Atd\_yz + gtu\_zz\ \partial_z Atd\_zz - Ct\_xxz\ Atud\_xx \\ & - Ct\_xyz\ Atud\_yx - Ct\_xzz\ Atud\_zx - Ct\_yxz\ Atud\_xy \\ & - Ct\_yyz\ Atud\_yy - Ct\_yzz\ Atud\_zy - .6666666666666667\ \partial_z trK \end{aligned} \tag{168}$$

Analysis field equation

$$trA = Op(x, y, z, t) \tag{169}$$

$$Op(x, y, z, t) = +Atud\_xx + Atud\_yy + Atud\_zz \tag{170}$$

Analysis field equation

$$detgtm1 = Op(x, y, z, t) \tag{171}$$

$$Op(x, y, z, t) = +detgtd + (-1.0) \tag{172}$$

Analysis field equation

$$M\_ADM\_surf = Op(x, y, z, t) \tag{173}$$

$$
\begin{aligned}
Op(x,y,z,t) = &+.1989436788648692e-1\ chi\ Gamt\_x\ dSigma\_x \\
&+.1989436788648692e-1\ chi\ Gamt\_y\ dSigma\_y \\
&+.1989436788648692e-1\ chi\ Gamt\_z\ dSigma\_z \\
&+.1250000000000000\ \frac{gtu\_xx\ dSigma\_x}{\pi}\ \partial_x chi \\
&+.1250000000000000\ \frac{gtu\_xy\ dSigma\_x}{\pi}\ \partial_y chi \\
&+.1250000000000000\ \frac{gtu\_xz\ dSigma\_x}{\pi}\ \partial_z chi \\
&+.1250000000000000\ \frac{gtu\_xy\ dSigma\_y}{\pi}\ \partial_x chi \\
&+.1250000000000000\ \frac{gtu\_yy\ dSigma\_y}{\pi}\ \partial_y chi \\
&+.1250000000000000\ \frac{gtu\_yz\ dSigma\_y}{\pi}\ \partial_z chi \\
&+.1250000000000000\ \frac{gtu\_xz\ dSigma\_z}{\pi}\ \partial_x chi \\
&+.1250000000000000\ \frac{gtu\_yz\ dSigma\_z}{\pi}\ \partial_y chi \\
&+.1250000000000000\ \frac{gtu\_zz\ dSigma\_z}{\pi}\ \partial_z chi
\end{aligned}
\tag{174}
$$

Analysis field equation

$$
Jz\_ADM\_surf = Op(x,y,z,t) \tag{175}
$$

$$
\begin{aligned}
Op(x,y,z,t) = &+.397887357729738^4e \\
&-1\ chi\ \ (uph\_x\ \ (.3333333333333333\ trK\ gtu\_xx + Atu\_xx) \\
&\qquad + uph\_y\ \ (.3333333333333333\ trK\ gtu\_xy + Atu\_xy) \\
&\qquad + uph\_z\ \ (.3333333333333333\ trK\ gtu\_xz + Atu\_xz))\ \ dSigma\_x \\
&+.397887357729738^4e \\
&-1\ chi\ \ (uph\_x\ \ (.3333333333333333\ trK\ gtu\_xy + Atu\_xy) \\
&\qquad + uph\_y\ \ (.3333333333333333\ trK\ gtu\_yy + Atu\_yy) \\
&\qquad + uph\_z\ \ (.3333333333333333\ trK\ gtu\_yz + Atu\_yz))\ \ dSigma\_y \\
&+.397887357729738^4e \\
&-1\ chi\ \ (uph\_x\ \ (.3333333333333333\ trK\ gtu\_xz + Atu\_xz) \\
&\qquad + uph\_y\ \ (.3333333333333333\ trK\ gtu\_yz + Atu\_yz) \\
&\qquad + uph\_z\ \ (.3333333333333333\ trK\ gtu\_zz + Atu\_zz))\ \ dSigma\_z
\end{aligned}
\tag{176}
$$

Analysis field equation

$$N\_Noetheri = Op(x, y, z, t) \tag{177}$$

$$Op(x, y, z, t) = -2.0\ \frac{1.\ phiI\ piR - 1.\ phiR\ piI}{chi^{1.500000000000000}} \tag{178}$$

Analysis field equation

$$N\_Noethere = Op(x, y, z, t) \tag{179}$$

$$Op(x, y, z, t) = -2.0\ \frac{(-1.\ peI\ pheR) + 1.\ peR\ pheI}{chi^{1.500000000000000}} \tag{180}$$

Analysis field equation

$$M\_Komar = Op(x, y, z, t) \tag{181}$$

$$Op(x, y, z, t) = \tag{182}$$
$$+2\ \frac{\frac{(-.5\ TT\ g4d\_tt)+Td\_tt}{Alpha} + \left(-\frac{((-.5\ TT\ g4d\_tx)+Td\_tx)\ Betau\_x}{Alpha}\right) + \left(-\frac{((-.5\ TT\ g4d\_ty)+Td\_ty)\ Betau\_y}{Alpha}\right) + \left(-\frac{((-.5}{}\right.}{chi^{1.500000000000000}}$$

Analysis field equation

$$Jz\_Komar = Op(x, y, z, t) \tag{183}$$

$$Op(x, y, z, t) = \tag{184}$$
$$-\frac{\frac{((-.5\ TT\ g4d\_tx)+Td\_tx)\ vph\_x}{Alpha} + \left(-\frac{((-.5\ TT\ g4d\_xx)+Td\_xx)\ Betau\_x\ vph\_x}{Alpha}\right) + \left(-\frac{((-.5\ TT\ g4d\_xy)+Td\_xy)\ Betau\_}{Alpha}\right.}{}$$

Analysis field equation

$$psi4R = Op(x, y, z, t) \tag{185}$$

$$Op(x,y,z,t) = +\max\{.1e-9, \sqrt{x^2+y^2+z^2}\}\ ((-BWeyl\_xx\ mmI\_xx) + EWeyl\_xx\ mmR\_xx + (-BWeyl\_yx\ mmI\_xy) + 2\ EWeyl\_xy\ mmR\_xy + (-BWeyl\_zx\ mmI\_xz) + 2\ EWeyl\_xz\ mmR\_xz + (-BWeyl\_xy\ mmI\_xy) + (-BWeyl\_yy\ mmI\_yy) + EWeyl\_yy\ mmR\_yy + (-BWeyl\_zy\ mmI\_yz) + 2\ EWeyl\_yz\ mmR\_yz + (-BWeyl\_xz\ mmI\_xz) + (-BWeyl\_yz\ mmI\_yz) + (-BWeyl\_zz\ mmI\_zz) + EWeyl\_zz\ mmR\_zz) \tag{186}$$

Analysis field equation

$$psi4I = Op(x,y,z,t) \tag{187}$$

$$Op(x,y,z,t) = +\max\{.1e-9, \sqrt{x^2+y^2+z^2}\}\ (BWeyl\_xx\ mmR\_xx + EWeyl\_xx\ mmI\_xx + BWeyl\_yx\ mmR\_xy + 2\ EWeyl\_xy\ mmI\_xy + BWeyl\_zx\ mmR\_xz + 2\ EWeyl\_xz\ mmI\_xz + BWeyl\_xy\ mmR\_xy + BWeyl\_yy\ mmR\_yy + EWeyl\_yy\ mmI\_yy + BWeyl\_zy\ mmR\_yz + 2\ EWeyl\_yz\ mmI\_yz + BWeyl\_xz\ mmR\_xz + BWeyl\_yz\ mmR\_yz + BWeyl\_zz\ mmR\_zz + EWeyl\_zz\ mmI\_zz) \tag{188}$$

Analysis field equation

$$Z\_x = Op(x,y,z,t) \tag{189}$$

$$Op(x,y,z,t) = +Zu\_x \tag{190}$$

Analysis field equation

$$Z\_y = Op(x,y,z,t) \tag{191}$$

$$Op(x,y,z,t) = +Zu\_y \tag{192}$$

Analysis field equation

$$Z\_z = Op(x, y, z, t) \tag{193}$$

$$Op(x, y, z, t) = +Zu\_z \tag{194}$$

Auxiliary Analysis Equations

Auxiliary analysis variable equation

$$kappa\_cc = Op(x, y, z, t) \tag{195}$$

$$Op(x, y, z, t) = +\min\{p\_kappa\_cc, p\_kappa\_cc \left(\frac{R\_0}{\max\{.1e-9, \sqrt{x^2+y^2+z^2}\}}\right)^{eta\_damping\_exp}\} \tag{196}$$

Auxiliary analysis variable equation

$$kappa\_z1 = Op(x, y, z, t) \tag{197}$$

$$Op(x, y, z, t) = +\min\{p\_kappa\_z1, p\_kappa\_z1 \left(\frac{R\_0}{\max\{.1e-9, \sqrt{x^2+y^2+z^2}\}}\right)^{eta\_damping\_exp}\} \tag{198}$$

Auxiliary analysis variable equation

$$kappa\_z2 = Op(x, y, z, t) \tag{199}$$

$$Op(x, y, z, t) = +\min\{p\_kappa\_z2, p\_kappa\_z2 \left(\frac{R\_0}{\max\{.1e-9, \sqrt{x^2+y^2+z^2}\}}\right)^{eta\_damping\_exp}\} \tag{200}$$

Auxiliary analysis variable equation

$$sfmass = Op(x, y, z, t) \tag{201}$$

$$Op(x, y, z, t) = +\min\{p\_sfmass, p\_sfmass \left(\frac{R\_0}{\max\{.1e-9, \sqrt{x^2+y^2+z^2}\}}\right)^{eta\_damping\_exp}\} \tag{202}$$

Auxiliary analysis variable equation

$$feta = Op(x, y, z, t) \tag{203}$$

$$Op(x, y, z, t) = +\min\{p\_feta, p\_feta \left(\frac{R\_0}{\max\{.1e-9, \sqrt{x^2+y^2+z^2}\}}\right)^{eta\_damping\_exp}\} \tag{204}$$

Auxiliary analysis variable equation

$$inv\_chi = Op(x, y, z, t) \tag{205}$$

$$Op(x, y, z, t) = +\frac{1}{|chi|} \tag{206}$$

Auxiliary analysis variable equation

$$detgtd = Op(x, y, z, t) \tag{207}$$

$$Op(x, y, z, t) = +gtd\_yy\ gtd\_zz\ gtd\_xx + (-gtd\_yy\ gtd\_xz^2) + (-gtd\_zz\ gtd\_xy^2) + (-gtd\_yz^2\ gtd\_xx) + 2\ gtd\_yz\ gtd\_xy\ gtd\_xz \tag{208}$$

Auxiliary analysis variable equation

$$idetgtd = Op(x, y, z, t) \tag{209}$$

$$Op(x, y, z, t) = +\frac{1}{detgtd} \tag{210}$$

Auxiliary analysis variable equation

$$gtu\_xx = Op(x, y, z, t) \tag{211}$$

$$Op(x, y, z, t) = +idetgtd\ \ (gtd\_yy\ gtd\_zz - gtd\_yz^2) \tag{212}$$

Auxiliary analysis variable equation

$$gtu\_xy = Op(x, y, z, t) \tag{213}$$

$$Op(x, y, z, t) = +idetgtd\ \ ((-gtd\_xy\ gtd\_zz) + gtd\_yz\ gtd\_xz) \tag{214}$$

Auxiliary analysis variable equation

$$gtu\_xz = Op(x, y, z, t) \tag{215}$$

$$Op(x, y, z, t) = +idetgtd\ \ (gtd\_xy\ gtd\_yz - gtd\_yy\ gtd\_xz) \tag{216}$$

Auxiliary analysis variable equation

$$gtu\_yy = Op(x, y, z, t) \tag{217}$$

$$Op(x, y, z, t) = +idetgtd\ \ (gtd\_xx\ gtd\_zz - gtd\_xz^2) \tag{218}$$

Auxiliary analysis variable equation

$$gtu\_yz = Op(x, y, z, t) \tag{219}$$

$$Op(x, y, z, t) = +idetgtd\ \ ((-gtd\_xx\ gtd\_yz) + gtd\_xy\ gtd\_xz) \tag{220}$$

Auxiliary analysis variable equation

$$gtu\_zz = Op(x, y, z, t) \tag{221}$$

$$Op(x, y, z, t) = +idetgtd\ \ (gtd\_xx\ gtd\_yy - gtd\_xy^2) \tag{222}$$

Auxiliary analysis variable equation

$$g4d\_tt = Op(x, y, z, t) \tag{223}$$

$$\begin{aligned} Op(x, y, z, t) = +(-Alpha^2) + inv\_chi\ \ (&gtd\_xx\ Betau\_x^2 \\ &+ 2\ gtd\_xy\ Betau\_y\ Betau\_x + 2\ gtd\_xz\ Betau\_z\ Betau\_x \\ &+ gtd\_yy\ Betau\_y^2 + 2\ gtd\_yz\ Betau\_z\ Betau\_y + gtd\_zz\ Betau\_z^2) \end{aligned} \tag{224}$$

Auxiliary analysis variable equation

$$g4d\_tx = Op(x, y, z, t) \tag{225}$$

$$Op(x, y, z, t) = +inv\_chi\ \ (gtd\_xx\ Betau\_x + gtd\_xy\ Betau\_y + gtd\_xz\ Betau\_z) \tag{226}$$

Auxiliary analysis variable equation

$$g4d\_ty = Op(x, y, z, t) \tag{227}$$

$$Op(x, y, z, t) = +inv\_chi\ \ (gtd\_xy\ Betau\_x + gtd\_yy\ Betau\_y + gtd\_yz\ Betau\_z) \tag{228}$$

Auxiliary analysis variable equation

$$g4d\_tz = Op(x, y, z, t) \tag{229}$$

$$Op(x, y, z, t) = +inv\_chi \ \ (gtd\_xz \ Betau\_x + gtd\_yz \ Betau\_y + gtd\_zz \ Betau\_z) \tag{230}$$

Auxiliary analysis variable equation

$$g4d\_xx = Op(x, y, z, t) \tag{231}$$

$$Op(x, y, z, t) = +inv\_chi \ gtd\_xx \tag{232}$$

Auxiliary analysis variable equation

$$g4d\_xy = Op(x, y, z, t) \tag{233}$$

$$Op(x, y, z, t) = +inv\_chi \ gtd\_xy \tag{234}$$

Auxiliary analysis variable equation

$$g4d\_xz = Op(x, y, z, t) \tag{235}$$

$$Op(x, y, z, t) = +inv\_chi \ gtd\_xz \tag{236}$$

Auxiliary analysis variable equation

$$g4d\_yy = Op(x, y, z, t) \tag{237}$$

$$Op(x, y, z, t) = +inv\_chi \ gtd\_yy \tag{238}$$

Auxiliary analysis variable equation

$$g4d\_yz = Op(x, y, z, t) \tag{239}$$

$$Op(x, y, z, t) = +inv\_chi\ gtd\_yz \tag{240}$$

Auxiliary analysis variable equation

$$g4d\_zz = Op(x, y, z, t) \tag{241}$$

$$Op(x, y, z, t) = +inv\_chi\ gtd\_zz \tag{242}$$

Auxiliary analysis variable equation

$$g4u\_tt = Op(x, y, z, t) \tag{243}$$

$$Op(x, y, z, t) = -\frac{1}{Alpha^2} \tag{244}$$

Auxiliary analysis variable equation

$$g4u\_tx = Op(x, y, z, t) \tag{245}$$

$$Op(x, y, z, t) = +\frac{Betau\_x}{Alpha^2} \tag{246}$$

Auxiliary analysis variable equation

$$g4u\_ty = Op(x, y, z, t) \tag{247}$$

$$Op(x, y, z, t) = +\frac{Betau\_y}{Alpha^2} \tag{248}$$

Auxiliary analysis variable equation

$$g4u\_tz = Op(x, y, z, t) \tag{249}$$

$$Op(x, y, z, t) = +\frac{Betau\_z}{Alpha^2} \tag{250}$$

Auxiliary analysis variable equation

$$g4u\_xx = Op(x, y, z, t) \tag{251}$$

$$Op(x, y, z, t) = +chi\ gtu\_xx + \left(-\frac{Betau\_x^2}{Alpha^2}\right) \tag{252}$$

Auxiliary analysis variable equation

$$g4u\_xy = Op(x, y, z, t) \tag{253}$$

$$Op(x, y, z, t) = +chi\ gtu\_xy + \left(-\frac{Betau\_x\ Betau\_y}{Alpha^2}\right) \tag{254}$$

Auxiliary analysis variable equation

$$g4u\_xz = Op(x, y, z, t) \tag{255}$$

$$Op(x, y, z, t) = +chi\ gtu\_xz + \left(-\frac{Betau\_x\ Betau\_z}{Alpha^2}\right) \tag{256}$$

Auxiliary analysis variable equation

$$g4u\_yy = Op(x, y, z, t) \tag{257}$$

$$Op(x, y, z, t) = +chi\ gtu\_yy + \left(-\frac{Betau\_y^2}{Alpha^2}\right) \tag{258}$$

Auxiliary analysis variable equation

$$g4u\_yz = Op(x, y, z, t) \tag{259}$$

$$Op(x, y, z, t) = +chi\ gtu\_yz + \left(-\frac{Betau\_y\ Betau\_z}{Alpha^2}\right) \tag{260}$$

Auxiliary analysis variable equation

$$g4u\_zz = Op(x, y, z, t) \tag{261}$$

$$Op(x, y, z, t) = +chi\ gtu\_zz + \left(-\frac{Betau\_z^2}{Alpha^2}\right) \tag{262}$$

Auxiliary analysis variable equation

$$d\_phiR4d\_t = Op(x, y, z, t) \tag{263}$$

$$\begin{aligned} Op(x, y, z, t) = &-Alpha\ piR + \max\{0, Betau\_x\}\ \partial_x phiR + \max\{0, Betau\_y\}\ \partial_y phiR \\ &+ \max\{0, Betau\_z\}\ \partial_z phiR + \min\{0, Betau\_x\}\ \partial_x phiR \\ &+ \min\{0, Betau\_y\}\ \partial_y phiR + \min\{0, Betau\_z\}\ \partial_z phiR \end{aligned} \tag{264}$$

Auxiliary analysis variable equation

$$d\_phiR4d\_x = Op(x, y, z, t) \tag{265}$$

$$Op(x, y, z, t) = +\partial_x phiR \tag{266}$$

Auxiliary analysis variable equation

$$d\_phiR4d\_y = Op(x, y, z, t) \tag{267}$$

$$Op(x, y, z, t) = +\partial_y phiR \tag{268}$$

Auxiliary analysis variable equation

$$d\_phiR4d\_z = Op(x, y, z, t) \tag{269}$$

$$Op(x, y, z, t) = +\partial_z phiR \tag{270}$$

Auxiliary analysis variable equation

$$d\_phiR4u\_t = Op(x, y, z, t) \tag{271}$$

$$\begin{aligned} Op(x, y, z, t) = &+ g4u\_tt\ d\_phiR4d\_t + g4u\_tx\ d\_phiR4d\_x \\ &+ g4u\_ty\ d\_phiR4d\_y + g4u\_tz\ d\_phiR4d\_z \end{aligned} \tag{272}$$

Auxiliary analysis variable equation

$$d\_phiR4u\_x = Op(x, y, z, t) \tag{273}$$

$$\begin{aligned} Op(x, y, z, t) = &+ g4u\_tx\ d\_phiR4d\_t + g4u\_xx\ d\_phiR4d\_x \\ &+ g4u\_xy\ d\_phiR4d\_y + g4u\_xz\ d\_phiR4d\_z \end{aligned} \tag{274}$$

Auxiliary analysis variable equation

$$d\_phiR4u\_y = Op(x, y, z, t) \tag{275}$$

$$\begin{aligned} Op(x, y, z, t) = &+ g4u\_ty\ d\_phiR4d\_t + g4u\_xy\ d\_phiR4d\_x \\ &+ g4u\_yy\ d\_phiR4d\_y + g4u\_yz\ d\_phiR4d\_z \end{aligned} \tag{276}$$

