Eq 50: $$\begin{Bmatrix} 0 \\ 22 \end{Bmatrix} = -y_0 \gamma \sin^2(y_1)$$

Eq 51: $$\begin{Bmatrix} 0 \\ 33 \end{Bmatrix} = \frac{c^2 r_g \gamma}{2(y_0)^2}$$

Eq 52: $$\begin{Bmatrix} 1 \\ 01 \end{Bmatrix} = \frac{1}{y_0}$$

Eq 53: $$\begin{Bmatrix} 1 \\ 22 \end{Bmatrix} = -\sin(y_1)\cos(y_1)$$

Eq 54: $$\begin{Bmatrix} 2 \\ 02 \end{Bmatrix} = \frac{1}{y_0}$$

Eq 55: $$\begin{Bmatrix} 2 \\ 12 \end{Bmatrix} = \cot(y_1)$$

Eq 56: $$\begin{Bmatrix} 3 \\ 03 \end{Bmatrix} = \frac{r_g}{2\gamma(y_0)^2}$$

The functions f_4 through f_7 are given by the following equations:

Eq 57: $$f_4 = -\begin{Bmatrix} 0 \\ 00 \end{Bmatrix}(y_4)^2 - \begin{Bmatrix} 0 \\ 11 \end{Bmatrix}(y_5)^2 - \begin{Bmatrix} 0 \\ 22 \end{Bmatrix}(y_6)^2 - \begin{Bmatrix} 0 \\ 33 \end{Bmatrix}(y_7)^2$$

Eq 58: $$f_5 = -2\begin{Bmatrix} 1 \\ 01 \end{Bmatrix} y_4 y_5 - \begin{Bmatrix} 1 \\ 22 \end{Bmatrix}(y_6)^2$$

Eq 59: $$f_6 = -2\begin{Bmatrix} 2 \\ 02 \end{Bmatrix} y_4 y_6 - 2\begin{Bmatrix} 2 \\ 12 \end{Bmatrix} y_5 y_6$$

Eq 60: $$f_7 = -2\begin{Bmatrix} 3 \\ 03 \end{Bmatrix} y_4 y_7$$

The initial conditions are taken from the Newtonian problem as shown in Eq 29. Eq 46 will be used to obtain the initial values for the derivatives of the coordinates with respect to the arc length parameter, s. Thus:

Eq 61: $$\left(\frac{ds}{dt}\right)^2 = -\gamma^{-1}\left(\frac{dr}{dt}\right)^2 - r^2\left(\frac{d\theta}{dt}\right)^2 - r^2 \sin^2\theta\left(\frac{d\varphi}{dt}\right)^2 + c^2\gamma$$