

A slow manifold of your dynamical system

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Generally, the lowest order, most important, terms are near the end of each expression.

off echo;

Specified dynamical system

$$\dot{u}_1 = \sigma w_1 - \varepsilon u_1^2 + u_2 - u_1$$

$$\dot{u}_2 = -\sigma w_1 + \varepsilon u_2^2 - u_2 + u_1$$

off echo;

Time dependent slow manifold parametrisation

$$u_1 = \sigma \varepsilon e^{-2t} \star (w_1) s_1 + \sigma e^{-2t} \star (w_1) - 1/2 \varepsilon s_1^2 + O(\varepsilon^2, \sigma^2) + s_1$$

$$u_2 = \sigma \varepsilon e^{-2t} \star (w_1) s_1 - \sigma e^{-2t} \star (w_1) + 1/2 \varepsilon s_1^2 + O(\varepsilon^2, \sigma^2) + s_1$$

Result slow manifold DEs

$$\dot{s}_1 = 1/2 \sigma^2 \varepsilon^2 e^{-2t} \star (w_1) s_1 w_1 - \sigma \varepsilon s_1 w_1 + \varepsilon^2 s_1^3 + O(\varepsilon^3, \sigma^3)$$