Auxiliary analysis variable equation

$$d\_phiR4u\_z = Op(x, y, z, t) \tag{277}$$

$$\begin{aligned} Op(x, y, z, t) = &+ g4u\_tz\ d\_phiR4d\_t + g4u\_xz\ d\_phiR4d\_x \\ &+ g4u\_yz\ d\_phiR4d\_y + g4u\_zz\ d\_phiR4d\_z \end{aligned} \tag{278}$$

Auxiliary analysis variable equation

$$d\_phiI4d\_t = Op(x, y, z, t) \tag{279}$$

$$\begin{aligned} Op(x, y, z, t) = &-Alpha\ piI + \max\{0, Betau\_x\}\ \partial_x phiI + \max\{0, Betau\_y\}\ \partial_y phiI \\ &+ \max\{0, Betau\_z\}\ \partial_z phiI + \min\{0, Betau\_x\}\ \partial_x phiI \\ &+ \min\{0, Betau\_y\}\ \partial_y phiI + \min\{0, Betau\_z\}\ \partial_z phiI \end{aligned} \tag{280}$$

Auxiliary analysis variable equation

$$d\_phiI4d\_x = Op(x, y, z, t) \tag{281}$$

$$Op(x, y, z, t) = +\partial_x phiI \tag{282}$$

Auxiliary analysis variable equation

$$d\_phiI4d\_y = Op(x, y, z, t) \tag{283}$$

$$Op(x, y, z, t) = +\partial_y phiI \tag{284}$$

Auxiliary analysis variable equation

$$d\_phiI4d\_z = Op(x, y, z, t) \tag{285}$$

$$Op(x, y, z, t) = +\partial_z phiI \tag{286}$$

Auxiliary analysis variable equation

$$d\_phiI4u\_t = Op(x, y, z, t) \tag{287}$$

$$\begin{aligned} Op(x, y, z, t) = &+g4u\_tt\ d\_phiI4d\_t + g4u\_tx\ d\_phiI4d\_x \\ &+ g4u\_ty\ d\_phiI4d\_y + g4u\_tz\ d\_phiI4d\_z \end{aligned} \tag{288}$$

Auxiliary analysis variable equation

$$d\_phiI4u\_x = Op(x, y, z, t) \tag{289}$$

$$\begin{aligned} Op(x, y, z, t) = {} & +g4u\_tx\ d\_phiI4d\_t + g4u\_xx\ d\_phiI4d\_x \\ & + g4u\_xy\ d\_phiI4d\_y + g4u\_xz\ d\_phiI4d\_z \end{aligned} \tag{290}$$

Auxiliary analysis variable equation

$$d\_phiI4u\_y = Op(x, y, z, t) \tag{291}$$

$$\begin{aligned} Op(x, y, z, t) = {} & +g4u\_ty\ d\_phiI4d\_t + g4u\_xy\ d\_phiI4d\_x \\ & + g4u\_yy\ d\_phiI4d\_y + g4u\_yz\ d\_phiI4d\_z \end{aligned} \tag{292}$$

Auxiliary analysis variable equation

$$d\_phiI4u\_z = Op(x, y, z, t) \tag{293}$$

$$\begin{aligned} Op(x, y, z, t) = {} & +g4u\_tz\ d\_phiI4d\_t + g4u\_xz\ d\_phiI4d\_x \\ & + g4u\_yz\ d\_phiI4d\_y + g4u\_zz\ d\_phiI4d\_z \end{aligned} \tag{294}$$

Auxiliary analysis variable equation

$$d\_pheR4d\_t = Op(x, y, z, t) \tag{295}$$

$$\begin{aligned} Op(x, y, z, t) = {} & -Alpha\ peR + \max\{0, Betau\_x\}\ \partial_x pheR + \max\{0, Betau\_y\}\ \partial_y pheR \\ & + \max\{0, Betau\_z\}\ \partial_z pheR + \min\{0, Betau\_x\}\ \partial_x pheR \\ & + \min\{0, Betau\_y\}\ \partial_y pheR + \min\{0, Betau\_z\}\ \partial_z pheR \end{aligned} \tag{296}$$

Auxiliary analysis variable equation

$$d\_pheR4d\_x = Op(x, y, z, t) \tag{297}$$

$$Op(x,y,z,t) = +\partial_x pheR \tag{298}$$

Auxiliary analysis variable equation

$$d\_pheR4d\_y = Op(x,y,z,t) \tag{299}$$

$$Op(x,y,z,t) = +\partial_y pheR \tag{300}$$

Auxiliary analysis variable equation

$$d\_pheR4d\_z = Op(x,y,z,t) \tag{301}$$

$$Op(x,y,z,t) = +\partial_z pheR \tag{302}$$

Auxiliary analysis variable equation

$$d\_pheR4u\_t = Op(x,y,z,t) \tag{303}$$

$$\begin{aligned} Op(x,y,z,t) = {} & +g4u\_tt\ d\_pheR4d\_t + g4u\_tx\ d\_pheR4d\_x \\ & + g4u\_ty\ d\_pheR4d\_y + g4u\_tz\ d\_pheR4d\_z \end{aligned} \tag{304}$$

Auxiliary analysis variable equation

$$d\_pheR4u\_x = Op(x,y,z,t) \tag{305}$$

$$\begin{aligned} Op(x,y,z,t) = {} & +g4u\_tx\ d\_pheR4d\_t + g4u\_xx\ d\_pheR4d\_x \\ & + g4u\_xy\ d\_pheR4d\_y + g4u\_xz\ d\_pheR4d\_z \end{aligned} \tag{306}$$

Auxiliary analysis variable equation

$$d\_pheR4u\_y = Op(x,y,z,t) \tag{307}$$

$$Op(x,y,z,t) = +g4u\_ty\ d\_pheR4d\_t + g4u\_xy\ d\_pheR4d\_x + g4u\_yy\ d\_pheR4d\_y + g4u\_yz\ d\_pheR4d\_z \tag{308}$$

Auxiliary analysis variable equation

$$d\_pheR4u\_z = Op(x,y,z,t) \tag{309}$$

$$Op(x,y,z,t) = +g4u\_tz\ d\_pheR4d\_t + g4u\_xz\ d\_pheR4d\_x + g4u\_yz\ d\_pheR4d\_y + g4u\_zz\ d\_pheR4d\_z \tag{310}$$

Auxiliary analysis variable equation

$$d\_pheI4d\_t = Op(x,y,z,t) \tag{311}$$

$$Op(x,y,z,t) = -Alpha\ peI + \max\{0, Betau\_x\}\ \partial_x pheI + \max\{0, Betau\_y\}\ \partial_y pheI + \max\{0, Betau\_z\}\ \partial_z pheI + \min\{0, Betau\_x\}\ \partial_x pheI + \min\{0, Betau\_y\}\ \partial_y pheI + \min\{0, Betau\_z\}\ \partial_z pheI \tag{312}$$

Auxiliary analysis variable equation

$$d\_pheI4d\_x = Op(x,y,z,t) \tag{313}$$

$$Op(x,y,z,t) = +\partial_x pheI \tag{314}$$

Auxiliary analysis variable equation

$$d\_pheI4d\_y = Op(x,y,z,t) \tag{315}$$

$$Op(x,y,z,t) = +\partial_y pheI \tag{316}$$

Auxiliary analysis variable equation

$$d\_pheI4d\_z = Op(x, y, z, t) \tag{317}$$

$$Op(x, y, z, t) = +\partial_z pheI \tag{318}$$

Auxiliary analysis variable equation

$$d\_pheI4u\_t = Op(x, y, z, t) \tag{319}$$

$$\begin{aligned} Op(x, y, z, t) = &+ g4u\_tt\ d\_pheI4d\_t + g4u\_tx\ d\_pheI4d\_x \\ &+ g4u\_ty\ d\_pheI4d\_y + g4u\_tz\ d\_pheI4d\_z \end{aligned} \tag{320}$$

Auxiliary analysis variable equation

$$d\_pheI4u\_x = Op(x, y, z, t) \tag{321}$$

$$\begin{aligned} Op(x, y, z, t) = &+ g4u\_tx\ d\_pheI4d\_t + g4u\_xx\ d\_pheI4d\_x \\ &+ g4u\_xy\ d\_pheI4d\_y + g4u\_xz\ d\_pheI4d\_z \end{aligned} \tag{322}$$

Auxiliary analysis variable equation

$$d\_pheI4u\_y = Op(x, y, z, t) \tag{323}$$

$$\begin{aligned} Op(x, y, z, t) = &+ g4u\_ty\ d\_pheI4d\_t + g4u\_xy\ d\_pheI4d\_x \\ &+ g4u\_yy\ d\_pheI4d\_y + g4u\_yz\ d\_pheI4d\_z \end{aligned} \tag{324}$$

Auxiliary analysis variable equation

$$d\_pheI4u\_z = Op(x, y, z, t) \tag{325}$$

$$\begin{aligned} Op(x, y, z, t) = &+ g4u\_tz\ d\_pheI4d\_t + g4u\_xz\ d\_pheI4d\_x \\ &+ g4u\_yz\ d\_pheI4d\_y + g4u\_zz\ d\_pheI4d\_z \end{aligned} \tag{326}$$

Auxiliary analysis variable equation

$$dphi4sq = Op(x, y, z, t) \tag{327}$$

$$\begin{aligned} Op(x, y, z, t) = &+d\_phiR4u\_t\ d\_phiR4d\_t + d\_phiR4u\_x\ d\_phiR4d\_x \\ &+ d\_phiR4u\_y\ d\_phiR4d\_y + d\_phiR4u\_z\ d\_phiR4d\_z \\ &+ d\_phiI4u\_t\ d\_phiI4d\_t + d\_phiI4u\_x\ d\_phiI4d\_x \\ &+ d\_phiI4u\_y\ d\_phiI4d\_y + d\_phiI4u\_z\ d\_phiI4d\_z \end{aligned} \tag{328}$$

Auxiliary analysis variable equation

$$dphe4sq = Op(x, y, z, t) \tag{329}$$

$$\begin{aligned} Op(x, y, z, t) = &+d\_pheR4u\_t\ d\_pheR4d\_t + d\_pheR4u\_x\ d\_pheR4d\_x \\ &+ d\_pheR4u\_y\ d\_pheR4d\_y + d\_pheR4u\_z\ d\_pheR4d\_z \\ &+ d\_pheI4u\_t\ d\_pheI4d\_t + d\_pheI4u\_x\ d\_pheI4d\_x \\ &+ d\_pheI4u\_y\ d\_pheI4d\_y + d\_pheI4u\_z\ d\_pheI4d\_z \end{aligned} \tag{330}$$

Auxiliary analysis variable equation

$$sfVi = Op(x, y, z, t) \tag{331}$$

$$Op(x, y, z, t) = +sfmass^2\ \ (phiR^2 + phiI^2)\ \ \left(1 - 2\ \frac{phiR^2 + phiI^2}{sfsigma^2}\right)^2 \tag{332}$$

Auxiliary analysis variable equation

$$sfVe = Op(x, y, z, t) \tag{333}$$

$$Op(x, y, z, t) = +sfmass^2\ \ (pheR^2 + pheI^2)\ \ \left(1 - 2\ \frac{pheR^2 + pheI^2}{sfsigma^2}\right)^2 \tag{334}$$

Auxiliary analysis variable equation

$$Tsfu\_tt = Op(x, y, z, t) \tag{335}$$

$$\begin{aligned} Op(x, y, z, t) = {} & +2\ d\_phiR4u\_t^2 + 2\ d\_phiI4u\_t^2 + (-g4u\_tt\ \ (dphi4sq + sfVi)) \\ & + 2\ d\_pheR4u\_t^2 + 2\ d\_pheI4u\_t^2 + (-g4u\_tt\ \ (dphe4sq + sfVe)) \end{aligned} \tag{336}$$

Auxiliary analysis variable equation

$$Tsfu\_tx = Op(x, y, z, t) \tag{337}$$

$$\begin{aligned} Op(x, y, z, t) = {} & +2\ d\_phiR4u\_t\ d\_phiR4u\_x + 2\ d\_phiI4u\_t\ d\_phiI4u\_x \\ & + (-g4u\_tx\ \ (dphi4sq + sfVi)) + 2\ d\_pheR4u\_t\ d\_pheR4u\_x \\ & + 2\ d\_pheI4u\_t\ d\_pheI4u\_x + (-g4u\_tx\ \ (dphe4sq + sfVe)) \end{aligned} \tag{338}$$

Auxiliary analysis variable equation

$$Tsfu\_ty = Op(x, y, z, t) \tag{339}$$

$$\begin{aligned} Op(x, y, z, t) = {} & +2\ d\_phiR4u\_t\ d\_phiR4u\_y + 2\ d\_phiI4u\_t\ d\_phiI4u\_y \\ & + (-g4u\_ty\ \ (dphi4sq + sfVi)) + 2\ d\_pheR4u\_t\ d\_pheR4u\_y \\ & + 2\ d\_pheI4u\_t\ d\_pheI4u\_y + (-g4u\_ty\ \ (dphe4sq + sfVe)) \end{aligned} \tag{340}$$

Auxiliary analysis variable equation

$$Tsfu\_tz = Op(x, y, z, t) \tag{341}$$

$$\begin{aligned} Op(x, y, z, t) = {} & +2\ d\_phiR4u\_t\ d\_phiR4u\_z + 2\ d\_phiI4u\_t\ d\_phiI4u\_z \\ & + (-g4u\_tz\ \ (dphi4sq + sfVi)) + 2\ d\_pheR4u\_t\ d\_pheR4u\_z \\ & + 2\ d\_pheI4u\_t\ d\_pheI4u\_z + (-g4u\_tz\ \ (dphe4sq + sfVe)) \end{aligned} \tag{342}$$

Auxiliary analysis variable equation

$$Tsfu\_xx = Op(x, y, z, t) \tag{343}$$

$$\begin{aligned} Op(x, y, z, t) = &+2\ d\_phiR4u\_x^2 + 2\ d\_phiI4u\_x^2 + (-g4u\_xx\ \ (dphi4sq + sfVi)) \\ &+ 2\ d\_pheR4u\_x^2 + 2\ d\_pheI4u\_x^2 + (-g4u\_xx\ \ (dphe4sq + sfVe)) \end{aligned} \tag{344}$$

Auxiliary analysis variable equation

$$Tsfu\_xy = Op(x, y, z, t) \tag{345}$$

$$\begin{aligned} Op(x, y, z, t) = &+2\ d\_phiR4u\_x\ d\_phiR4u\_y + 2\ d\_phiI4u\_x\ d\_phiI4u\_y \\ &+ (-g4u\_xy\ \ (dphi4sq + sfVi)) + 2\ d\_pheR4u\_x\ d\_pheR4u\_y \\ &+ 2\ d\_pheI4u\_x\ d\_pheI4u\_y + (-g4u\_xy\ \ (dphe4sq + sfVe)) \end{aligned} \tag{346}$$

Auxiliary analysis variable equation

$$Tsfu\_xz = Op(x, y, z, t) \tag{347}$$

$$\begin{aligned} Op(x, y, z, t) = &+2\ d\_phiR4u\_x\ d\_phiR4u\_z + 2\ d\_phiI4u\_x\ d\_phiI4u\_z \\ &+ (-g4u\_xz\ \ (dphi4sq + sfVi)) + 2\ d\_pheR4u\_x\ d\_pheR4u\_z \\ &+ 2\ d\_pheI4u\_x\ d\_pheI4u\_z + (-g4u\_xz\ \ (dphe4sq + sfVe)) \end{aligned} \tag{348}$$

Auxiliary analysis variable equation

$$Tsfu\_yy = Op(x, y, z, t) \tag{349}$$

$$\begin{aligned} Op(x, y, z, t) = &+2\ d\_phiR4u\_y^2 + 2\ d\_phiI4u\_y^2 + (-g4u\_yy\ \ (dphi4sq + sfVi)) \\ &+ 2\ d\_pheR4u\_y^2 + 2\ d\_pheI4u\_y^2 + (-g4u\_yy\ \ (dphe4sq + sfVe)) \end{aligned} \tag{350}$$

Auxiliary analysis variable equation

$$Tsfu\_yz = Op(x, y, z, t) \tag{351}$$

$$\begin{aligned} Op(x, y, z, t) = {} & +2\ d\_phiR4u\_y\ d\_phiR4u\_z + 2\ d\_phiI4u\_y\ d\_phiI4u\_z \\ & + (-g4u\_yz\ \ (dphi4sq + sfVi)) + 2\ d\_pheR4u\_y\ d\_pheR4u\_z \\ & + 2\ d\_pheI4u\_y\ d\_pheI4u\_z + (-g4u\_yz\ \ (dphe4sq + sfVe)) \end{aligned} \tag{352}$$

Auxiliary analysis variable equation

$$Tsfu\_zz = Op(x, y, z, t) \tag{353}$$

$$\begin{aligned} Op(x, y, z, t) = {} & +2\ d\_phiR4u\_z^2 + 2\ d\_phiI4u\_z^2 + (-g4u\_zz\ \ (dphi4sq + sfVi)) \\ & + 2\ d\_pheR4u\_z^2 + 2\ d\_pheI4u\_z^2 + (-g4u\_zz\ \ (dphe4sq + sfVe)) \end{aligned} \tag{354}$$

Auxiliary analysis variable equation

$$Tu\_tt = Op(x, y, z, t) \tag{355}$$

$$Op(x, y, z, t) = +Tsfu\_tt \tag{356}$$

Auxiliary analysis variable equation

$$Tu\_tx = Op(x, y, z, t) \tag{357}$$

$$Op(x, y, z, t) = +Tsfu\_tx \tag{358}$$

Auxiliary analysis variable equation

$$Tu\_ty = Op(x, y, z, t) \tag{359}$$

$$Op(x, y, z, t) = +Tsfu\_ty \tag{360}$$

Auxiliary analysis variable equation

$$Tu\_tz = Op(x, y, z, t) \tag{361}$$

$$Op(x, y, z, t) = +Tsfu\_tz \tag{362}$$

Auxiliary analysis variable equation

$$Tu\_xx = Op(x, y, z, t) \tag{363}$$

$$Op(x, y, z, t) = +Tsfu\_xx \tag{364}$$

Auxiliary analysis variable equation

$$Tu\_xy = Op(x, y, z, t) \tag{365}$$

$$Op(x, y, z, t) = +Tsfu\_xy \tag{366}$$

Auxiliary analysis variable equation

$$Tu\_xz = Op(x, y, z, t) \tag{367}$$

$$Op(x, y, z, t) = +Tsfu\_xz \tag{368}$$

Auxiliary analysis variable equation

$$Tu\_yy = Op(x, y, z, t) \tag{369}$$

$$Op(x, y, z, t) = +Tsfu\_yy \tag{370}$$

Auxiliary analysis variable equation

$$Tu\_yz = Op(x, y, z, t) \tag{371}$$

$$Op(x,y,z,t) = +Tsfu\_yz \tag{372}$$

Auxiliary analysis variable equation

$$Tu\_zz = Op(x,y,z,t) \tag{373}$$

$$Op(x,y,z,t) = +Tsfu\_zz \tag{374}$$

Auxiliary analysis variable equation

$$rho\_ADM = Op(x,y,z,t) \tag{375}$$

$$Op(x,y,z,t) = +Alpha^2\ Tu\_tt \tag{376}$$

Auxiliary analysis variable equation

$$Jtd\_ADM\_x = Op(x,y,z,t) \tag{377}$$

$$\begin{aligned} Op(x,y,z,t) = +Alpha\ \ ((Betau\_x\ Tu\_tt + Tu\_tx)\ \ gtd\_xx \\ + (Betau\_y\ Tu\_tt + Tu\_ty)\ \ gtd\_xy \\ + (Betau\_z\ Tu\_tt + Tu\_tz)\ \ gtd\_xz) \end{aligned} \tag{378}$$

