

$$\underbrace{\text{d} \begin{bmatrix} \text{ss_level} \\ \text{ss_velocity} \end{bmatrix}}_{\text{d}\boldsymbol{\eta}(t)}(t) = \left(\underbrace{\begin{bmatrix} 0 & 1 \\ \text{a21} & \text{a22} \end{bmatrix}}_{\substack{\mathbf{A} \\ \text{DRIFT}}} \underbrace{\begin{bmatrix} \text{ss_level} \\ \text{ss_velocity} \end{bmatrix}}_{\boldsymbol{\eta}(t)}(t) + \underbrace{\begin{bmatrix} 0 \\ 0 \end{bmatrix}}_{\substack{\mathbf{b} \\ \text{CINT}}} \right) \text{d}t \quad +$$

$$\underbrace{\text{cholsdcor}\left(\begin{bmatrix} 0 & 0 \\ 0 & \text{diffusion} \end{bmatrix}\right)}_{\substack{\mathbf{G} \\ \text{DIFFUSION}}} \underbrace{\text{d} \begin{bmatrix} W_1 \\ W_2 \end{bmatrix}}_{\text{d}\mathbf{W}(t)}(t)$$

$$\underbrace{\begin{bmatrix} W_1 \\ W_2 \end{bmatrix}}_{\mathbf{W}(t+u)}(t+u) - \underbrace{\begin{bmatrix} W_1 \\ W_2 \end{bmatrix}}_{\mathbf{W}(t)}(t) \sim \text{N}\left(\begin{bmatrix} 0 \\ 0 \end{bmatrix}, \begin{bmatrix} \text{u-t} & 0 \\ 0 & \text{u-t} \end{bmatrix}\right)$$

$$\underbrace{[\text{sunspots}]}_{\mathbf{Y}(t)}(t) = \underbrace{\begin{bmatrix} 1 & 0 \end{bmatrix}}_{\substack{\mathbf{\Lambda} \\ \text{LAMBDA}}} \underbrace{\begin{bmatrix} \text{ss_level} \\ \text{ss_velocity} \end{bmatrix}}_{\boldsymbol{\eta}(t)}(t) + \underbrace{\begin{bmatrix} \text{m1} \end{bmatrix}}_{\substack{\boldsymbol{\tau} \\ \text{MANIFESTMEANS}}} + \underbrace{\begin{bmatrix} 0 \end{bmatrix}}_{\substack{\boldsymbol{\Theta} \\ \text{MANIFESTVAR}}} \underbrace{[\epsilon_1]}_{\boldsymbol{\epsilon}(t)}(t)$$

$$\underbrace{[\epsilon_1]}_{\boldsymbol{\epsilon}(t)}(t) \sim \text{N}\left(\begin{bmatrix} 0 \end{bmatrix}, \begin{bmatrix} 1 \end{bmatrix}\right)$$

cholsdcor = Function converting lower tri matrix of std dev and unconstrained correlation to Cholesky factor.

See Driver & Voelkle (2018) p11.