Crosskey2017

Slow manifold of your dynamical system

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xrhs:={4/2*x(1)*(y(1)-x(1)^2)*(1+2*y(1)*small+2*x(1)^2*small)+w(1)};
yrhs:={-(y(1)-x(1)^2)*(1+4*x(1)^2*small)+w(2)};
zrhs:={ };
```

The specified dynamical system

$$\dot{x}_1 = \sigma w_1 - 4x_1^5\varepsilon^2 - 2x_1^3\varepsilon + 4x_1y_1^2\varepsilon^2 + 2x_1y_1\varepsilon$$

$$\dot{y}_1 = \sigma w_2 + 4x_1^4\varepsilon^2 - 4x_1^2y_1\varepsilon^2 + x_1^2\varepsilon - y_1$$

The stochastic slow manifold

$$y_1 = \sigma\Big(- 8e^{-1t}\star e^{-1t}\star w_2\ X_1^2 - 4e^{-1t}\star e^{-1t}\star w_1\ X_1^3 - 4e^{-1t}\star w_2\, X_1^2 + e^{-1t}\star w_2\ - 32e^{-1t}\star w_1 X_1^3 - 2e^{-1t}\star w_1\, X_1\Big) + 8X_1^4 + X_1^2$$

$$x_1 = \sigma\Big(- 8e^{-1t}\star w_2\ X_1^3 - 2e^{-1t}\star w_2\, X_1 + 4e^{-1t}\star w_1\, X_1^2\Big) + X_1$$

Slow manifold SDEs

$$\dot{X}_1 = \sigma^2\Big(- 16e^{-1t}\star e^{-1t}\star w_2\ w_1X_1^2 - 8e^{-1t}\star e^{-1t}\star w_1\ w_1X_1^3 + 24e^{-1t}\star w_2\ w_2X_1^2 + 4e^{-1t}\star w_2\, w_2X_1 + 160e^{-1t}\star w_2\ w_1X_1^4 + 24e^{-1t}\star w_2\, w_1X_1^2 + 2e^{-1t}\star w_2\, w_1 - 8e^{-1t}\star w_1\, w_2X_1^2 -$$

$$112e^{-1t}\star w_1\, w_1 X_1^3 - 4e^{-1t}\star w_1\, w_1 X_1\Big) + \sigma\Big(32w_2 X_1^5 - 8w_2 X_1^3 + 2w_2 X_1 - 80w_1 X_1^4 - 4w_1 X_1^2 + w_1\Big) + 12X_1^5$$