Auxiliary analysis variable equation

$$Jtd\_ADM\_y = Op(x,y,z,t) \tag{379}$$

$$\begin{aligned} Op(x,y,z,t) = +Alpha\ \ ((Betau\_x\ Tu\_tt + Tu\_tx)\ \ gtd\_xy \\ +(Betau\_y\ Tu\_tt+Tu\_ty)\ \ gtd\_yy+(Betau\_z\ Tu\_tt+Tu\_tz)\ \ gtd\_yz) \end{aligned} \tag{380}$$

Auxiliary analysis variable equation

$$Jtd\_ADM\_z = Op(x, y, z, t) \tag{381}$$

$$\begin{aligned} Op(x, y, z, t) = +Alpha\ \ &((Betau\_x\ Tu\_tt + Tu\_tx)\ \ gtd\_xz \\ &+(Betau\_y\ Tu\_tt+Tu\_ty)\ \ gtd\_yz+(Betau\_z\ Tu\_tt+Tu\_tz)\ \ gtd\_zz) \end{aligned} \tag{382}$$

Auxiliary analysis variable equation

$$Atud\_xx = Op(x, y, z, t) \tag{383}$$

$$Op(x, y, z, t) = +gtu\_xx\ Atd\_xx + gtu\_xy\ Atd\_xy + gtu\_xz\ Atd\_xz \tag{384}$$

Auxiliary analysis variable equation

$$Atud\_xy = Op(x, y, z, t) \tag{385}$$

$$Op(x, y, z, t) = +gtu\_xx\ Atd\_xy + gtu\_xy\ Atd\_yy + gtu\_xz\ Atd\_yz \tag{386}$$

Auxiliary analysis variable equation

$$Atud\_xz = Op(x, y, z, t) \tag{387}$$

$$Op(x, y, z, t) = +gtu\_xx\ Atd\_xz + gtu\_xy\ Atd\_yz + gtu\_xz\ Atd\_zz \tag{388}$$

Auxiliary analysis variable equation

$$Atud\_yx = Op(x, y, z, t) \tag{389}$$

$$Op(x, y, z, t) = +gtu\_xy\ Atd\_xx + gtu\_yy\ Atd\_xy + gtu\_yz\ Atd\_xz \tag{390}$$

Auxiliary analysis variable equation

$$Atud\_yy = Op(x, y, z, t) \tag{391}$$

$$Op(x, y, z, t) = +gtu\_xy\ Atd\_xy + gtu\_yy\ Atd\_yy + gtu\_yz\ Atd\_yz \tag{392}$$

Auxiliary analysis variable equation

$$Atud\_yz = Op(x, y, z, t) \tag{393}$$

$$Op(x, y, z, t) = +gtu\_xy\ Atd\_xz + gtu\_yy\ Atd\_yz + gtu\_yz\ Atd\_zz \tag{394}$$

Auxiliary analysis variable equation

$$Atud\_zx = Op(x, y, z, t) \tag{395}$$

$$Op(x, y, z, t) = +gtu\_xz\ Atd\_xx + gtu\_yz\ Atd\_xy + gtu\_zz\ Atd\_xz \tag{396}$$

Auxiliary analysis variable equation

$$Atud\_zy = Op(x, y, z, t) \tag{397}$$

$$Op(x, y, z, t) = +gtu\_xz\ Atd\_xy + gtu\_yz\ Atd\_yy + gtu\_zz\ Atd\_yz \tag{398}$$

Auxiliary analysis variable equation

$$Atud\_zz = Op(x, y, z, t) \tag{399}$$

$$Op(x, y, z, t) = +gtu\_xz\ Atd\_xz + gtu\_yz\ Atd\_yz + gtu\_zz\ Atd\_zz \tag{400}$$

Auxiliary analysis variable equation

$$Atu\_xx = Op(x, y, z, t) \tag{401}$$

$$Op(x,y,z,t) = +Atud\_xx\ gtu\_xx + Atud\_xy\ gtu\_xy + Atud\_xz\ gtu\_xz \quad (402)$$

Auxiliary analysis variable equation

$$Atu\_xy = Op(x,y,z,t) \quad (403)$$

$$Op(x,y,z,t) = +Atud\_xx\ gtu\_xy + Atud\_xy\ gtu\_yy + Atud\_xz\ gtu\_yz \quad (404)$$

Auxiliary analysis variable equation

$$Atu\_xz = Op(x,y,z,t) \quad (405)$$

$$Op(x,y,z,t) = +Atud\_xx\ gtu\_xz + Atud\_xy\ gtu\_yz + Atud\_xz\ gtu\_zz \quad (406)$$

Auxiliary analysis variable equation

$$Atu\_yy = Op(x,y,z,t) \quad (407)$$

$$Op(x,y,z,t) = +Atud\_yx\ gtu\_xy + Atud\_yy\ gtu\_yy + Atud\_yz\ gtu\_yz \quad (408)$$

Auxiliary analysis variable equation

$$Atu\_yz = Op(x,y,z,t) \quad (409)$$

$$Op(x,y,z,t) = +Atud\_yx\ gtu\_xz + Atud\_yy\ gtu\_yz + Atud\_yz\ gtu\_zz \quad (410)$$

Auxiliary analysis variable equation

$$Atu\_zz = Op(x,y,z,t) \quad (411)$$

$$Op(x,y,z,t) = +Atud\_zx\ gtu\_xz + Atud\_zy\ gtu\_yz + Atud\_zz\ gtu\_zz \quad (412)$$

Auxiliary analysis variable equation

$$Ctd\_xxx = Op(x, y, z, t) \tag{413}$$

$$Op(x, y, z, t) = +.5\ \partial_x gtd\_xx \tag{414}$$

Auxiliary analysis variable equation

$$Ctd\_xxy = Op(x, y, z, t) \tag{415}$$

$$Op(x, y, z, t) = +.5\ \partial_y gtd\_xx \tag{416}$$

Auxiliary analysis variable equation

$$Ctd\_xxz = Op(x, y, z, t) \tag{417}$$

$$Op(x, y, z, t) = +.5\ \partial_z gtd\_xx \tag{418}$$

Auxiliary analysis variable equation

$$Ctd\_xyy = Op(x, y, z, t) \tag{419}$$

$$Op(x, y, z, t) = +1.0\ \partial_y gtd\_xy - .5\ \partial_x gtd\_yy \tag{420}$$

Auxiliary analysis variable equation

$$Ctd\_xyz = Op(x, y, z, t) \tag{421}$$

$$Op(x, y, z, t) = +.5\ \partial_y gtd\_xz + .5\ \partial_z gtd\_xy - .5\ \partial_x gtd\_yz \tag{422}$$

Auxiliary analysis variable equation

$$Ctd\_xzz = Op(x, y, z, t) \tag{423}$$

$$Op(x,y,z,t) = +1.0\ \partial_z gtd\_xz - .5\ \partial_x gtd\_zz \tag{424}$$

Auxiliary analysis variable equation

$$Ctd\_yxx = Op(x,y,z,t) \tag{425}$$

$$Op(x,y,z,t) = +1.0\ \partial_x gtd\_xy - .5\ \partial_y gtd\_xx \tag{426}$$

Auxiliary analysis variable equation

$$Ctd\_yxy = Op(x,y,z,t) \tag{427}$$

$$Op(x,y,z,t) = +.5\ \partial_x gtd\_yy \tag{428}$$

Auxiliary analysis variable equation

$$Ctd\_yxz = Op(x,y,z,t) \tag{429}$$

$$Op(x,y,z,t) = +.5\ \partial_x gtd\_yz + .5\ \partial_z gtd\_xy - .5\ \partial_y gtd\_xz \tag{430}$$

Auxiliary analysis variable equation

$$Ctd\_yyy = Op(x,y,z,t) \tag{431}$$

$$Op(x,y,z,t) = +.5\ \partial_y gtd\_yy \tag{432}$$

Auxiliary analysis variable equation

$$Ctd\_yyz = Op(x,y,z,t) \tag{433}$$

$$Op(x,y,z,t) = +.5\ \partial_z gtd\_yy \tag{434}$$

Auxiliary analysis variable equation

$$Ctd\_yzz = Op(x, y, z, t) \tag{435}$$

$$Op(x, y, z, t) = +1.0\ \partial_z gtd\_yz - .5\ \partial_y gtd\_zz \tag{436}$$

Auxiliary analysis variable equation

$$Ctd\_zxx = Op(x, y, z, t) \tag{437}$$

$$Op(x, y, z, t) = +1.0\ \partial_x gtd\_xz - .5\ \partial_z gtd\_xx \tag{438}$$

Auxiliary analysis variable equation

$$Ctd\_zxy = Op(x, y, z, t) \tag{439}$$

$$Op(x, y, z, t) = +.5\ \partial_x gtd\_yz + .5\ \partial_y gtd\_xz - .5\ \partial_z gtd\_xy \tag{440}$$

Auxiliary analysis variable equation

$$Ctd\_zxz = Op(x, y, z, t) \tag{441}$$

$$Op(x, y, z, t) = +.5\ \partial_x gtd\_zz \tag{442}$$

Auxiliary analysis variable equation

$$Ctd\_zyy = Op(x, y, z, t) \tag{443}$$

$$Op(x, y, z, t) = +1.0\ \partial_y gtd\_yz - .5\ \partial_z gtd\_yy \tag{444}$$

Auxiliary analysis variable equation

$$Ctd\_zyz = Op(x, y, z, t) \tag{445}$$

$$Op(x,y,z,t) = +.5\ \partial_y gtd\_zz \tag{446}$$

Auxiliary analysis variable equation

$$Ctd\_zzz = Op(x,y,z,t) \tag{447}$$

$$Op(x,y,z,t) = +.5\ \partial_z gtd\_zz \tag{448}$$

Auxiliary analysis variable equation

$$Ct\_xxx = Op(x,y,z,t) \tag{449}$$

$$Op(x,y,z,t) = +gtu\_xx\ Ctd\_xxx + gtu\_xy\ Ctd\_yxx + gtu\_xz\ Ctd\_zxx \tag{450}$$

Auxiliary analysis variable equation

$$Ct\_xxy = Op(x,y,z,t) \tag{451}$$

$$Op(x,y,z,t) = +gtu\_xx\ Ctd\_xxy + gtu\_xy\ Ctd\_yxy + gtu\_xz\ Ctd\_zxy \tag{452}$$

Auxiliary analysis variable equation

$$Ct\_xxz = Op(x,y,z,t) \tag{453}$$

$$Op(x,y,z,t) = +gtu\_xx\ Ctd\_xxz + gtu\_xy\ Ctd\_yxz + gtu\_xz\ Ctd\_zxz \tag{454}$$

Auxiliary analysis variable equation

$$Ct\_xyy = Op(x,y,z,t) \tag{455}$$

$$Op(x,y,z,t) = +gtu\_xx\ Ctd\_xyy + gtu\_xy\ Ctd\_yyy + gtu\_xz\ Ctd\_zyy \tag{456}$$

Auxiliary analysis variable equation

$$Ct\_xyz = Op(x, y, z, t) \tag{457}$$

$$Op(x, y, z, t) = +gtu\_xx\ Ctd\_xyz + gtu\_xy\ Ctd\_yyz + gtu\_xz\ Ctd\_zyz \tag{458}$$

Auxiliary analysis variable equation

$$Ct\_xzz = Op(x, y, z, t) \tag{459}$$

$$Op(x, y, z, t) = +gtu\_xx\ Ctd\_xzz + gtu\_xy\ Ctd\_yzz + gtu\_xz\ Ctd\_zzz \tag{460}$$

Auxiliary analysis variable equation

$$Ct\_yxx = Op(x, y, z, t) \tag{461}$$

$$Op(x, y, z, t) = +gtu\_xy\ Ctd\_xxx + gtu\_yy\ Ctd\_yxx + gtu\_yz\ Ctd\_zxx \tag{462}$$

Auxiliary analysis variable equation

$$Ct\_yxy = Op(x, y, z, t) \tag{463}$$

$$Op(x, y, z, t) = +gtu\_xy\ Ctd\_xxy + gtu\_yy\ Ctd\_yxy + gtu\_yz\ Ctd\_zxy \tag{464}$$

Auxiliary analysis variable equation

$$Ct\_yxz = Op(x, y, z, t) \tag{465}$$

$$Op(x, y, z, t) = +gtu\_xy\ Ctd\_xxz + gtu\_yy\ Ctd\_yxz + gtu\_yz\ Ctd\_zxz \tag{466}$$

Auxiliary analysis variable equation

$$Ct\_yyy = Op(x, y, z, t) \tag{467}$$

$$Op(x,y,z,t) = +gtu\_xy\ Ctd\_xyy + gtu\_yy\ Ctd\_yyy + gtu\_yz\ Ctd\_zyy \quad (468)$$

Auxiliary analysis variable equation

$$Ct\_yyz = Op(x,y,z,t) \quad (469)$$

$$Op(x,y,z,t) = +gtu\_xy\ Ctd\_xyz + gtu\_yy\ Ctd\_yyz + gtu\_yz\ Ctd\_zyz \quad (470)$$

Auxiliary analysis variable equation

$$Ct\_yzz = Op(x,y,z,t) \quad (471)$$

$$Op(x,y,z,t) = +gtu\_xy\ Ctd\_xzz + gtu\_yy\ Ctd\_yzz + gtu\_yz\ Ctd\_zzz \quad (472)$$

Auxiliary analysis variable equation

$$Ct\_zxx = Op(x,y,z,t) \quad (473)$$

$$Op(x,y,z,t) = +gtu\_xz\ Ctd\_xxx + gtu\_yz\ Ctd\_yxx + gtu\_zz\ Ctd\_zxx \quad (474)$$

Auxiliary analysis variable equation

$$Ct\_zxy = Op(x,y,z,t) \quad (475)$$

$$Op(x,y,z,t) = +gtu\_xz\ Ctd\_xxy + gtu\_yz\ Ctd\_yxy + gtu\_zz\ Ctd\_zxy \quad (476)$$

Auxiliary analysis variable equation

$$Ct\_zxz = Op(x,y,z,t) \quad (477)$$

$$Op(x,y,z,t) = +gtu\_xz\ Ctd\_xxz + gtu\_yz\ Ctd\_yxz + gtu\_zz\ Ctd\_zxz \quad (478)$$

Auxiliary analysis variable equation

$$Ct\_zyy = Op(x, y, z, t) \tag{479}$$

$$Op(x, y, z, t) = +gtu\_xz\ Ctd\_xyy + gtu\_yz\ Ctd\_yyy + gtu\_zz\ Ctd\_zyy \tag{480}$$

Auxiliary analysis variable equation

$$Ct\_zyz = Op(x, y, z, t) \tag{481}$$

$$Op(x, y, z, t) = +gtu\_xz\ Ctd\_xyz + gtu\_yz\ Ctd\_yyz + gtu\_zz\ Ctd\_zyz \tag{482}$$

Auxiliary analysis variable equation

$$Ct\_zzz = Op(x, y, z, t) \tag{483}$$

$$Op(x, y, z, t) = +gtu\_xz\ Ctd\_xzz + gtu\_yz\ Ctd\_yzz + gtu\_zz\ Ctd\_zzz \tag{484}$$

Auxiliary analysis variable equation

$$Gamt\_x = Op(x, y, z, t) \tag{485}$$

$$\begin{aligned} Op(x, y, z, t) = {} & +gtu\_xx\ Ct\_xxx + 2\ gtu\_xy\ Ct\_xxy + 2\ gtu\_xz\ Ct\_xxz \\ & + gtu\_yy\ Ct\_xyy + 2\ gtu\_yz\ Ct\_xyz + gtu\_zz\ Ct\_xzz \end{aligned} \tag{486}$$

Auxiliary analysis variable equation

$$Gamt\_y = Op(x, y, z, t) \tag{487}$$

$$\begin{aligned} Op(x, y, z, t) = {} & +gtu\_xx\ Ct\_yxx + 2\ gtu\_xy\ Ct\_yxy + 2\ gtu\_xz\ Ct\_yxz \\ & + gtu\_yy\ Ct\_yyy + 2\ gtu\_yz\ Ct\_yyz + gtu\_zz\ Ct\_yzz \end{aligned} \tag{488}$$

Auxiliary analysis variable equation

$$Gamt\_z = Op(x, y, z, t) \tag{489}$$

$$\begin{aligned} Op(x, y, z, t) = {} & +gtu\_xx\ Ct\_zxx + 2\ gtu\_xy\ Ct\_zxy + 2\ gtu\_xz\ Ct\_zxz \\ & + gtu\_yy\ Ct\_zyy + 2\ gtu\_yz\ Ct\_zyz + gtu\_zz\ Ct\_zzz \end{aligned} \tag{490}$$

Auxiliary analysis variable equation

$$Zu\_x = Op(x, y, z, t) \tag{491}$$

$$Op(x, y, z, t) = +.5\ chi\ \ (Gamh\_x - Gamt\_x) \tag{492}$$

Auxiliary analysis variable equation

$$Zu\_y = Op(x, y, z, t) \tag{493}$$

$$Op(x, y, z, t) = +.5\ chi\ \ (Gamh\_y - Gamt\_y) \tag{494}$$

Auxiliary analysis variable equation

$$Zu\_z = Op(x, y, z, t) \tag{495}$$

$$Op(x, y, z, t) = +.5\ chi\ \ (Gamh\_z - Gamt\_z) \tag{496}$$

Auxiliary analysis variable equation

$$Rpd\_xx = Op(x, y, z, t) \tag{497}$$

$$
\begin{aligned}
Op(x,y,z,t) = & -.5\ gtd\_xx\ Gamh\_x\ \partial_x chi - .5\ gtd\_xx\ Gamh\_y\ \partial_y chi \\
& - .5\ gtd\_xx\ Gamh\_z\ \partial_z chi + .5\ gtd\_xx\ gtu\_xx\ \partial_x\partial_x chi \\
& + 1.0\ gtd\_xx\ gtu\_xy\ \partial_y\partial_x chi + 1.0\ gtd\_xx\ gtu\_xz\ \partial_z\partial_x chi \\
& + .5\ gtd\_xx\ gtu\_yy\ \partial_y\partial_y chi + 1.0\ gtd\_xx\ gtu\_yz\ \partial_z\partial_y chi \\
& + .5\ gtd\_xx\ gtu\_zz\ \partial_z\partial_z chi - .5\ Ct\_xxx\ \partial_x chi - .5\ Ct\_yxx\ \partial_y chi \\
& - .5\ Ct\_zxx\ \partial_z chi - .2500000000000000\ inv\_chi\ \partial_x chi\partial_x chi \\
& - 1.500000000000000\ gtd\_xx\ gtu\_xy\ inv\_chi\ \partial_y chi\partial_x chi \\
& - 1.500000000000000\ gtd\_xx\ gtu\_xz\ inv\_chi\ \partial_z chi\partial_x chi \\
& - 1.500000000000000\ gtd\_xx\ gtu\_yz\ inv\_chi\ \partial_z chi\partial_y chi \\
& + 2\ inv\_chi\ Zu\_x\ gtd\_xx\ \partial_x chi \\
& + 2\ inv\_chi\ Zu\_y\ gtd\_xy\ \partial_x chi + 2\ inv\_chi\ Zu\_z\ gtd\_xz\ \partial_x chi \\
& - .7500000000000000\ gtd\_xx\ gtu\_xx\ inv\_chi\ \partial_x chi\partial_x chi \\
& - .7500000000000000\ gtd\_xx\ gtu\_yy\ inv\_chi\ \partial_y chi\partial_y chi \\
& - .7500000000000000\ gtd\_xx\ gtu\_zz\ inv\_chi\ \partial_z chi\partial_z chi + .5\ \partial_x\partial_x chi
\end{aligned}
\tag{498}
$$

