

# Design of decentralized adaptive control approach for large-scale nonlinear systems subjected to input delays under prescribed performance

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## Research Article

**Keywords:** Adaptive control, Decentralized, Large-scale nonlinear systems, Input delays, Prescribed

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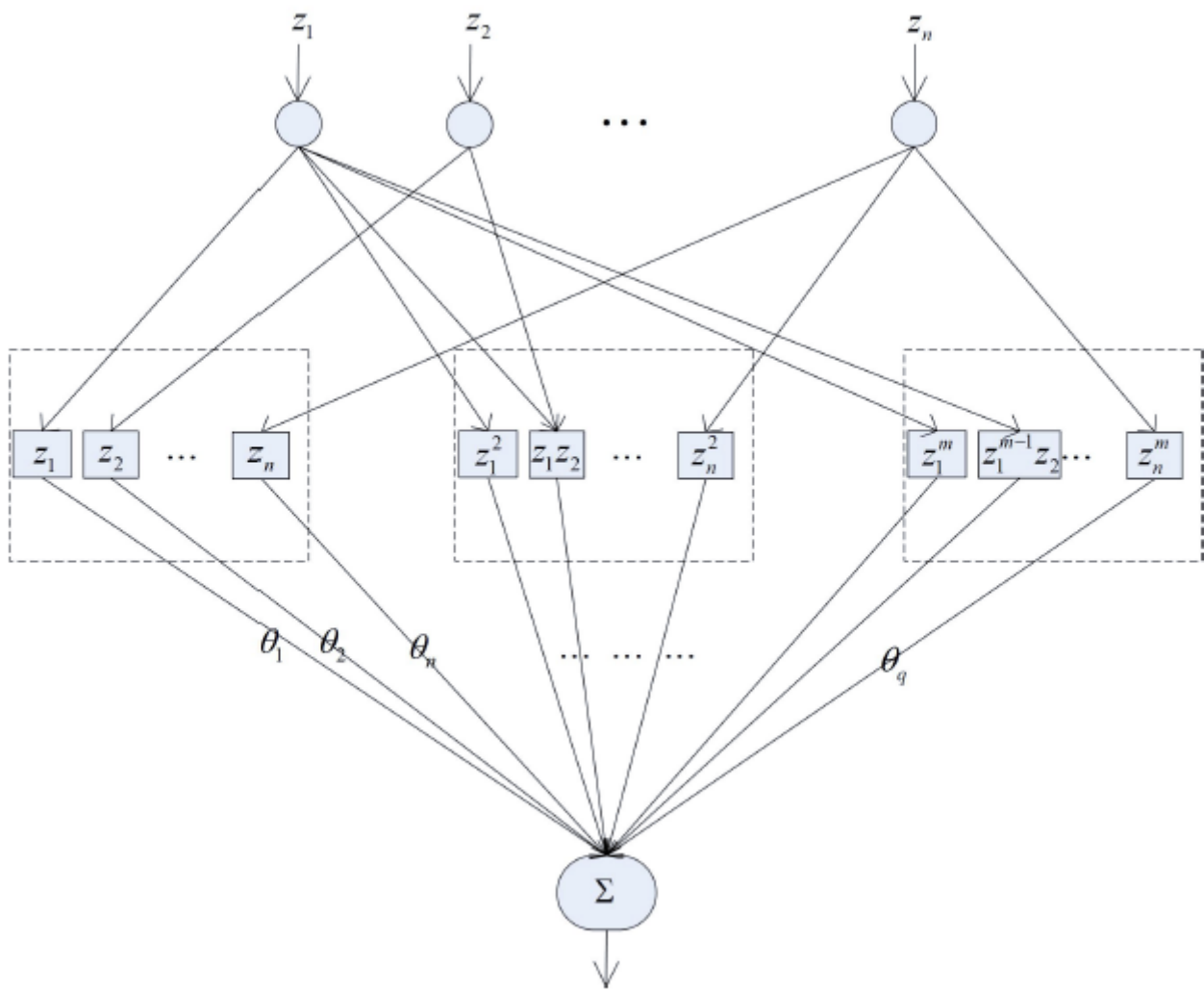
# Abstract

For the first time, the issue of input delays and prescribed performance control is investigated in the same framework for large-scale nonlinear systems in this study, and a original adaptive decentralized control method is proposed take advantage of multi-dimensional Taylor network (MTN) method. Firstly, the problem of input delays is solved by introducing new variables, and a new form of coordinate transformation is introduced before controller design, which simplified the control system. Secondly, the problem of prescribed performance control is coped with by integrating the idea of prescribed performance into the Lyapunov functions of first step of backstepping of each subsystem. Thirdly, MTNs are employed to evaluate the combination of unknown functions, and then a decentralized MTN-based adaptive control scheme is developed by way of backstepping technology. The theoretical analysis indicates that the proposed control scheme can implement the expected tracking goals under the condition of meeting the prescribed performance control. Finally, one numerical example is given to show the validity and rationality of the proposed control method.