Auxiliary analysis variable equation

$$
Rpd\_xy = Op(x,y,z,t) \tag{499}
$$

$$
\begin{aligned}
Op(x,y,z,t) = & -.5\ gtd\_xy\ Gamh\_x\ \partial_x chi - .5\ gtd\_xy\ Gamh\_y\ \partial_y chi \\
& - .5\ gtd\_xy\ Gamh\_z\ \partial_z chi + .5\ gtd\_xy\ gtu\_xx\ \partial_x\partial_x chi \\
& + 1.0\ gtd\_xy\ gtu\_xy\ \partial_y\partial_x chi + 1.0\ gtd\_xy\ gtu\_xz\ \partial_z\partial_x chi \\
& + .5\ gtd\_xy\ gtu\_yy\ \partial_y\partial_y chi + 1.0\ gtd\_xy\ gtu\_yz\ \partial_z\partial_y chi \\
& + .5\ gtd\_xy\ gtu\_zz\ \partial_z\partial_z chi - .2500000000000000\ inv\_chi\ \partial_x chi\partial_y chi \\
& - .5\ Ct\_xxy\ \partial_x chi - .5\ Ct\_yxy\ \partial_y chi - .5\ Ct\_zxy\ \partial_z chi \\
& - 1.500000000000000\ gtd\_xy\ gtu\_xy\ inv\_chi\ \partial_y chi\partial_x chi \\
& - 1.500000000000000\ gtd\_xy\ gtu\_xz\ inv\_chi\ \partial_z chi\partial_x chi \\
& - 1.500000000000000\ gtd\_xy\ gtu\_yz\ inv\_chi\ \partial_z chi\partial_y chi \\
& + inv\_chi\ Zu\_x\ gtd\_xx\ \partial_y chi + inv\_chi\ Zu\_y\ gtd\_xy\ \partial_y chi \\
& + inv\_chi\ Zu\_z\ gtd\_xz\ \partial_y chi + inv\_chi\ Zu\_x\ gtd\_xy\ \partial_x chi \\
& + inv\_chi\ Zu\_y\ gtd\_yy\ \partial_x chi + inv\_chi\ Zu\_z\ gtd\_yz\ \partial_x chi \\
& - .7500000000000000\ gtd\_xy\ gtu\_xx\ inv\_chi\ \partial_x chi\partial_x chi \\
& - .7500000000000000\ gtd\_xy\ gtu\_yy\ inv\_chi\ \partial_y chi\partial_y chi \\
& - .7500000000000000\ gtd\_xy\ gtu\_zz\ inv\_chi\ \partial_z chi\partial_z chi + .5\ \partial_y\partial_x chi
\end{aligned}
\tag{500}
$$

Auxiliary analysis variable equation

$$Rpd\_xz = Op(x, y, z, t) \tag{501}$$

$$\begin{aligned} Op(x, y, z, t) = & -.5\ gtd\_xz\ Gamh\_x\ \partial_x chi - .5\ gtd\_xz\ Gamh\_y\ \partial_y chi \\ & - .5\ gtd\_xz\ Gamh\_z\ \partial_z chi + .5\ gtd\_xz\ gtu\_xx\ \partial_x \partial_x chi \\ & + 1.0\ gtd\_xz\ gtu\_xy\ \partial_y \partial_x chi + 1.0\ gtd\_xz\ gtu\_xz\ \partial_z \partial_x chi \\ & + .5\ gtd\_xz\ gtu\_yy\ \partial_y \partial_y chi + 1.0\ gtd\_xz\ gtu\_yz\ \partial_z \partial_y chi \\ & + .5\ gtd\_xz\ gtu\_zz\ \partial_z \partial_z chi - .2500000000000000\ inv\_chi\ \partial_x chi \partial_z chi \\ & - .5\ Ct\_xxz\ \partial_x chi - .5\ Ct\_yxz\ \partial_y chi - .5\ Ct\_zxz\ \partial_z chi \\ & - 1.500000000000000\ gtd\_xz\ gtu\_xy\ inv\_chi\ \partial_y chi \partial_x chi \\ & - 1.500000000000000\ gtd\_xz\ gtu\_xz\ inv\_chi\ \partial_z chi \partial_x chi \\ & - 1.500000000000000\ gtd\_xz\ gtu\_yz\ inv\_chi\ \partial_z chi \partial_y chi \\ & + inv\_chi\ Zu\_x\ gtd\_xx\ \partial_z chi + inv\_chi\ Zu\_y\ gtd\_xy\ \partial_z chi \\ & + inv\_chi\ Zu\_z\ gtd\_xz\ \partial_z chi + inv\_chi\ Zu\_x\ gtd\_xz\ \partial_x chi \\ & + inv\_chi\ Zu\_y\ gtd\_yz\ \partial_x chi + inv\_chi\ Zu\_z\ gtd\_zz\ \partial_x chi \\ & - .7500000000000000\ gtd\_xz\ gtu\_xx\ inv\_chi\ \partial_x chi \partial_x chi \\ & - .7500000000000000\ gtd\_xz\ gtu\_yy\ inv\_chi\ \partial_y chi \partial_y chi \\ & - .7500000000000000\ gtd\_xz\ gtu\_zz\ inv\_chi\ \partial_z chi \partial_z chi + .5\ \partial_z \partial_x chi \end{aligned} \tag{502}$$

Auxiliary analysis variable equation

$$Rpd\_yy = Op(x, y, z, t) \tag{503}$$

$$
\begin{aligned}
Op(x,y,z,t) = &-.5\ Ct\_xyy\ \partial_x chi - .5\ Ct\_yyy\ \partial_y chi - .5\ Ct\_zyy\ \partial_z chi \\
&- .2500000000000000\ inv\_chi\ \partial_y chi \partial_y chi - .5\ gtd\_yy\ Gamh\_x\ \partial_x chi \\
&- .5\ gtd\_yy\ Gamh\_y\ \partial_y chi - .5\ gtd\_yy\ Gamh\_z\ \partial_z chi \\
&+ .5\ gtd\_yy\ gtu\_xx\ \partial_x \partial_x chi + 1.0\ gtd\_yy\ gtu\_xy\ \partial_y \partial_x chi \\
&+ 1.0\ gtd\_yy\ gtu\_xz\ \partial_z \partial_x chi + .5\ gtd\_yy\ gtu\_yy\ \partial_y \partial_y chi \\
&+ 1.0\ gtd\_yy\ gtu\_yz\ \partial_z \partial_y chi + .5\ gtd\_yy\ gtu\_zz\ \partial_z \partial_z chi \\
&- 1.500000000000000\ gtd\_yy\ gtu\_xy\ inv\_chi\ \partial_y chi \partial_x chi \\
&- 1.500000000000000\ gtd\_yy\ gtu\_xz\ inv\_chi\ \partial_z chi \partial_x chi \\
&- 1.500000000000000\ gtd\_yy\ gtu\_yz\ inv\_chi\ \partial_z chi \partial_y chi \\
&+ 2\ inv\_chi\ Zu\_x\ gtd\_xy\ \partial_y chi \\
&+ 2\ inv\_chi\ Zu\_y\ gtd\_yy\ \partial_y chi + 2\ inv\_chi\ Zu\_z\ gtd\_yz\ \partial_y chi \\
&- .7500000000000000\ gtd\_yy\ gtu\_xx\ inv\_chi\ \partial_x chi \partial_x chi \\
&- .7500000000000000\ gtd\_yy\ gtu\_yy\ inv\_chi\ \partial_y chi \partial_y chi \\
&- .7500000000000000\ gtd\_yy\ gtu\_zz\ inv\_chi\ \partial_z chi \partial_z chi + .5\ \partial_y \partial_y chi
\end{aligned}
\tag{504}
$$

Auxiliary analysis variable equation

$$
Rpd\_yz = Op(x,y,z,t) \tag{505}
$$

$$
\begin{aligned}
Op(x,y,z,t) = &-.5\ Ct\_xyz\ \partial_x chi - .5\ Ct\_yyz\ \partial_y chi - .5\ Ct\_zyz\ \partial_z chi \\
&+ 1.0\ gtd\_yz\ gtu\_xz\ \partial_z \partial_x chi + .5\ gtd\_yz\ gtu\_yy\ \partial_y \partial_y chi \\
&+ 1.0\ gtd\_yz\ gtu\_yz\ \partial_z \partial_y chi + .5\ gtd\_yz\ gtu\_zz\ \partial_z \partial_z chi \\
&- .2500000000000000\ inv\_chi\ \partial_y chi \partial_z chi - .5\ gtd\_yz\ Gamh\_x\ \partial_x chi \\
&- .5\ gtd\_yz\ Gamh\_y\ \partial_y chi - .5\ gtd\_yz\ Gamh\_z\ \partial_z chi \\
&+ .5\ gtd\_yz\ gtu\_xx\ \partial_x \partial_x chi + 1.0\ gtd\_yz\ gtu\_xy\ \partial_y \partial_x chi \\
&- 1.500000000000000\ gtd\_yz\ gtu\_xy\ inv\_chi\ \partial_y chi \partial_x chi \\
&- 1.500000000000000\ gtd\_yz\ gtu\_xz\ inv\_chi\ \partial_z chi \partial_x chi \\
&- 1.500000000000000\ gtd\_yz\ gtu\_yz\ inv\_chi\ \partial_z chi \partial_y chi \\
&+ inv\_chi\ Zu\_x\ gtd\_xy\ \partial_z chi + inv\_chi\ Zu\_y\ gtd\_yy\ \partial_z chi \\
&+ inv\_chi\ Zu\_z\ gtd\_yz\ \partial_z chi + inv\_chi\ Zu\_x\ gtd\_xz\ \partial_y chi \\
&+ inv\_chi\ Zu\_y\ gtd\_yz\ \partial_y chi + inv\_chi\ Zu\_z\ gtd\_zz\ \partial_y chi \\
&- .7500000000000000\ gtd\_yz\ gtu\_xx\ inv\_chi\ \partial_x chi \partial_x chi \\
&- .7500000000000000\ gtd\_yz\ gtu\_yy\ inv\_chi\ \partial_y chi \partial_y chi \\
&- .7500000000000000\ gtd\_yz\ gtu\_zz\ inv\_chi\ \partial_z chi \partial_z chi + .5\ \partial_z \partial_y chi
\end{aligned}
\tag{506}
$$

Auxiliary analysis variable equation

$$Rpd\_zz = Op(x, y, z, t) \tag{507}$$

$$\begin{aligned} Op(x, y, z, t) = & -.5\ gtd\_zz\ Gamh\_x\ \partial_x chi - .5\ gtd\_zz\ Gamh\_y\ \partial_y chi \\ & - .5\ gtd\_zz\ Gamh\_z\ \partial_z chi + .5\ gtd\_zz\ gtu\_xx\ \partial_x \partial_x chi \\ & + 1.0\ gtd\_zz\ gtu\_xy\ \partial_y \partial_x chi + 1.0\ gtd\_zz\ gtu\_xz\ \partial_z \partial_x chi \\ & + .5\ gtd\_zz\ gtu\_yy\ \partial_y \partial_y chi + 1.0\ gtd\_zz\ gtu\_yz\ \partial_z \partial_y chi \\ & + .5\ gtd\_zz\ gtu\_zz\ \partial_z \partial_z chi - .5\ Ct\_xzz\ \partial_x chi - .5\ Ct\_yzz\ \partial_y chi \\ & - .5\ Ct\_zzz\ \partial_z chi - .2500000000000000\ inv\_chi\ \partial_z chi \partial_z chi \\ & - 1.500000000000000\ gtd\_zz\ gtu\_xy\ inv\_chi\ \partial_y chi \partial_x chi \\ & - 1.500000000000000\ gtd\_zz\ gtu\_xz\ inv\_chi\ \partial_z chi \partial_x chi \\ & - 1.500000000000000\ gtd\_zz\ gtu\_yz\ inv\_chi\ \partial_z chi \partial_y chi \\ & + 2\ inv\_chi\ Zu\_x\ gtd\_xz\ \partial_z chi \\ & + 2\ inv\_chi\ Zu\_y\ gtd\_yz\ \partial_z chi + 2\ inv\_chi\ Zu\_z\ gtd\_zz\ \partial_z chi \\ & - .7500000000000000\ gtd\_zz\ gtu\_xx\ inv\_chi\ \partial_x chi \partial_x chi \\ & - .7500000000000000\ gtd\_zz\ gtu\_yy\ inv\_chi\ \partial_y chi \partial_y chi \\ & - .7500000000000000\ gtd\_zz\ gtu\_zz\ inv\_chi\ \partial_z chi \partial_z chi + .5\ \partial_z \partial_z chi \end{aligned} \tag{508}$$

Auxiliary analysis variable equation

$$Rtd\_xx = Op(x, y, z, t) \tag{509}$$

$$
\begin{aligned}
Op(x,y,z,t) = &-.5\ gtu\_xx\ \partial_x\partial_x gtd\_xx - 1.0\ gtu\_xy\ \partial_y\partial_x gtd\_xx \\
&- 1.0\ gtu\_xz\ \partial_z\partial_x gtd\_xx - .5\ gtu\_yy\ \partial_y\partial_y gtd\_xx \\
&- 1.0\ gtu\_yz\ \partial_z\partial_y gtd\_xx - .5\ gtu\_zz\ \partial_z\partial_z gtd\_xx \\
&+ 1.0\ gtd\_xx\ \partial_x Gamh\_x + 1.0\ gtd\_xy\ \partial_x Gamh\_y \\
&+ 1.0\ gtd\_xz\ \partial_x Gamh\_z + 1.0\ Gamh\_x\ Ctd\_xxx \\
&+ 1.0\ Gamh\_y\ Ctd\_xxy + 1.0\ Gamh\_z\ Ctd\_xxz \\
&+ gtu\_xx\ (3\ Ct\_xxx\ Ctd\_xxx + 2\ Ct\_yxx\ Ctd\_xxy \\
&\quad + Ct\_yxx\ Ctd\_yxx + 2\ Ct\_zxx\ Ctd\_xxz + Ct\_zxx\ Ctd\_zxx) \\
&+ gtu\_xy\ (3\ Ct\_xxy\ Ctd\_xxx + 2\ Ct\_yxy\ Ctd\_xxy \\
&\quad + Ct\_yxy\ Ctd\_yxx + 2\ Ct\_zxy\ Ctd\_xxz + Ct\_zxy\ Ctd\_zxx) \\
&+ gtu\_xz\ (3\ Ct\_xxz\ Ctd\_xxx + 2\ Ct\_yxz\ Ctd\_xxy \\
&\quad + Ct\_yxz\ Ctd\_yxx + 2\ Ct\_zxz\ Ctd\_xxz + Ct\_zxz\ Ctd\_zxx) \\
&+ gtu\_xy\ (3\ Ct\_xxx\ Ctd\_xxy + 2\ Ct\_yxx\ Ctd\_xyy \\
&\quad + Ct\_yxx\ Ctd\_yxy + 2\ Ct\_zxx\ Ctd\_xyz + Ct\_zxx\ Ctd\_zxy) \\
&+ gtu\_yy\ (3\ Ct\_xxy\ Ctd\_xxy + 2\ Ct\_yxy\ Ctd\_xyy \\
&\quad + Ct\_yxy\ Ctd\_yxy + 2\ Ct\_zxy\ Ctd\_xyz + Ct\_zxy\ Ctd\_zxy) \\
&+ gtu\_yz\ (3\ Ct\_xxz\ Ctd\_xxy + 2\ Ct\_yxz\ Ctd\_xyy \\
&\quad + Ct\_yxz\ Ctd\_yxy + 2\ Ct\_zxz\ Ctd\_xyz + Ct\_zxz\ Ctd\_zxy) \\
&+ gtu\_xz\ (3\ Ct\_xxx\ Ctd\_xxz + 2\ Ct\_yxx\ Ctd\_xyz \\
&\quad + Ct\_yxx\ Ctd\_yxz + 2\ Ct\_zxx\ Ctd\_xzz + Ct\_zxx\ Ctd\_zxz) \\
&+ gtu\_yz\ (3\ Ct\_xxy\ Ctd\_xxz + 2\ Ct\_yxy\ Ctd\_xyz \\
&\quad + Ct\_yxy\ Ctd\_yxz + 2\ Ct\_zxy\ Ctd\_xzz + Ct\_zxy\ Ctd\_zxz) \\
&+ gtu\_zz\ (3\ Ct\_xxz\ Ctd\_xxz + 2\ Ct\_yxz\ Ctd\_xyz + Ct\_yxz\ Ctd\_yxz \\
&\quad + 2\ Ct\_zxz\ Ctd\_xzz + Ct\_zxz\ Ctd\_zxz)
\end{aligned}
\tag{510}
$$

Auxiliary analysis variable equation

$$
Rtd\_xy = Op(x,y,z,t) \tag{511}
$$

$$
\begin{aligned}
Op(x,y,z,t) = &-.5\ gtu\_xx\ \partial_x\partial_x gtd\_xy - 1.0\ gtu\_xy\ \partial_y\partial_x gtd\_xy \\
&- 1.0\ gtu\_xz\ \partial_z\partial_x gtd\_xy - .5\ gtu\_yy\ \partial_y\partial_y gtd\_xy \\
&- 1.0\ gtu\_yz\ \partial_z\partial_y gtd\_xy - .5\ gtu\_zz\ \partial_z\partial_z gtd\_xy \\
&+ .5\ gtd\_xx\ \partial_y Gamh\_x + .5\ gtd\_xy\ \partial_y Gamh\_y \\
&+ .5\ gtd\_xz\ \partial_y Gamh\_z + .5\ gtd\_xy\ \partial_x Gamh\_x + .5\ gtd\_yy\ \partial_x Gamh\_y \\
&+ .5\ gtd\_yz\ \partial_x Gamh\_z + .5\ Gamh\_x\ (Ctd\_xxy + Ctd\_yxx) \\
&+ .5\ Gamh\_y\ (Ctd\_xyy + Ctd\_yxy) \\
&+ .5\ Gamh\_z\ (Ctd\_xyz + Ctd\_yxz) \\
&+ gtu\_xx\ (Ct\_xxx\ Ctd\_yxx + Ct\_xxx\ Ctd\_xxy + Ct\_xxy\ Ctd\_xxx \\
&\qquad + 2\ Ct\_yxx\ Ctd\_yxy + Ct\_yxy\ Ctd\_xxy + Ct\_zxx\ Ctd\_yxz \\
&\qquad + Ct\_zxx\ Ctd\_zxy + Ct\_zxy\ Ctd\_xxz) \\
&+ gtu\_xy\ (Ct\_xxy\ Ctd\_yxx + Ct\_xxy\ Ctd\_xxy + Ct\_xyy\ Ctd\_xxx \\
&\qquad + 2\ Ct\_yxy\ Ctd\_yxy + Ct\_yyy\ Ctd\_xxy + Ct\_zxy\ Ctd\_yxz \\
&\qquad + Ct\_zxy\ Ctd\_zxy + Ct\_zyy\ Ctd\_xxz) \\
&+ gtu\_xz\ (Ct\_xxz\ Ctd\_yxx + Ct\_xxz\ Ctd\_xxy + Ct\_xyz\ Ctd\_xxx \\
&\qquad + 2\ Ct\_yxz\ Ctd\_yxy + Ct\_yyz\ Ctd\_xxy + Ct\_zxz\ Ctd\_yxz \\
&\qquad + Ct\_zxz\ Ctd\_zxy + Ct\_zyz\ Ctd\_xxz) \\
&+ gtu\_xy\ (Ct\_xxx\ Ctd\_yxy + Ct\_xxx\ Ctd\_xyy + Ct\_xxy\ Ctd\_xxy \\
&\qquad + 2\ Ct\_yxx\ Ctd\_yyy + Ct\_yxy\ Ctd\_xyy + Ct\_zxx\ Ctd\_yyz \\
&\qquad + Ct\_zxx\ Ctd\_zyy + Ct\_zxy\ Ctd\_xyz) \\
&+ gtu\_yy\ (Ct\_xxy\ Ctd\_yxy + Ct\_xxy\ Ctd\_xyy + Ct\_xyy\ Ctd\_xxy \\
&\qquad + 2\ Ct\_yxy\ Ctd\_yyy + Ct\_yyy\ Ctd\_xyy + Ct\_zxy\ Ctd\_yyz \\
&\qquad + Ct\_zxy\ Ctd\_zyy + Ct\_zyy\ Ctd\_xyz) \\
&+ gtu\_yz\ (Ct\_xxz\ Ctd\_yxy + Ct\_xxz\ Ctd\_xyy + Ct\_xyz\ Ctd\_xxy \\
&\qquad + 2\ Ct\_yxz\ Ctd\_yyy + Ct\_yyz\ Ctd\_xyy + Ct\_zxz\ Ctd\_yyz \\
&\qquad + Ct\_zxz\ Ctd\_zyy + Ct\_zyz\ Ctd\_xyz) \\
&+ gtu\_xz\ (Ct\_xxx\ Ctd\_yxz + Ct\_xxx\ Ctd\_xyz + Ct\_xxy\ Ctd\_xxz \\
&\qquad + 2\ Ct\_yxx\ Ctd\_yyz + Ct\_yxy\ Ctd\_xyz + Ct\_zxx\ Ctd\_yzz \\
&\qquad + Ct\_zxx\ Ctd\_zyz + Ct\_zxy\ Ctd\_xzz) \\
&+ gtu\_yz\ (Ct\_xxy\ Ctd\_yxz + Ct\_xxy\ Ctd\_xyz + Ct\_xyy\ Ctd\_xxz \\
&\qquad + 2\ Ct\_yxy\ Ctd\_yyz + Ct\_yyy\ Ctd\_xyz + Ct\_zxy\ Ctd\_yzz \\
&\qquad + Ct\_zxy\ Ctd\_zyz + Ct\_zyy\ Ctd\_xzz) \\
&+ gtu\_zz\ (Ct\_xxz\ Ctd\_yxz + Ct\_xxz\ Ctd\_xyz + Ct\_xyz\ Ctd\_xxz \\
&\qquad + 2\ Ct\_yxz\ Ctd\_yyz + Ct\_yyz\ Ctd\_xyz + Ct\_zxz\ Ctd\_yzz \\
&\qquad + Ct\_zxz\ Ctd\_zyz + Ct\_zyz\ Ctd\_xzz)
\end{aligned}
\tag{512}
$$

Auxiliary analysis variable equation

$$Rtd\_xz = Op(x, y, z, t) \tag{513}$$

$$
\begin{aligned}
Op(x,y,z,t) = &-.5\ gtu\_xx\ \partial_x\partial_x gtd\_xz - 1.0\ gtu\_xy\ \partial_y\partial_x gtd\_xz \\
&- 1.0\ gtu\_xz\ \partial_z\partial_x gtd\_xz - .5\ gtu\_yy\ \partial_y\partial_y gtd\_xz \\
&- 1.0\ gtu\_yz\ \partial_z\partial_y gtd\_xz - .5\ gtu\_zz\ \partial_z\partial_z gtd\_xz \\
&+ .5\ gtd\_xx\ \partial_z Gamh\_x + .5\ gtd\_xy\ \partial_z Gamh\_y \\
&+ .5\ gtd\_xz\ \partial_z Gamh\_z + .5\ gtd\_xz\ \partial_x Gamh\_x + .5\ gtd\_yz\ \partial_x Gamh\_y \\
&+ .5\ gtd\_zz\ \partial_x Gamh\_z + .5\ Gamh\_x\ (Ctd\_xxz + Ctd\_zxx) \\
&+ .5\ Gamh\_y\ (Ctd\_xyz + Ctd\_zxy) \\
&+ .5\ Gamh\_z\ (Ctd\_xzz + Ctd\_zxz) \\
&+ gtu\_xx\ (Ct\_xxx\ Ctd\_zxx + Ct\_xxx\ Ctd\_xxz + Ct\_xxz\ Ctd\_xxx \\
&\qquad + Ct\_yxx\ Ctd\_zxy + Ct\_yxx\ Ctd\_yxz + Ct\_yxz\ Ctd\_xxy \\
&\qquad + 2\ Ct\_zxx\ Ctd\_zxz + Ct\_zxz\ Ctd\_xxz) \\
&+ gtu\_xy\ (Ct\_xxy\ Ctd\_zxx + Ct\_xxy\ Ctd\_xxz + Ct\_xyz\ Ctd\_xxx \\
&\qquad + Ct\_yxy\ Ctd\_zxy + Ct\_yxy\ Ctd\_yxz + Ct\_yyz\ Ctd\_xxy \\
&\qquad + 2\ Ct\_zxy\ Ctd\_zxz + Ct\_zyz\ Ctd\_xxz) \\
&+ gtu\_xz\ (Ct\_xxz\ Ctd\_zxx + Ct\_xxz\ Ctd\_xxz + Ct\_xzz\ Ctd\_xxx \\
&\qquad + Ct\_yxz\ Ctd\_zxy + Ct\_yxz\ Ctd\_yxz + Ct\_yzz\ Ctd\_xxy \\
&\qquad + 2\ Ct\_zxz\ Ctd\_zxz + Ct\_zzz\ Ctd\_xxz) \\
&+ gtu\_xy\ (Ct\_xxx\ Ctd\_zxy + Ct\_xxx\ Ctd\_xyz + Ct\_xxz\ Ctd\_xxy \\
&\qquad + Ct\_yxx\ Ctd\_zyy + Ct\_yxx\ Ctd\_yyz + Ct\_yxz\ Ctd\_xyy \\
&\qquad + 2\ Ct\_zxx\ Ctd\_zyz + Ct\_zxz\ Ctd\_xyz) \\
&+ gtu\_yy\ (Ct\_xxy\ Ctd\_zxy + Ct\_xxy\ Ctd\_xyz + Ct\_xyz\ Ctd\_xxy \\
&\qquad + Ct\_yxy\ Ctd\_zyy + Ct\_yxy\ Ctd\_yyz + Ct\_yyz\ Ctd\_xyy \\
&\qquad + 2\ Ct\_zxy\ Ctd\_zyz + Ct\_zyz\ Ctd\_xyz) \\
&+ gtu\_yz\ (Ct\_xxz\ Ctd\_zxy + Ct\_xxz\ Ctd\_xyz + Ct\_xzz\ Ctd\_xxy \\
&\qquad + Ct\_yxz\ Ctd\_zyy + Ct\_yxz\ Ctd\_yyz + Ct\_yzz\ Ctd\_xyy \\
&\qquad + 2\ Ct\_zxz\ Ctd\_zyz + Ct\_zzz\ Ctd\_xyz) \\
&+ gtu\_xz\ (Ct\_xxx\ Ctd\_zxz + Ct\_xxx\ Ctd\_xzz + Ct\_xxz\ Ctd\_xxz \\
&\qquad + Ct\_yxx\ Ctd\_zyz + Ct\_yxx\ Ctd\_yzz + Ct\_yxz\ Ctd\_xyz \\
&\qquad + 2\ Ct\_zxx\ Ctd\_zzz + Ct\_zxz\ Ctd\_xzz) \\
&+ gtu\_yz\ (Ct\_xxy\ Ctd\_zxz + Ct\_xxy\ Ctd\_xzz + Ct\_xyz\ Ctd\_xxz \\
&\qquad + Ct\_yxy\ Ctd\_zyz + Ct\_yxy\ Ctd\_yzz + Ct\_yyz\ Ctd\_xyz \\
&\qquad + 2\ Ct\_zxy\ Ctd\_zzz + Ct\_zyz\ Ctd\_xzz) \\
&+ gtu\_zz\ (Ct\_xxz\ Ctd\_zxz + Ct\_xxz\ Ctd\_xzz + Ct\_xzz\ Ctd\_xxz \\
&\qquad + Ct\_yxz\ Ctd\_zyz + Ct\_yxz\ Ctd\_yzz + Ct\_yzz\ Ctd\_xyz \\
&\qquad + 2\ Ct\_zxz\ Ctd\_zzz + Ct\_zzz\ Ctd\_xzz)
\end{aligned}
\tag{514}
$$

Auxiliary analysis variable equation

$$Rtd\_yy = Op(x, y, z, t) \tag{515}$$

$$\begin{aligned}
Op(x,y,z,t) = &-.5\ gtu_xx\ \partial_x\partial_x gtd_yy - 1.0\ gtu_xy\ \partial_y\partial_x gtd_yy \\
&- 1.0\ gtu_xz\ \partial_z\partial_x gtd_yy - .5\ gtu_yy\ \partial_y\partial_y gtd_yy \\
&- 1.0\ gtu_yz\ \partial_z\partial_y gtd_yy - .5\ gtu_zz\ \partial_z\partial_z gtd_yy \\
&+ 1.0\ gtd_xy\ \partial_y Gamh_x + 1.0\ gtd_yy\ \partial_y Gamh_y \\
&+ 1.0\ gtd_yz\ \partial_y Gamh_z + 1.0\ Gamh_x\ Ctd_yxy \\
&+ 1.0\ Gamh_y\ Ctd_yyy + 1.0\ Gamh_z\ Ctd_yyz \\
&+ gtu_xx\ (2\ Ct_xxy\ Ctd_yxx + Ct_xxy\ Ctd_xxy \\
&\qquad + 3\ Ct_yxy\ Ctd_yxy + 2\ Ct_zxy\ Ctd_yxz + Ct_zxy\ Ctd_zxy) \\
&+ gtu_xy\ (2\ Ct_xyy\ Ctd_yxx + Ct_xyy\ Ctd_xxy + 3\ Ct_yyy\ Ctd_yxy \\
&\qquad + 2\ Ct_zyy\ Ctd_yxz + Ct_zyy\ Ctd_zxy) \\
&+ gtu_xz\ (2\ Ct_xyz\ Ctd_yxx + Ct_xyz\ Ctd_xxy + 3\ Ct_yyz\ Ctd_yxy \\
&\qquad + 2\ Ct_zyz\ Ctd_yxz + Ct_zyz\ Ctd_zxy) \\
&+ gtu_xy\ (2\ Ct_xxy\ Ctd_yxy + Ct_xxy\ Ctd_xyy + 3\ Ct_yxy\ Ctd_yyy \\
&\qquad + 2\ Ct_zxy\ Ctd_yyz + Ct_zxy\ Ctd_zyy) \\
&+ gtu_yy\ (2\ Ct_xyy\ Ctd_yxy + Ct_xyy\ Ctd_xyy + 3\ Ct_yyy\ Ctd_yyy \\
&\qquad + 2\ Ct_zyy\ Ctd_yyz + Ct_zyy\ Ctd_zyy) \\
&+ gtu_yz\ (2\ Ct_xyz\ Ctd_yxy + Ct_xyz\ Ctd_xyy + 3\ Ct_yyz\ Ctd_yyy \\
&\qquad + 2\ Ct_zyz\ Ctd_yyz + Ct_zyz\ Ctd_zyy) \\
&+ gtu_xz\ (2\ Ct_xxy\ Ctd_yxz + Ct_xxy\ Ctd_xyz + 3\ Ct_yxy\ Ctd_yyz \\
&\qquad + 2\ Ct_zxy\ Ctd_yzz + Ct_zxy\ Ctd_zyz) \\
&+ gtu_yz\ (2\ Ct_xyy\ Ctd_yxz + Ct_xyy\ Ctd_xyz + 3\ Ct_yyy\ Ctd_yyz \\
&\qquad + 2\ Ct_zyy\ Ctd_yzz + Ct_zyy\ Ctd_zyz) \\
&+ gtu_zz\ (2\ Ct_xyz\ Ctd_yxz + Ct_xyz\ Ctd_xyz + 3\ Ct_yyz\ Ctd_yyz \\
&\qquad + 2\ Ct_zyz\ Ctd_yzz + Ct_zyz\ Ctd_zyz)
\end{aligned} \tag{516}$$

Auxiliary analysis variable equation

$$Rtd\_yz = Op(x, y, z, t) \tag{517}$$

$$
\begin{aligned}
Op(x,y,z,t) = &-.5\ gtu\_xx\ \partial_x\partial_x gtd\_yz - 1.0\ gtu\_xy\ \partial_y\partial_x gtd\_yz \\
&- 1.0\ gtu\_xz\ \partial_z\partial_x gtd\_yz - .5\ gtu\_yy\ \partial_y\partial_y gtd\_yz \\
&- 1.0\ gtu\_yz\ \partial_z\partial_y gtd\_yz - .5\ gtu\_zz\ \partial_z\partial_z gtd\_yz \\
&+ .5\ gtd\_xy\ \partial_z Gamh\_x + .5\ gtd\_yy\ \partial_z Gamh\_y \\
&+ .5\ gtd\_yz\ \partial_z Gamh\_z + .5\ gtd\_xz\ \partial_y Gamh\_x + .5\ gtd\_yz\ \partial_y Gamh\_y \\
&+ .5\ gtd\_zz\ \partial_y Gamh\_z + .5\ Gamh\_x\ (Ctd\_yxz + Ctd\_zxy) \\
&+ .5\ Gamh\_y\ (Ctd\_yyz + Ctd\_zyy) + .5\ Gamh\_z\ (Ctd\_yzz + Ctd\_zyz) \\
&+ gtu\_xx\ (Ct\_xxy\ Ctd\_zxx + Ct\_xxy\ Ctd\_xxz + Ct\_xxz\ Ctd\_yxx \\
&\qquad + Ct\_yxy\ Ctd\_zxy + Ct\_yxy\ Ctd\_yxz + Ct\_yxz\ Ctd\_yxy \\
&\qquad + 2\ Ct\_zxy\ Ctd\_zxz + Ct\_zxz\ Ctd\_yxz) \\
&+ gtu\_xy\ (Ct\_xyy\ Ctd\_zxx + Ct\_xyy\ Ctd\_xxz + Ct\_xyz\ Ctd\_yxx \\
&\qquad + Ct\_yyy\ Ctd\_zxy + Ct\_yyy\ Ctd\_yxz + Ct\_yyz\ Ctd\_yxy \\
&\qquad + 2\ Ct\_zyy\ Ctd\_zxz + Ct\_zyz\ Ctd\_yxz) \\
&+ gtu\_xz\ (Ct\_xyz\ Ctd\_zxx + Ct\_xyz\ Ctd\_xxz + Ct\_xzz\ Ctd\_yxx \\
&\qquad + Ct\_yyz\ Ctd\_zxy + Ct\_yyz\ Ctd\_yxz + Ct\_yzz\ Ctd\_yxy \\
&\qquad + 2\ Ct\_zyz\ Ctd\_zxz + Ct\_zzz\ Ctd\_yxz) \\
&+ gtu\_xy\ (Ct\_xxy\ Ctd\_zxy + Ct\_xxy\ Ctd\_xyz + Ct\_xxz\ Ctd\_yxy \\
&\qquad + Ct\_yxy\ Ctd\_zyy + Ct\_yxy\ Ctd\_yyz + Ct\_yxz\ Ctd\_yyy \\
&\qquad + 2\ Ct\_zxy\ Ctd\_zyz + Ct\_zxz\ Ctd\_yyz) \\
&+ gtu\_yy\ (Ct\_xyy\ Ctd\_zxy + Ct\_xyy\ Ctd\_xyz + Ct\_xyz\ Ctd\_yxy \\
&\qquad + Ct\_yyy\ Ctd\_zyy + Ct\_yyy\ Ctd\_yyz + Ct\_yyz\ Ctd\_yyy \\
&\qquad + 2\ Ct\_zyy\ Ctd\_zyz + Ct\_zyz\ Ctd\_yyz) \\
&+ gtu\_yz\ (Ct\_xyz\ Ctd\_zxy + Ct\_xyz\ Ctd\_xyz + Ct\_xzz\ Ctd\_yxy \\
&\qquad + Ct\_yyz\ Ctd\_zyy + Ct\_yyz\ Ctd\_yyz + Ct\_yzz\ Ctd\_yyy \\
&\qquad + 2\ Ct\_zyz\ Ctd\_zyz + Ct\_zzz\ Ctd\_yyz) \\
&+ gtu\_xz\ (Ct\_xxy\ Ctd\_zxz + Ct\_xxy\ Ctd\_xzz + Ct\_xxz\ Ctd\_yxz \\
&\qquad + Ct\_yxy\ Ctd\_zyz + Ct\_yxy\ Ctd\_yzz + Ct\_yxz\ Ctd\_yyz \\
&\qquad + 2\ Ct\_zxy\ Ctd\_zzz + Ct\_zxz\ Ctd\_yzz) \\
&+ gtu\_yz\ (Ct\_xyy\ Ctd\_zxz + Ct\_xyy\ Ctd\_xzz + Ct\_xyz\ Ctd\_yxz \\
&\qquad + Ct\_yyy\ Ctd\_zyz + Ct\_yyy\ Ctd\_yzz + Ct\_yyz\ Ctd\_yyz \\
&\qquad + 2\ Ct\_zyy\ Ctd\_zzz + Ct\_zyz\ Ctd\_yzz) \\
&+ gtu\_zz\ (Ct\_xyz\ Ctd\_zxz + Ct\_xyz\ Ctd\_xzz + Ct\_xzz\ Ctd\_yxz \\
&\qquad + Ct\_yyz\ Ctd\_zyz + Ct\_yyz\ Ctd\_yzz + Ct\_yzz\ Ctd\_yyz \\
&\qquad + 2\ Ct\_zyz\ Ctd\_zzz + Ct\_zzz\ Ctd\_yzz)
\end{aligned}
\tag{518}
$$

Auxiliary analysis variable equation

$$Rtd\_zz = Op(x, y, z, t) \tag{519}$$

$$\begin{aligned}
Op(x,y,z,t) = &-.5\ gtu_xx\ \partial_x\partial_x gtd_zz - 1.0\ gtu_xy\ \partial_y\partial_x gtd_zz \\
&- 1.0\ gtu_xz\ \partial_z\partial_x gtd_zz - .5\ gtu_yy\ \partial_y\partial_y gtd_zz \\
&- 1.0\ gtu_yz\ \partial_z\partial_y gtd_zz - .5\ gtu_zz\ \partial_z\partial_z gtd_zz \\
&+ 1.0\ gtd_xz\ \partial_z Gamh_x + 1.0\ gtd_yz\ \partial_z Gamh_y \\
&+ 1.0\ gtd_zz\ \partial_z Gamh_z + 1.0\ Gamh_x\ Ctd_zxz \\
&+ 1.0\ Gamh_y\ Ctd_zyz + 1.0\ Gamh_z\ Ctd_zzz \\
&+ gtu_xx\ (2\ Ct_xxz\ Ctd_zxx + Ct_xxz\ Ctd_xxz \\
&\qquad + 2\ Ct_yxz\ Ctd_zxy + Ct_yxz\ Ctd_yxz + 3\ Ct_zxz\ Ctd_zxz) \\
&+ gtu_xy\ (2\ Ct_xyz\ Ctd_zxx + Ct_xyz\ Ctd_xxz + 2\ Ct_yyz\ Ctd_zxy \\
&\qquad + Ct_yyz\ Ctd_yxz + 3\ Ct_zyz\ Ctd_zxz) \\
&+ gtu_xz\ (2\ Ct_xzz\ Ctd_zxx + Ct_xzz\ Ctd_xxz + 2\ Ct_yzz\ Ctd_zxy \\
&\qquad + Ct_yzz\ Ctd_yxz + 3\ Ct_zzz\ Ctd_zxz) \\
&+ gtu_xy\ (2\ Ct_xxz\ Ctd_zxy + Ct_xxz\ Ctd_xyz + 2\ Ct_yxz\ Ctd_zyy \\
&\qquad + Ct_yxz\ Ctd_yyz + 3\ Ct_zxz\ Ctd_zyz) \\
&+ gtu_yy\ (2\ Ct_xyz\ Ctd_zxy + Ct_xyz\ Ctd_xyz + 2\ Ct_yyz\ Ctd_zyy \\
&\qquad + Ct_yyz\ Ctd_yyz + 3\ Ct_zyz\ Ctd_zyz) \\
&+ gtu_yz\ (2\ Ct_xzz\ Ctd_zxy + Ct_xzz\ Ctd_xyz + 2\ Ct_yzz\ Ctd_zyy \\
&\qquad + Ct_yzz\ Ctd_yyz + 3\ Ct_zzz\ Ctd_zyz) \\
&+ gtu_xz\ (2\ Ct_xxz\ Ctd_zxz + Ct_xxz\ Ctd_xzz + 2\ Ct_yxz\ Ctd_zyz \\
&\qquad + Ct_yxz\ Ctd_yzz + 3\ Ct_zxz\ Ctd_zzz) \\
&+ gtu_yz\ (2\ Ct_xyz\ Ctd_zxz + Ct_xyz\ Ctd_xzz + 2\ Ct_yyz\ Ctd_zyz \\
&\qquad + Ct_yyz\ Ctd_yzz + 3\ Ct_zyz\ Ctd_zzz) \\
&+ gtu_zz\ (2\ Ct_xzz\ Ctd_zxz + Ct_xzz\ Ctd_xzz + 2\ Ct_yzz\ Ctd_zyz \\
&\qquad + Ct_yzz\ Ctd_yzz + 3\ Ct_zzz\ Ctd_zzz)
\end{aligned} \tag{520}$$

Auxiliary analysis variable equation

$$uph\_x = Op(x, y, z, t) \tag{521}$$

$$Op(x, y, z, t) = -y \tag{522}$$

Auxiliary analysis variable equation

$$uph\_y = Op(x, y, z, t) \tag{523}$$

$$Op(x, y, z, t) = +x \tag{524}$$

Auxiliary analysis variable equation

$$uph\_z = Op(x, y, z, t) \tag{525}$$

$$Op(x, y, z, t) = +\mathrm{o} \tag{526}$$

Auxiliary analysis variable equation

$$ur\_x = Op(x, y, z, t) \tag{527}$$

$$Op(x, y, z, t) = +x \tag{528}$$

Auxiliary analysis variable equation

$$ur\_y = Op(x, y, z, t) \tag{529}$$

$$Op(x, y, z, t) = +y \tag{530}$$

Auxiliary analysis variable equation

$$ur\_z = Op(x, y, z, t) \tag{531}$$

$$Op(x, y, z, t) = +z \tag{532}$$

Auxiliary analysis variable equation

$$uthd\_x = Op(x, y, z, t) \tag{533}$$

$$Op(x, y, z, t) = +x\ z \tag{534}$$

Auxiliary analysis variable equation

$$uthd\_y = Op(x, y, z, t) \tag{535}$$

$$Op(x, y, z, t) = +y\ z \tag{536}$$

Auxiliary analysis variable equation

$$uthd\_z = Op(x, y, z, t) \tag{537}$$

$$Op(x, y, z, t) = +(-x^2) + (-y^2) \tag{538}$$

Auxiliary analysis variable equation

$$uth\_x = Op(x, y, z, t) \tag{539}$$

$$Op(x, y, z, t) = +chi\ gtu\_xx\ uthd\_x + chi\ gtu\_xy\ uthd\_y + chi\ gtu\_xz\ uthd\_z \tag{540}$$

Auxiliary analysis variable equation

$$uth\_y = Op(x, y, z, t) \tag{541}$$

$$Op(x, y, z, t) = +chi\ gtu\_xy\ uthd\_x + chi\ gtu\_yy\ uthd\_y + chi\ gtu\_yz\ uthd\_z \tag{542}$$

Auxiliary analysis variable equation

$$uth\_z = Op(x, y, z, t) \tag{543}$$

$$Op(x, y, z, t) = +chi\ gtu\_xz\ uthd\_x + chi\ gtu\_yz\ uthd\_y + chi\ gtu\_zz\ uthd\_z \tag{544}$$

Auxiliary analysis variable equation

$$wphph = Op(x, y, z, t) \tag{545}$$

$$\begin{aligned} Op(x, y, z, t) = &+ inv\_chi\ gtd\_xx\ uph\_x^2 + 2\ inv\_chi\ gtd\_xy\ uph\_x\ uph\_y \\ &+ 2\ inv\_chi\ gtd\_xz\ uph\_x\ uph\_z + inv\_chi\ gtd\_yy\ uph\_y^2 \\ &+ 2\ inv\_chi\ gtd\_yz\ uph\_y\ uph\_z + inv\_chi\ gtd\_zz\ uph\_z^2 \end{aligned} \tag{546}$$

Auxiliary analysis variable equation

$$vph\_x = Op(x, y, z, t) \tag{547}$$

$$Op(x, y, z, t) = + \frac{uph\_x}{\max\{.10e-3, \sqrt{wphph}\}} \tag{548}$$

Auxiliary analysis variable equation

$$vph\_y = Op(x, y, z, t) \tag{549}$$

$$Op(x, y, z, t) = + \frac{uph\_y}{\max\{.10e-3, \sqrt{wphph}\}} \tag{550}$$

Auxiliary analysis variable equation

$$vph\_z = Op(x, y, z, t) \tag{551}$$

$$Op(x, y, z, t) = + \frac{uph\_z}{\max\{.10e-3, \sqrt{wphph}\}} \tag{552}$$

Auxiliary analysis variable equation

$$wrph = Op(x, y, z, t) \tag{553}$$

$$\begin{aligned} Op(x,y,z,t) = &+inv\_chi\ gtd\_xx\ ur\_x\ vph\_x + inv\_chi\ gtd\_xy\ ur\_x\ vph\_y \\ &+ inv\_chi\ gtd\_xz\ ur\_x\ vph\_z \\ &+ inv\_chi\ gtd\_xy\ ur\_y\ vph\_x + inv\_chi\ gtd\_yy\ ur\_y\ vph\_y \\ &+ inv\_chi\ gtd\_yz\ ur\_y\ vph\_z + inv\_chi\ gtd\_xz\ ur\_z\ vph\_x \\ &+ inv\_chi\ gtd\_yz\ ur\_z\ vph\_y + inv\_chi\ gtd\_zz\ ur\_z\ vph\_z \end{aligned} \tag{554}$$

Auxiliary analysis variable equation

$$wrr = Op(x,y,z,t) \tag{555}$$

$$\begin{aligned} Op(x,y,z,t) = &+inv\_chi\ gtd\_xx\ ur\_x^2 + 2\ inv\_chi\ gtd\_xy\ ur\_x\ ur\_y \\ &+ 2\ inv\_chi\ gtd\_xz\ ur\_x\ ur\_z + inv\_chi\ gtd\_yy\ ur\_y^2 \\ &+ 2\ inv\_chi\ gtd\_yz\ ur\_y\ ur\_z + inv\_chi\ gtd\_zz\ ur\_z^2 \end{aligned} \tag{556}$$

Auxiliary analysis variable equation

$$vr\_x = Op(x,y,z,t) \tag{557}$$

$$Op(x,y,z,t) = +\frac{(-wrph\ vph\_x) + ur\_x}{\max\{.10e-3, \sqrt{wrr}\}} \tag{558}$$

Auxiliary analysis variable equation

$$vr\_y = Op(x,y,z,t) \tag{559}$$

$$Op(x,y,z,t) = +\frac{(-wrph\ vph\_y) + ur\_y}{\max\{.10e-3, \sqrt{wrr}\}} \tag{560}$$

Auxiliary analysis variable equation

$$vr\_z = Op(x,y,z,t) \tag{561}$$

$$Op(x,y,z,t) = +\frac{(-wrph\ vph\_z) + ur\_z}{\max\{.10e-3, \sqrt{wrr}\}} \tag{562}$$

Auxiliary analysis variable equation

$$wthph = Op(x,y,z,t) \tag{563}$$

$$\begin{aligned} Op(x,y,z,t) = &+inv\_chi\ gtd\_xx\ uth\_x\ vph\_x + inv\_chi\ gtd\_xy\ uth\_x\ vph\_y \\ &+ inv\_chi\ gtd\_xz\ uth\_x\ vph\_z \\ &+ inv\_chi\ gtd\_xy\ uth\_y\ vph\_x + inv\_chi\ gtd\_yy\ uth\_y\ vph\_y \\ &+ inv\_chi\ gtd\_yz\ uth\_y\ vph\_z + inv\_chi\ gtd\_xz\ uth\_z\ vph\_x \\ &+ inv\_chi\ gtd\_yz\ uth\_z\ vph\_y + inv\_chi\ gtd\_zz\ uth\_z\ vph\_z \end{aligned} \tag{564}$$

Auxiliary analysis variable equation

$$wthr = Op(x,y,z,t) \tag{565}$$

$$\begin{aligned} Op(x,y,z,t) = &+inv\_chi\ gtd\_xx\ uth\_x\ vr\_x + inv\_chi\ gtd\_xy\ uth\_x\ vr\_y \\ &+ inv\_chi\ gtd\_xz\ uth\_x\ vr\_z \\ &+ inv\_chi\ gtd\_xy\ uth\_y\ vr\_x + inv\_chi\ gtd\_yy\ uth\_y\ vr\_y \\ &+ inv\_chi\ gtd\_yz\ uth\_y\ vr\_z + inv\_chi\ gtd\_xz\ uth\_z\ vr\_x \\ &+ inv\_chi\ gtd\_yz\ uth\_z\ vr\_y + inv\_chi\ gtd\_zz\ uth\_z\ vr\_z \end{aligned} \tag{566}$$

Auxiliary analysis variable equation

$$wthth = Op(x,y,z,t) \tag{567}$$

$$\begin{aligned} Op(x,y,z,t) = &+inv\_chi\ gtd\_xx\ uth\_x^2 + 2\ inv\_chi\ gtd\_xy\ uth\_x\ uth\_y \\ &+ 2\ inv\_chi\ gtd\_xz\ uth\_x\ uth\_z + inv\_chi\ gtd\_yy\ uth\_y^2 \\ &+ 2\ inv\_chi\ gtd\_yz\ uth\_y\ uth\_z + inv\_chi\ gtd\_zz\ uth\_z^2 \end{aligned} \tag{568}$$

Auxiliary analysis variable equation

$$vth\_x = Op(x, y, z, t) \tag{569}$$

$$Op(x, y, z, t) = +\frac{(-wthph\ vph\_x) + (-wthr\ vr\_x) + uth\_x}{\max\{.10e-3, \sqrt{wthth}\}} \tag{570}$$

Auxiliary analysis variable equation

$$vth\_y = Op(x, y, z, t) \tag{571}$$

$$Op(x, y, z, t) = +\frac{(-wthph\ vph\_y) + (-wthr\ vr\_y) + uth\_y}{\max\{.10e-3, \sqrt{wthth}\}} \tag{572}$$

Auxiliary analysis variable equation

$$vth\_z = Op(x, y, z, t) \tag{573}$$

$$Op(x, y, z, t) = +\frac{(-wthph\ vph\_z) + (-wthr\ vr\_z) + uth\_z}{\max\{.10e-3, \sqrt{wthth}\}} \tag{574}$$

Auxiliary analysis variable equation

$$dSigma\_x = Op(x, y, z, t) \tag{575}$$

$$Op(x, y, z, t) = +\frac{1.\ ur\_x\ \max\{.1e-9, \sqrt{x^2+y^2+z^2}\}}{chi^{1.500000000000000}} \tag{576}$$

Auxiliary analysis variable equation

$$dSigma\_y = Op(x, y, z, t) \tag{577}$$

$$Op(x, y, z, t) = +\frac{1.\ ur\_y\ \max\{.1e-9, \sqrt{x^2+y^2+z^2}\}}{chi^{1.500000000000000}} \tag{578}$$

Auxiliary analysis variable equation

$$dSigma\_z = Op(x, y, z, t) \tag{579}$$

$$Op(x, y, z, t) = +\frac{1.\ ur\_z\ \max\{.1e-9, \sqrt{x^2+y^2+z^2}\}}{chi^{1.500000000000000}} \tag{580}$$

Auxiliary analysis variable equation

$$Td\_tt = Op(x, y, z, t) \tag{581}$$

$$\begin{aligned} Op(x, y, z, t) = {} & +g4d\_tt^2\ Tu\_tt + 2\ g4d\_tx\ g4d\_tt\ Tu\_tx + 2\ g4d\_ty\ g4d\_tt\ Tu\_ty \\ & + 2\ g4d\_tz\ g4d\_tt\ Tu\_tz + g4d\_tx^2\ Tu\_xx \\ & + 2\ g4d\_ty\ g4d\_tx\ Tu\_xy + 2\ g4d\_tz\ g4d\_tx\ Tu\_xz \\ & + g4d\_ty^2\ Tu\_yy + 2\ g4d\_tz\ g4d\_ty\ Tu\_yz + g4d\_tz^2\ Tu\_zz \end{aligned} \tag{582}$$

Auxiliary analysis variable equation

$$Td\_tx = Op(x, y, z, t) \tag{583}$$

$$\begin{aligned} Op(x, y, z, t) = {} & +g4d\_tt\ g4d\_tx\ Tu\_tt + g4d\_tx^2\ Tu\_tx + g4d\_ty\ g4d\_tx\ Tu\_ty \\ & + g4d\_tz\ g4d\_tx\ Tu\_tz + g4d\_tt\ g4d\_xx\ Tu\_tx + g4d\_tx\ g4d\_xx\ Tu\_xx \\ & + g4d\_ty\ g4d\_xx\ Tu\_xy + g4d\_tz\ g4d\_xx\ Tu\_xz \\ & + g4d\_tt\ g4d\_xy\ Tu\_ty + g4d\_tx\ g4d\_xy\ Tu\_xy + g4d\_ty\ g4d\_xy\ Tu\_yy \\ & + g4d\_tz\ g4d\_xy\ Tu\_yz + g4d\_tt\ g4d\_xz\ Tu\_tz + g4d\_tx\ g4d\_xz\ Tu\_xz \\ & + g4d\_ty\ g4d\_xz\ Tu\_yz + g4d\_tz\ g4d\_xz\ Tu\_zz \end{aligned} \tag{584}$$

Auxiliary analysis variable equation

$$Td\_ty = Op(x, y, z, t) \tag{585}$$

$$Op(x,y,z,t) = +g4d\_tt\ g4d\_ty\ Tu\_tt + g4d\_tx\ g4d\_ty\ Tu\_tx + g4d\_ty^2\ Tu\_ty + g4d\_tz\ g4d\_ty\ Tu\_tz + g4d\_tt\ g4d\_xy\ Tu\_tx + g4d\_tx\ g4d\_xy\ Tu\_xx + g4d\_ty\ g4d\_xy\ Tu\_xy + g4d\_tz\ g4d\_xy\ Tu\_xz + g4d\_tt\ g4d\_yy\ Tu\_ty + g4d\_tx\ g4d\_yy\ Tu\_xy + g4d\_ty\ g4d\_yy\ Tu\_yy + g4d\_tz\ g4d\_yy\ Tu\_yz + g4d\_tt\ g4d\_yz\ Tu\_tz + g4d\_tx\ g4d\_yz\ Tu\_xz + g4d\_ty\ g4d\_yz\ Tu\_yz + g4d\_tz\ g4d\_yz\ Tu\_zz \tag{586}$$

Auxiliary analysis variable equation

$$Td\_tz = Op(x,y,z,t) \tag{587}$$

$$Op(x,y,z,t) = +g4d\_tt\ g4d\_tz\ Tu\_tt + g4d\_tx\ g4d\_tz\ Tu\_tx + g4d\_ty\ g4d\_tz\ Tu\_ty + g4d\_tz^2\ Tu\_tz + g4d\_tt\ g4d\_xz\ Tu\_tx + g4d\_tx\ g4d\_xz\ Tu\_xx + g4d\_ty\ g4d\_xz\ Tu\_xy + g4d\_tz\ g4d\_xz\ Tu\_xz + g4d\_tt\ g4d\_yz\ Tu\_ty + g4d\_tx\ g4d\_yz\ Tu\_xy + g4d\_ty\ g4d\_yz\ Tu\_yy + g4d\_tz\ g4d\_yz\ Tu\_yz + g4d\_tt\ g4d\_zz\ Tu\_tz + g4d\_tx\ g4d\_zz\ Tu\_xz + g4d\_ty\ g4d\_zz\ Tu\_yz + g4d\_tz\ g4d\_zz\ Tu\_zz \tag{588}$$

Auxiliary analysis variable equation

$$Td\_xx = Op(x,y,z,t) \tag{589}$$

$$Op(x,y,z,t) = +g4d\_tx^2\ Tu\_tt + 2\ g4d\_xx\ g4d\_tx\ Tu\_tx + 2\ g4d\_xy\ g4d\_tx\ Tu\_ty + 2\ g4d\_xz\ g4d\_tx\ Tu\_tz + g4d\_xx^2\ Tu\_xx + 2\ g4d\_xy\ g4d\_xx\ Tu\_xy + 2\ g4d\_xz\ g4d\_xx\ Tu\_xz + g4d\_xy^2\ Tu\_yy + 2\ g4d\_xz\ g4d\_xy\ Tu\_yz + g4d\_xz^2\ Tu\_zz \tag{590}$$

Auxiliary analysis variable equation

$$Td\_xy = Op(x,y,z,t) \tag{591}$$

$$
\begin{aligned}
Op(x,y,z,t) = &+g4d\_tx\ g4d\_ty\ Tu\_tt + g4d\_xx\ g4d\_ty\ Tu\_tx + g4d\_xy\ g4d\_ty\ Tu\_ty \\
&+ g4d\_xz\ g4d\_ty\ Tu\_tz + g4d\_tx\ g4d\_xy\ Tu\_tx \\
&+ g4d\_xx\ g4d\_xy\ Tu\_xx + g4d\_xy^2\ Tu\_xy + g4d\_xz\ g4d\_xy\ Tu\_xz \\
&+ g4d\_tx\ g4d\_yy\ Tu\_ty + g4d\_xx\ g4d\_yy\ Tu\_xy \\
&+ g4d\_xy\ g4d\_yy\ Tu\_yy + g4d\_xz\ g4d\_yy\ Tu\_yz \\
&+ g4d\_tx\ g4d\_yz\ Tu\_tz + g4d\_xx\ g4d\_yz\ Tu\_xz \\
&+ g4d\_xy\ g4d\_yz\ Tu\_yz + g4d\_xz\ g4d\_yz\ Tu\_zz
\end{aligned}
\tag{592}
$$

Auxiliary analysis variable equation

$$
Td\_xz = Op(x,y,z,t) \tag{593}
$$

$$
\begin{aligned}
Op(x,y,z,t) = &+g4d\_tx\ g4d\_tz\ Tu\_tt + g4d\_xx\ g4d\_tz\ Tu\_tx + g4d\_xy\ g4d\_tz\ Tu\_ty \\
&+ g4d\_xz\ g4d\_tz\ Tu\_tz + g4d\_tx\ g4d\_xz\ Tu\_tx \\
&+ g4d\_xx\ g4d\_xz\ Tu\_xx + g4d\_xy\ g4d\_xz\ Tu\_xy \\
&+ g4d\_xz^2\ Tu\_xz + g4d\_tx\ g4d\_yz\ Tu\_ty + g4d\_xx\ g4d\_yz\ Tu\_xy \\
&+ g4d\_xy\ g4d\_yz\ Tu\_yy + g4d\_xz\ g4d\_yz\ Tu\_yz \\
&+ g4d\_tx\ g4d\_zz\ Tu\_tz + g4d\_xx\ g4d\_zz\ Tu\_xz \\
&+ g4d\_xy\ g4d\_zz\ Tu\_yz + g4d\_xz\ g4d\_zz\ Tu\_zz
\end{aligned}
\tag{594}
$$

Auxiliary analysis variable equation

$$
Td\_yy = Op(x,y,z,t) \tag{595}
$$

$$
\begin{aligned}
Op(x,y,z,t) = &+g4d\_ty^2\ Tu\_tt + 2\ g4d\_xy\ g4d\_ty\ Tu\_tx + 2\ g4d\_yy\ g4d\_ty\ Tu\_ty \\
&+ 2\ g4d\_yz\ g4d\_ty\ Tu\_tz + g4d\_xy^2\ Tu\_xx \\
&+ 2\ g4d\_yy\ g4d\_xy\ Tu\_xy + 2\ g4d\_yz\ g4d\_xy\ Tu\_xz \\
&+ g4d\_yy^2\ Tu\_yy + 2\ g4d\_yz\ g4d\_yy\ Tu\_yz + g4d\_yz^2\ Tu\_zz
\end{aligned}
\tag{596}
$$

Auxiliary analysis variable equation

$$
Td\_yz = Op(x,y,z,t) \tag{597}
$$

$$\begin{aligned} Op(x,y,z,t) = &+g4d\_ty\ g4d\_tz\ Tu\_tt + g4d\_xy\ g4d\_tz\ Tu\_tx + g4d\_yy\ g4d\_tz\ Tu\_ty \\ &+ g4d\_yz\ g4d\_tz\ Tu\_tz + g4d\_ty\ g4d\_xz\ Tu\_tx \\ &+ g4d\_xy\ g4d\_xz\ Tu\_xx + g4d\_yy\ g4d\_xz\ Tu\_xy \\ &+ g4d\_yz\ g4d\_xz\ Tu\_xz + g4d\_ty\ g4d\_yz\ Tu\_ty \\ &+ g4d\_xy\ g4d\_yz\ Tu\_xy + g4d\_yy\ g4d\_yz\ Tu\_yy \\ &+ g4d\_yz^2\ Tu\_yz + g4d\_ty\ g4d\_zz\ Tu\_tz + g4d\_xy\ g4d\_zz\ Tu\_xz \\ &+ g4d\_yy\ g4d\_zz\ Tu\_yz + g4d\_yz\ g4d\_zz\ Tu\_zz \end{aligned} \tag{598}$$

Auxiliary analysis variable equation

$$Td\_zz = Op(x,y,z,t) \tag{599}$$

$$\begin{aligned} Op(x,y,z,t) = &+g4d\_tz^2\ Tu\_tt + 2\ g4d\_xz\ g4d\_tz\ Tu\_tx + 2\ g4d\_yz\ g4d\_tz\ Tu\_ty \\ &+ 2\ g4d\_zz\ g4d\_tz\ Tu\_tz + g4d\_xz^2\ Tu\_xx \\ &+ 2\ g4d\_yz\ g4d\_xz\ Tu\_xy + 2\ g4d\_zz\ g4d\_xz\ Tu\_xz \\ &+ g4d\_yz^2\ Tu\_yy + 2\ g4d\_zz\ g4d\_yz\ Tu\_yz + g4d\_zz^2\ Tu\_zz \end{aligned} \tag{600}$$

Auxiliary analysis variable equation

$$TT = Op(x,y,z,t) \tag{601}$$

$$\begin{aligned} Op(x,y,z,t) = &+g4d\_tt\ Tu\_tt + 2\ g4d\_tx\ Tu\_tx + 2\ g4d\_ty\ Tu\_ty + 2\ g4d\_tz\ Tu\_tz \\ &+ g4d\_xx\ Tu\_xx + 2\ g4d\_xy\ Tu\_xy + 2\ g4d\_xz\ Tu\_xz \\ &+ g4d\_yy\ Tu\_yy + 2\ g4d\_yz\ Tu\_yz + g4d\_zz\ Tu\_zz \end{aligned} \tag{602}$$

Auxiliary analysis variable equation

$$EWeyl\_xx = Op(x,y,z,t) \tag{603}$$

$$\begin{aligned} Op(x,y,z,t) = &+ (-inv\_chi\ Rpd\_xx) + (-Rtd\_xx) \\ &+ inv\_chi\ \ (Atd\_xx\ Atud\_xx + Atd\_xy\ Atud\_yx + Atd\_xz\ Atud\_zx) \\ &+ (-.3333333333333333\ inv\_chi\ trK\ Atd\_xx) \\ &+ (-.2222222222222222\ inv\_chi\ gtd\_xx\ trK^2) \end{aligned} \tag{604}$$

Auxiliary analysis variable equation

$$EWeyl\_xy = Op(x,y,z,t) \tag{605}$$

$$\begin{aligned} Op(x,y,z,t) = &+ (-inv\_chi\ Rpd\_xy) + (-Rtd\_xy) \\ &+ inv\_chi\ \ (Atd\_xx\ Atud\_xy + Atd\_xy\ Atud\_yy + Atd\_xz\ Atud\_zy) \\ &+ (-.3333333333333333\ inv\_chi\ trK\ Atd\_xy) \\ &+ (-.2222222222222222\ inv\_chi\ gtd\_xy\ trK^2) \end{aligned} \tag{606}$$

Auxiliary analysis variable equation

$$EWeyl\_xz = Op(x,y,z,t) \tag{607}$$

$$\begin{aligned} Op(x,y,z,t) = &+ (-inv\_chi\ Rpd\_xz) + (-Rtd\_xz) \\ &+ inv\_chi\ \ (Atd\_xx\ Atud\_xz + Atd\_xy\ Atud\_yz + Atd\_xz\ Atud\_zz) \\ &+ (-.3333333333333333\ inv\_chi\ trK\ Atd\_xz) \\ &+ (-.2222222222222222\ inv\_chi\ gtd\_xz\ trK^2) \end{aligned} \tag{608}$$

Auxiliary analysis variable equation

$$EWeyl\_yy = Op(x,y,z,t) \tag{609}$$

$$\begin{aligned} Op(x,y,z,t) = &+ (-inv\_chi\ Rpd\_yy) + (-Rtd\_yy) \\ &+ inv\_chi\ \ (Atd\_xy\ Atud\_xy + Atd\_yy\ Atud\_yy + Atd\_yz\ Atud\_zy) \\ &+ (-.3333333333333333\ inv\_chi\ trK\ Atd\_yy) \\ &+ (-.2222222222222222\ inv\_chi\ gtd\_yy\ trK^2) \end{aligned} \tag{610}$$

Auxiliary analysis variable equation

$$EWeyl\_yz = Op(x, y, z, t) \tag{611}$$

$$\begin{aligned} Op(x, y, z, t) = &+ (-inv\_chi\ Rpd\_yz) + (-Rtd\_yz) \\ &+ inv\_chi\ \ (Atd\_xy\ Atud\_xz + Atd\_yy\ Atud\_yz + Atd\_yz\ Atud\_zz) \\ &+ (-.3333333333333333\ inv\_chi\ trK\ Atd\_yz) \\ &+ (-.2222222222222222\ inv\_chi\ gtd\_yz\ trK^2) \end{aligned} \tag{612}$$

Auxiliary analysis variable equation

$$EWeyl\_zz = Op(x, y, z, t) \tag{613}$$

$$\begin{aligned} Op(x, y, z, t) = &+ (-inv\_chi\ Rpd\_zz) + (-Rtd\_zz) \\ &+ inv\_chi\ \ (Atd\_xz\ Atud\_xz + Atd\_yz\ Atud\_yz + Atd\_zz\ Atud\_zz) \\ &+ (-.3333333333333333\ inv\_chi\ trK\ Atd\_zz) \\ &+ (-.2222222222222222\ inv\_chi\ gtd\_zz\ trK^2) \end{aligned} \tag{614}$$

Auxiliary analysis variable equation

$$Del\_Kd\_xxx = Op(x, y, z, t) \tag{615}$$

$$\begin{aligned} Op(x, y, z, t) = &+ inv\_chi\ \partial_x Atd\_xx \\ &- inv\_chi\ \ (2\ Atd\_xx\ Ct\_xxx + 2\ Atd\_xy\ Ct\_yxx + 2\ Atd\_xz\ Ct\_zxx) \\ &+ .3333333333333333\ inv\_chi\ gtd\_xx\ \partial_x trK \\ &+ 1.0\ inv\_chi^2\ Atd\_xx\ \partial_x chi - 1.0\ inv\_chi^2\ gtd\_xx\ Atud\_xx\ \partial_x chi \\ &- 1.0\ inv\_chi^2\ gtd\_xx\ Atud\_yx\ \partial_y chi \\ &- 1.0\ inv\_chi^2\ gtd\_xx\ Atud\_zx\ \partial_z chi \end{aligned} \tag{616}$$

Auxiliary analysis variable equation

$$Del\_Kd\_xxy = Op(x, y, z, t) \tag{617}$$

$$
\begin{aligned}
Op(x,y,z,t) = &+inv\_chi\ \partial_x Atd\_xy \\
&- inv\_chi\ (Atd\_xy\ Ct\_xxx + Atd\_xx\ Ct\_xxy + Atd\_yy\ Ct\_yxx \\
&\qquad + Atd\_xy\ Ct\_yxy + Atd\_yz\ Ct\_zxx + Atd\_xz\ Ct\_zxy) \\
&+ .3333333333333333\ inv\_chi\ gtd\_xy\ \partial_x trK \\
&+ .5\ inv\_chi^2\ Atd\_xy\ \partial_x chi + .5\ inv\_chi^2\ Atd\_xx\ \partial_y chi \\
&- .5\ inv\_chi^2\ gtd\_xx\ Atud\_xy\ \partial_x chi \\
&- .5\ inv\_chi^2\ gtd\_xx\ Atud\_yy\ \partial_y chi \\
&- .5\ inv\_chi^2\ gtd\_xx\ Atud\_zy\ \partial_z chi \\
&- .5\ inv\_chi^2\ gtd\_xy\ Atud\_xx\ \partial_x chi \\
&- .5\ inv\_chi^2\ gtd\_xy\ Atud\_yx\ \partial_y chi \\
&- .5\ inv\_chi^2\ gtd\_xy\ Atud\_zx\ \partial_z chi
\end{aligned}
\tag{618}
$$

Auxiliary analysis variable equation

$$
Del\_Kd\_xxz = Op(x,y,z,t) \tag{619}
$$

$$
\begin{aligned}
Op(x,y,z,t) = &+inv\_chi\ \partial_x Atd\_xz \\
&- inv\_chi\ (Atd\_xz\ Ct\_xxx + Atd\_xx\ Ct\_xxz + Atd\_yz\ Ct\_yxx \\
&\qquad + Atd\_xy\ Ct\_yxz + Atd\_zz\ Ct\_zxx + Atd\_xz\ Ct\_zxz) \\
&+ .3333333333333333\ inv\_chi\ gtd\_xz\ \partial_x trK \\
&+ .5\ inv\_chi^2\ Atd\_xz\ \partial_x chi + .5\ inv\_chi^2\ Atd\_xx\ \partial_z chi \\
&- .5\ inv\_chi^2\ gtd\_xx\ Atud\_xz\ \partial_x chi \\
&- .5\ inv\_chi^2\ gtd\_xx\ Atud\_yz\ \partial_y chi \\
&- .5\ inv\_chi^2\ gtd\_xx\ Atud\_zz\ \partial_z chi \\
&- .5\ inv\_chi^2\ gtd\_xz\ Atud\_xx\ \partial_x chi \\
&- .5\ inv\_chi^2\ gtd\_xz\ Atud\_yx\ \partial_y chi \\
&- .5\ inv\_chi^2\ gtd\_xz\ Atud\_zx\ \partial_z chi
\end{aligned}
\tag{620}
$$

Auxiliary analysis variable equation

$$
Del\_Kd\_yxx = Op(x,y,z,t) \tag{621}
$$

$$
\begin{aligned}
Op(x,y,z,t) = {} & +inv\_chi\ \partial_y Atd\_xx \\
& - inv\_chi\ \left(2\ Atd\_xx\ Ct\_xxy + 2\ Atd\_xy\ Ct\_yxy + 2\ Atd\_xz\ Ct\_zxy\right) \\
& + .3333333333333333\ inv\_chi\ gtd\_xx\ \partial_y trK \\
& + 1.0\ inv\_chi^2\ Atd\_xy\ \partial_x chi - 1.0\ inv\_chi^2\ gtd\_xy\ Atud\_xx\ \partial_x chi \\
& - 1.0\ inv\_chi^2\ gtd\_xy\ Atud\_yx\ \partial_y chi \\
& - 1.0\ inv\_chi^2\ gtd\_xy\ Atud\_zx\ \partial_z chi
\end{aligned}
\tag{622}
$$

Auxiliary analysis variable equation

$$
Del\_Kd\_yxy = Op(x,y,z,t) \tag{623}
$$

$$
\begin{aligned}
Op(x,y,z,t) = {} & +inv\_chi\ \partial_y Atd\_xy \\
& - inv\_chi\ \left(Atd\_xy\ Ct\_xxy + Atd\_xx\ Ct\_xyy + Atd\_yy\ Ct\_yxy \right. \\
& \qquad \left. + Atd\_xy\ Ct\_yyy + Atd\_yz\ Ct\_zxy + Atd\_xz\ Ct\_zyy\right) \\
& + .3333333333333333\ inv\_chi\ gtd\_xy\ \partial_y trK \\
& + .5\ inv\_chi^2\ Atd\_yy\ \partial_x chi + .5\ inv\_chi^2\ Atd\_xy\ \partial_y chi \\
& - .5\ inv\_chi^2\ gtd\_xy\ Atud\_xy\ \partial_x chi \\
& - .5\ inv\_chi^2\ gtd\_xy\ Atud\_yy\ \partial_y chi \\
& - .5\ inv\_chi^2\ gtd\_xy\ Atud\_zy\ \partial_z chi \\
& - .5\ inv\_chi^2\ gtd\_yy\ Atud\_xx\ \partial_x chi \\
& - .5\ inv\_chi^2\ gtd\_yy\ Atud\_yx\ \partial_y chi \\
& - .5\ inv\_chi^2\ gtd\_yy\ Atud\_zx\ \partial_z chi
\end{aligned}
\tag{624}
$$

Auxiliary analysis variable equation

$$
Del\_Kd\_yxz = Op(x,y,z,t) \tag{625}
$$

$$
\begin{aligned}
Op(x,y,z,t) = &+inv\_chi\ \partial_y Atd\_xz - inv\_chi\ (Atd\_xz\ Ct\_xxy + Atd\_xx\ Ct\_xyz \\
&+ Atd\_yz\ Ct\_yxy + Atd\_xy\ Ct\_yyz + Atd\_zz\ Ct\_zxy + Atd\_xz\ Ct\_zyz) \\
&+ .3333333333333333\ inv\_chi\ gtd\_xz\ \partial_y trK \\
&+ .5\ inv\_chi^2\ Atd\_yz\ \partial_x chi + .5\ inv\_chi^2\ Atd\_xy\ \partial_z chi \\
&- .5\ inv\_chi^2\ gtd\_xy\ Atud\_xz\ \partial_x chi \\
&- .5\ inv\_chi^2\ gtd\_xy\ Atud\_yz\ \partial_y chi \\
&- .5\ inv\_chi^2\ gtd\_xy\ Atud\_zz\ \partial_z chi \\
&- .5\ inv\_chi^2\ gtd\_yz\ Atud\_xx\ \partial_x chi \\
&- .5\ inv\_chi^2\ gtd\_yz\ Atud\_yx\ \partial_y chi \\
&- .5\ inv\_chi^2\ gtd\_yz\ Atud\_zx\ \partial_z chi
\end{aligned}
\tag{626}
$$

Auxiliary analysis variable equation

$$
Del\_Kd\_zxx = Op(x,y,z,t) \tag{627}
$$

$$
\begin{aligned}
Op(x,y,z,t) = &+inv\_chi\ \partial_z Atd\_xx \\
&- inv\_chi\ (2\ Atd\_xx\ Ct\_xxz + 2\ Atd\_xy\ Ct\_yxz + 2\ Atd\_xz\ Ct\_zxz) \\
&+ .3333333333333333\ inv\_chi\ gtd\_xx\ \partial_z trK \\
&+ 1.0\ inv\_chi^2\ Atd\_xz\ \partial_x chi - 1.0\ inv\_chi^2\ gtd\_xz\ Atud\_xx\ \partial_x chi \\
&- 1.0\ inv\_chi^2\ gtd\_xz\ Atud\_yx\ \partial_y chi \\
&- 1.0\ inv\_chi^2\ gtd\_xz\ Atud\_zx\ \partial_z chi
\end{aligned}
\tag{628}
$$

Auxiliary analysis variable equation

$$
Del\_Kd\_zxy = Op(x,y,z,t) \tag{629}
$$

$$
\begin{aligned}
Op(x,y,z,t) = &+inv\_chi\ \partial_z Atd\_xy - inv\_chi\ (Atd\_xy\ Ct\_xxz + Atd\_xx\ Ct\_xyz \\
&+ Atd\_yy\ Ct\_yxz + Atd\_xy\ Ct\_yyz + Atd\_yz\ Ct\_zxz + Atd\_xz\ Ct\_zyz) \\
&+ .3333333333333333\ inv\_chi\ gtd\_xy\ \partial_z trK \\
&+ .5\ inv\_chi^2\ Atd\_yz\ \partial_x chi + .5\ inv\_chi^2\ Atd\_xz\ \partial_y chi \\
&- .5\ inv\_chi^2\ gtd\_xz\ Atud\_xy\ \partial_x chi \\
&- .5\ inv\_chi^2\ gtd\_xz\ Atud\_yy\ \partial_y chi \\
&- .5\ inv\_chi^2\ gtd\_xz\ Atud\_zy\ \partial_z chi \\
&- .5\ inv\_chi^2\ gtd\_yz\ Atud\_xx\ \partial_x chi \\
&- .5\ inv\_chi^2\ gtd\_yz\ Atud\_yx\ \partial_y chi \\
&- .5\ inv\_chi^2\ gtd\_yz\ Atud\_zx\ \partial_z chi
\end{aligned}
\tag{630}
$$

Auxiliary analysis variable equation

$$
Del\_Kd\_zxz = Op(x,y,z,t) \tag{631}
$$

$$
\begin{aligned}
Op(x,y,z,t) = &+inv\_chi\ \partial_z Atd\_xz - inv\_chi\ (Atd\_xz\ Ct\_xxz + Atd\_xx\ Ct\_xzz \\
&+ Atd\_yz\ Ct\_yxz + Atd\_xy\ Ct\_yzz + Atd\_zz\ Ct\_zxz + Atd\_xz\ Ct\_zzz) \\
&+ .3333333333333333\ inv\_chi\ gtd\_xz\ \partial_z trK \\
&+ .5\ inv\_chi^2\ Atd\_zz\ \partial_x chi + .5\ inv\_chi^2\ Atd\_xz\ \partial_z chi \\
&- .5\ inv\_chi^2\ gtd\_xz\ Atud\_xz\ \partial_x chi \\
&- .5\ inv\_chi^2\ gtd\_xz\ Atud\_yz\ \partial_y chi \\
&- .5\ inv\_chi^2\ gtd\_xz\ Atud\_zz\ \partial_z chi \\
&- .5\ inv\_chi^2\ gtd\_zz\ Atud\_xx\ \partial_x chi \\
&- .5\ inv\_chi^2\ gtd\_zz\ Atud\_yx\ \partial_y chi \\
&- .5\ inv\_chi^2\ gtd\_zz\ Atud\_zx\ \partial_z chi
\end{aligned}
\tag{632}
$$

Auxiliary analysis variable equation

$$
Del\_Kd\_xyy = Op(x,y,z,t) \tag{633}
$$

$$
\begin{aligned}
Op(x,y,z,t) = &+inv\_chi\ \partial_x Atd\_yy \\
&- inv\_chi\ \left(2\ Atd\_xy\ Ct\_xxy + 2\ Atd\_yy\ Ct\_yxy + 2\ Atd\_yz\ Ct\_zxy\right) \\
&+ .3333333333333333\ inv\_chi\ gtd\_yy\ \partial_x trK \\
&+ 1.0\ inv\_chi^2\ Atd\_xy\ \partial_y chi - 1.0\ inv\_chi^2\ gtd\_xy\ Atud\_xy\ \partial_x chi \\
&- 1.0\ inv\_chi^2\ gtd\_xy\ Atud\_yy\ \partial_y chi \\
&- 1.0\ inv\_chi^2\ gtd\_xy\ Atud\_zy\ \partial_z chi
\end{aligned}
\tag{634}
$$

Auxiliary analysis variable equation

$$
Del\_Kd\_xyz = Op(x,y,z,t) \tag{635}
$$

$$
\begin{aligned}
Op(x,y,z,t) = &+inv\_chi\ \partial_x Atd\_yz - inv\_chi\ \left(Atd\_xz\ Ct\_xxy + Atd\_xy\ Ct\_xxz\right. \\
&\left.+Atd\_yz\ Ct\_yxy+Atd\_yy\ Ct\_yxz+Atd\_zz\ Ct\_zxy+Atd\_yz\ Ct\_zxz\right) \\
&+ .3333333333333333\ inv\_chi\ gtd\_yz\ \partial_x trK \\
&+ .5\ inv\_chi^2\ Atd\_xz\ \partial_y chi + .5\ inv\_chi^2\ Atd\_xy\ \partial_z chi \\
&- .5\ inv\_chi^2\ gtd\_xy\ Atud\_xz\ \partial_x chi \\
&- .5\ inv\_chi^2\ gtd\_xy\ Atud\_yz\ \partial_y chi \\
&- .5\ inv\_chi^2\ gtd\_xy\ Atud\_zz\ \partial_z chi \\
&- .5\ inv\_chi^2\ gtd\_xz\ Atud\_xy\ \partial_x chi \\
&- .5\ inv\_chi^2\ gtd\_xz\ Atud\_yy\ \partial_y chi \\
&- .5\ inv\_chi^2\ gtd\_xz\ Atud\_zy\ \partial_z chi
\end{aligned}
\tag{636}
$$

Auxiliary analysis variable equation

$$
Del\_Kd\_yyy = Op(x,y,z,t) \tag{637}
$$

$$
\begin{aligned}
Op(x,y,z,t) = &+inv\_chi\ \partial_y Atd\_yy \\
&- inv\_chi\ \left(2\ Atd\_xy\ Ct\_xyy + 2\ Atd\_yy\ Ct\_yyy + 2\ Atd\_yz\ Ct\_zyy\right) \\
&+ .3333333333333333\ inv\_chi\ gtd\_yy\ \partial_y trK \\
&+ 1.0\ inv\_chi^2\ Atd\_yy\ \partial_y chi - 1.0\ inv\_chi^2\ gtd\_yy\ Atud\_xy\ \partial_x chi \\
&- 1.0\ inv\_chi^2\ gtd\_yy\ Atud\_yy\ \partial_y chi \\
&- 1.0\ inv\_chi^2\ gtd\_yy\ Atud\_zy\ \partial_z chi
\end{aligned}
\tag{638}
$$

Auxiliary analysis variable equation

$$Del\_Kd\_yyz = Op(x, y, z, t) \tag{639}$$

$$\begin{aligned} Op(x, y, z, t) = &+inv\_chi\ \partial_y Atd\_yz - inv\_chi\ (Atd\_xz\ Ct\_xyy + Atd\_xy\ Ct\_xyz \\ &+ Atd\_yz\ Ct\_yyy + Atd\_yy\ Ct\_yyz + Atd\_zz\ Ct\_zyy + Atd\_yz\ Ct\_zyz) \\ &+ .3333333333333333\ inv\_chi\ gtd\_yz\ \partial_y trK \\ &+ .5\ inv\_chi^2\ Atd\_yz\ \partial_y chi + .5\ inv\_chi^2\ Atd\_yy\ \partial_z chi \\ &- .5\ inv\_chi^2\ gtd\_yy\ Atud\_xz\ \partial_x chi \\ &- .5\ inv\_chi^2\ gtd\_yy\ Atud\_yz\ \partial_y chi \\ &- .5\ inv\_chi^2\ gtd\_yy\ Atud\_zz\ \partial_z chi \\ &- .5\ inv\_chi^2\ gtd\_yz\ Atud\_xy\ \partial_x chi \\ &- .5\ inv\_chi^2\ gtd\_yz\ Atud\_yy\ \partial_y chi \\ &- .5\ inv\_chi^2\ gtd\_yz\ Atud\_zy\ \partial_z chi \end{aligned} \tag{640}$$

Auxiliary analysis variable equation

$$Del\_Kd\_zyy = Op(x, y, z, t) \tag{641}$$

$$\begin{aligned} Op(x, y, z, t) = &+inv\_chi\ \partial_z Atd\_yy \\ &- inv\_chi\ (2\ Atd\_xy\ Ct\_xyz + 2\ Atd\_yy\ Ct\_yyz + 2\ Atd\_yz\ Ct\_zyz) \\ &+ .3333333333333333\ inv\_chi\ gtd\_yy\ \partial_z trK \\ &+ 1.0\ inv\_chi^2\ Atd\_yz\ \partial_y chi - 1.0\ inv\_chi^2\ gtd\_yz\ Atud\_xy\ \partial_x chi \\ &- 1.0\ inv\_chi^2\ gtd\_yz\ Atud\_yy\ \partial_y chi \\ &- 1.0\ inv\_chi^2\ gtd\_yz\ Atud\_zy\ \partial_z chi \end{aligned} \tag{642}$$

Auxiliary analysis variable equation

$$Del\_Kd\_zyz = Op(x, y, z, t) \tag{643}$$

$$
\begin{aligned}
Op(x,y,z,t) = &+inv\_chi\ \partial_z Atd\_yz - inv\_chi\ (Atd\_xz\ Ct\_xyz + Atd\_xy\ Ct\_xzz \\
&+ Atd\_yz\ Ct\_yyz + Atd\_yy\ Ct\_yzz + Atd\_zz\ Ct\_zyz + Atd\_yz\ Ct\_zzz) \\
&+ .3333333333333333\ inv\_chi\ gtd\_yz\ \partial_z trK \\
&+ .5\ inv\_chi^2\ Atd\_zz\ \partial_y chi + .5\ inv\_chi^2\ Atd\_yz\ \partial_z chi \\
&- .5\ inv\_chi^2\ gtd\_yz\ Atud\_xz\ \partial_x chi \\
&- .5\ inv\_chi^2\ gtd\_yz\ Atud\_yz\ \partial_y chi \\
&- .5\ inv\_chi^2\ gtd\_yz\ Atud\_zz\ \partial_z chi \\
&- .5\ inv\_chi^2\ gtd\_zz\ Atud\_xy\ \partial_x chi \\
&- .5\ inv\_chi^2\ gtd\_zz\ Atud\_yy\ \partial_y chi \\
&- .5\ inv\_chi^2\ gtd\_zz\ Atud\_zy\ \partial_z chi
\end{aligned}
\tag{644}
$$

Auxiliary analysis variable equation

$$
Del\_Kd\_xzz = Op(x,y,z,t) \tag{645}
$$

$$
\begin{aligned}
Op(x,y,z,t) = &+inv\_chi\ \partial_x Atd\_zz \\
&- inv\_chi\ (2\ Atd\_xz\ Ct\_xxz + 2\ Atd\_yz\ Ct\_yxz + 2\ Atd\_zz\ Ct\_zxz) \\
&+ .3333333333333333\ inv\_chi\ gtd\_zz\ \partial_x trK \\
&+ 1.0\ inv\_chi^2\ Atd\_xz\ \partial_z chi - 1.0\ inv\_chi^2\ gtd\_xz\ Atud\_xz\ \partial_x chi \\
&- 1.0\ inv\_chi^2\ gtd\_xz\ Atud\_yz\ \partial_y chi \\
&- 1.0\ inv\_chi^2\ gtd\_xz\ Atud\_zz\ \partial_z chi
\end{aligned}
\tag{646}
$$

Auxiliary analysis variable equation

$$
Del\_Kd\_yzz = Op(x,y,z,t) \tag{647}
$$

$$
\begin{aligned}
Op(x,y,z,t) = &+inv\_chi\ \partial_y Atd\_zz \\
&- inv\_chi\ (2\ Atd\_xz\ Ct\_xyz + 2\ Atd\_yz\ Ct\_yyz + 2\ Atd\_zz\ Ct\_zyz) \\
&+ .3333333333333333\ inv\_chi\ gtd\_zz\ \partial_y trK \\
&+ 1.0\ inv\_chi^2\ Atd\_yz\ \partial_z chi - 1.0\ inv\_chi^2\ gtd\_yz\ Atud\_xz\ \partial_x chi \\
&- 1.0\ inv\_chi^2\ gtd\_yz\ Atud\_yz\ \partial_y chi \\
&- 1.0\ inv\_chi^2\ gtd\_yz\ Atud\_zz\ \partial_z chi
\end{aligned}
\tag{648}
$$

Auxiliary analysis variable equation

$$Del\_Kd\_zzz = Op(x,y,z,t) \tag{649}$$

$$\begin{aligned} Op(x,y,z,t) = &+inv\_chi\ \partial_z Atd\_zz \\ &- inv\_chi\ \left(2\ Atd\_xz\ Ct\_xzz + 2\ Atd\_yz\ Ct\_yzz + 2\ Atd\_zz\ Ct\_zzz\right) \\ &+ .3333333333333333\ inv\_chi\ gtd\_zz\ \partial_z trK \\ &+ 1.0\ inv\_chi^2\ Atd\_zz\ \partial_z chi - 1.0\ inv\_chi^2\ gtd\_zz\ Atud\_xz\ \partial_x chi \\ &- 1.0\ inv\_chi^2\ gtd\_zz\ Atud\_yz\ \partial_y chi \\ &- 1.0\ inv\_chi^2\ gtd\_zz\ Atud\_zz\ \partial_z chi \end{aligned} \tag{650}$$

Auxiliary analysis variable equation

$$BWeyl\_xx = Op(x,y,z,t) \tag{651}$$

$$\begin{aligned} Op(x,y,z,t) = &+\left(-gtd\_xz\ inv\_chi^{2.5}\ Del\_Kd\_yxx\right) + gtd\_xy\ inv\_chi^{2.5}\ Del\_Kd\_zxx \\ &+ gtd\_xz\ inv\_chi^{2.5}\ Del\_Kd\_xxy + \left(-gtd\_xx\ inv\_chi^{2.5}\ Del\_Kd\_zxy\right) \\ &+ \left(-gtd\_xy\ inv\_chi^{2.5}\ Del\_Kd\_xxz\right) + gtd\_xx\ inv\_chi^{2.5}\ Del\_Kd\_yxz \end{aligned} \tag{652}$$

Auxiliary analysis variable equation

$$BWeyl\_xy = Op(x,y,z,t) \tag{653}$$

$$\begin{aligned} Op(x,y,z,t) = &+\left(-gtd\_xz\ inv\_chi^{2.5}\ Del\_Kd\_yxy\right) + gtd\_xy\ inv\_chi^{2.5}\ Del\_Kd\_zxy \\ &+ gtd\_xz\ inv\_chi^{2.5}\ Del\_Kd\_xyy + \left(-gtd\_xx\ inv\_chi^{2.5}\ Del\_Kd\_zyy\right) \\ &+ \left(-gtd\_xy\ inv\_chi^{2.5}\ Del\_Kd\_xyz\right) + gtd\_xx\ inv\_chi^{2.5}\ Del\_Kd\_yyz \end{aligned} \tag{654}$$

Auxiliary analysis variable equation

$$BWeyl\_xz = Op(x,y,z,t) \tag{655}$$

$$Op(x,y,z,t) = +(-gtd\_xz\ inv\_chi^{2.5}\ Del\_Kd\_yxz) + gtd\_xy\ inv\_chi^{2.5}\ Del\_Kd\_zxz + gtd\_xz\ inv\_chi^{2.5}\ Del\_Kd\_xyz + (-gtd\_xx\ inv\_chi^{2.5}\ Del\_Kd\_zyz) + (-gtd\_xy\ inv\_chi^{2.5}\ Del\_Kd\_xzz) + gtd\_xx\ inv\_chi^{2.5}\ Del\_Kd\_yzz \tag{656}$$

Auxiliary analysis variable equation

$$BWeyl\_yx = Op(x,y,z,t) \tag{657}$$

$$Op(x,y,z,t) = +(-gtd\_yz\ inv\_chi^{2.5}\ Del\_Kd\_yxx) + gtd\_yy\ inv\_chi^{2.5}\ Del\_Kd\_zxx + gtd\_yz\ inv\_chi^{2.5}\ Del\_Kd\_xxy + (-gtd\_xy\ inv\_chi^{2.5}\ Del\_Kd\_zxy) + (-gtd\_yy\ inv\_chi^{2.5}\ Del\_Kd\_xxz) + gtd\_xy\ inv\_chi^{2.5}\ Del\_Kd\_yxz \tag{658}$$

Auxiliary analysis variable equation

$$BWeyl\_yy = Op(x,y,z,t) \tag{659}$$

$$Op(x,y,z,t) = +(-gtd\_yz\ inv\_chi^{2.5}\ Del\_Kd\_yxy) + gtd\_yy\ inv\_chi^{2.5}\ Del\_Kd\_zxy + gtd\_yz\ inv\_chi^{2.5}\ Del\_Kd\_xyy + (-gtd\_xy\ inv\_chi^{2.5}\ Del\_Kd\_zyy) + (-gtd\_yy\ inv\_chi^{2.5}\ Del\_Kd\_xyz) + gtd\_xy\ inv\_chi^{2.5}\ Del\_Kd\_yyz \tag{660}$$

Auxiliary analysis variable equation

$$BWeyl\_yz = Op(x,y,z,t) \tag{661}$$

$$Op(x,y,z,t) = +(-gtd\_yz\ inv\_chi^{2.5}\ Del\_Kd\_yxz) + gtd\_yy\ inv\_chi^{2.5}\ Del\_Kd\_zxz + gtd\_yz\ inv\_chi^{2.5}\ Del\_Kd\_xyz + (-gtd\_xy\ inv\_chi^{2.5}\ Del\_Kd\_zyz) + (-gtd\_yy\ inv\_chi^{2.5}\ Del\_Kd\_xzz) + gtd\_xy\ inv\_chi^{2.5}\ Del\_Kd\_yzz \tag{662}$$

Auxiliary analysis variable equation

$$BWeyl\_zx = Op(x, y, z, t) \tag{663}$$

$$\begin{aligned} Op(x, y, z, t) = &+ (-gtd\_zz\ inv\_chi^{2.5}\ Del\_Kd\_yxx) + gtd\_yz\ inv\_chi^{2.5}\ Del\_Kd\_zxx \\ &+ gtd\_zz\ inv\_chi^{2.5}\ Del\_Kd\_xxy + (-gtd\_xz\ inv\_chi^{2.5}\ Del\_Kd\_zxy) \\ &+ (-gtd\_yz\ inv\_chi^{2.5}\ Del\_Kd\_xxz) + gtd\_xz\ inv\_chi^{2.5}\ Del\_Kd\_yxz \end{aligned} \tag{664}$$

Auxiliary analysis variable equation

$$BWeyl\_zy = Op(x, y, z, t) \tag{665}$$

$$\begin{aligned} Op(x, y, z, t) = &+ (-gtd\_zz\ inv\_chi^{2.5}\ Del\_Kd\_yxy) + gtd\_yz\ inv\_chi^{2.5}\ Del\_Kd\_zxy \\ &+ gtd\_zz\ inv\_chi^{2.5}\ Del\_Kd\_xyy + (-gtd\_xz\ inv\_chi^{2.5}\ Del\_Kd\_zyy) \\ &+ (-gtd\_yz\ inv\_chi^{2.5}\ Del\_Kd\_xyz) + gtd\_xz\ inv\_chi^{2.5}\ Del\_Kd\_yyz \end{aligned} \tag{666}$$

Auxiliary analysis variable equation

$$BWeyl\_zz = Op(x, y, z, t) \tag{667}$$

$$\begin{aligned} Op(x, y, z, t) = &+ (-gtd\_zz\ inv\_chi^{2.5}\ Del\_Kd\_yxz) + gtd\_yz\ inv\_chi^{2.5}\ Del\_Kd\_zxz \\ &+ gtd\_zz\ inv\_chi^{2.5}\ Del\_Kd\_xyz + (-gtd\_xz\ inv\_chi^{2.5}\ Del\_Kd\_zyz) \\ &+ (-gtd\_yz\ inv\_chi^{2.5}\ Del\_Kd\_xzz) + gtd\_xz\ inv\_chi^{2.5}\ Del\_Kd\_yzz \end{aligned} \tag{668}$$

Auxiliary analysis variable equation

$$mmR\_xx = Op(x, y, z, t) \tag{669}$$

$$Op(x, y, z, t) = + (-.5\ vph\_x^2) + .5\ vth\_x^2 \tag{670}$$

Auxiliary analysis variable equation

$$mmR\_xy = Op(x, y, z, t) \tag{671}$$

$$Op(x, y, z, t) = +(-.5\ vph\_x\ vph\_y) + .5\ vth\_x\ vth\_y \tag{672}$$

Auxiliary analysis variable equation

$$mmR\_xz = Op(x, y, z, t) \tag{673}$$

$$Op(x, y, z, t) = +(-.5\ vph\_x\ vph\_z) + .5\ vth\_x\ vth\_z \tag{674}$$

Auxiliary analysis variable equation

$$mmR\_yy = Op(x, y, z, t) \tag{675}$$

$$Op(x, y, z, t) = +(-.5\ vph\_y^2) + .5\ vth\_y^2 \tag{676}$$

Auxiliary analysis variable equation

$$mmR\_yz = Op(x, y, z, t) \tag{677}$$

$$Op(x, y, z, t) = +(-.5\ vph\_y\ vph\_z) + .5\ vth\_y\ vth\_z \tag{678}$$

Auxiliary analysis variable equation

$$mmR\_zz = Op(x, y, z, t) \tag{679}$$

$$Op(x, y, z, t) = +(-0.5\ vph\_z^2) + 0.5\ vth\_z^2 \tag{680}$$

Auxiliary analysis variable equation

$$mmI\_xx = Op(x, y, z, t) \tag{681}$$

$$Op(x, y, z, t) = -1.0\ vph\_x\ vth\_x \tag{682}$$

Auxiliary analysis variable equation

$$mmI\_xy = Op(x, y, z, t) \tag{683}$$

$$Op(x, y, z, t) = +(-.5\ vph\_x\ vth\_y) + (-.5\ vph\_y\ vth\_x) \tag{684}$$

Auxiliary analysis variable equation

$$mmI\_xz = Op(x, y, z, t) \tag{685}$$

$$Op(x, y, z, t) = +(-.5\ vph\_x\ vth\_z) + (-.5\ vph\_z\ vth\_x) \tag{686}$$

Auxiliary analysis variable equation

$$mmI\_yy = Op(x, y, z, t) \tag{687}$$

$$Op(x, y, z, t) = -1.0\ vph\_y\ vth\_y \tag{688}$$

Auxiliary analysis variable equation

$$mmI\_yz = Op(x, y, z, t) \tag{689}$$

$$Op(x, y, z, t) = +(-.5\ vph\_y\ vth\_z) + (-.5\ vph\_z\ vth\_y) \tag{690}$$

Auxiliary analysis variable equation

$$mmI\_zz = Op(x, y, z, t) \tag{691}$$

$$Op(x, y, z, t) = -1.0\ vph\_z\ vth\_z \tag{692}$$

Boundary conditions

Segments: main

Type: extrapolation
Axis: All
Side: All

Fields: gtd_xx, gtd_xy, gtd_xz, gtd_yy, gtd_yz, gtd_zz, Atd_xx, Atd_xy, Atd_xz, Atd_yy, Atd_yz, Atd_zz, $Gamh\_x$, $Gamh\_y$, $Gamh\_z$, $Betau\_x$, $Betau\_y$, $Betau\_z$, $Alpha$, chi, trK, $theta$, $phiR$, $pheR$, $phiI$, $pheI$, piR, peR, piI, peI, $phi2$

Boundary precedences

1. x-Lower
2. x-Upper
3. y-Lower
4. y-Upper
5. z-Lower
6. z-Upper

Finalization Conditions

The condition is:

$$t \geq tend \tag{693}$$