# Full Text

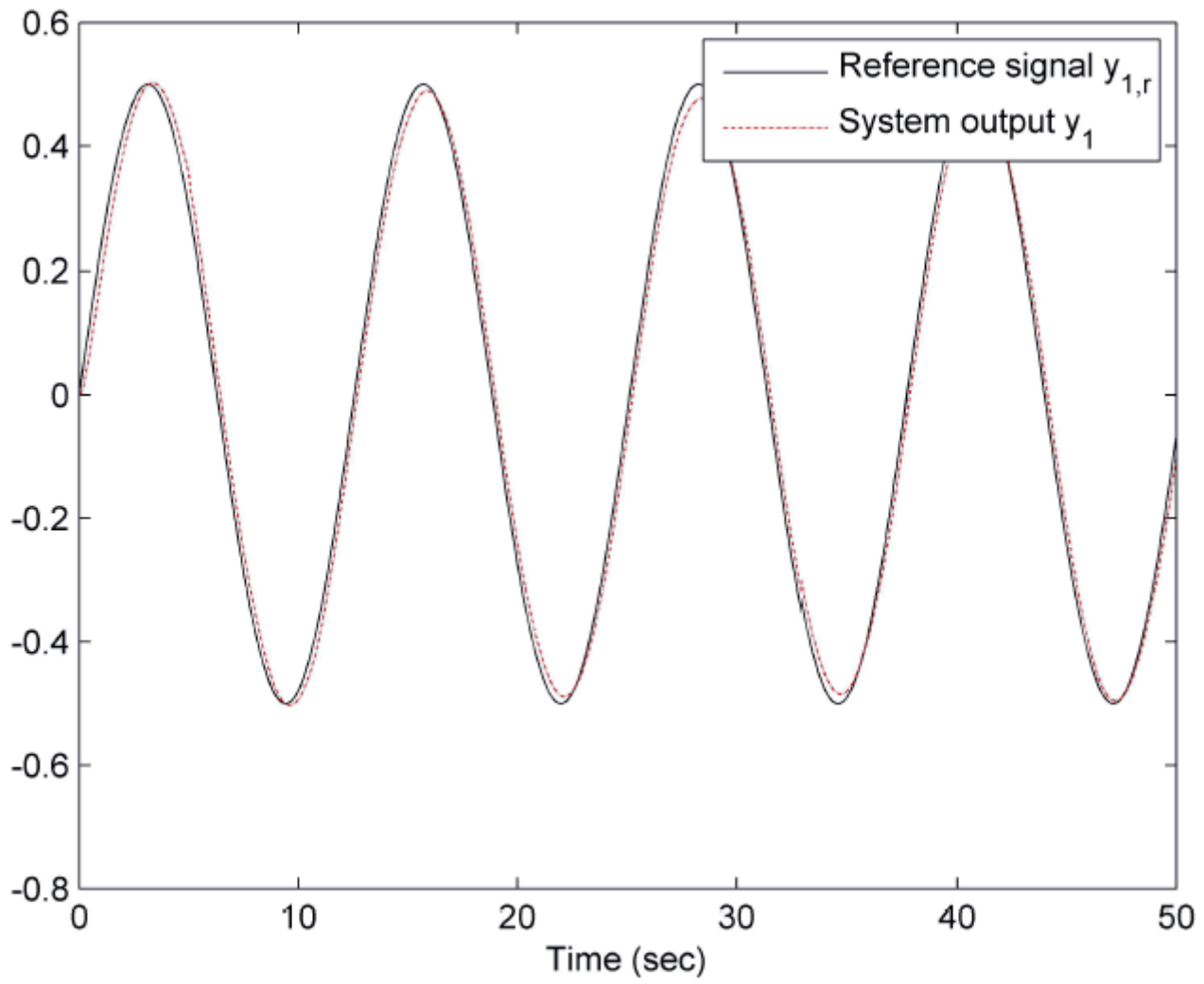
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# Figures



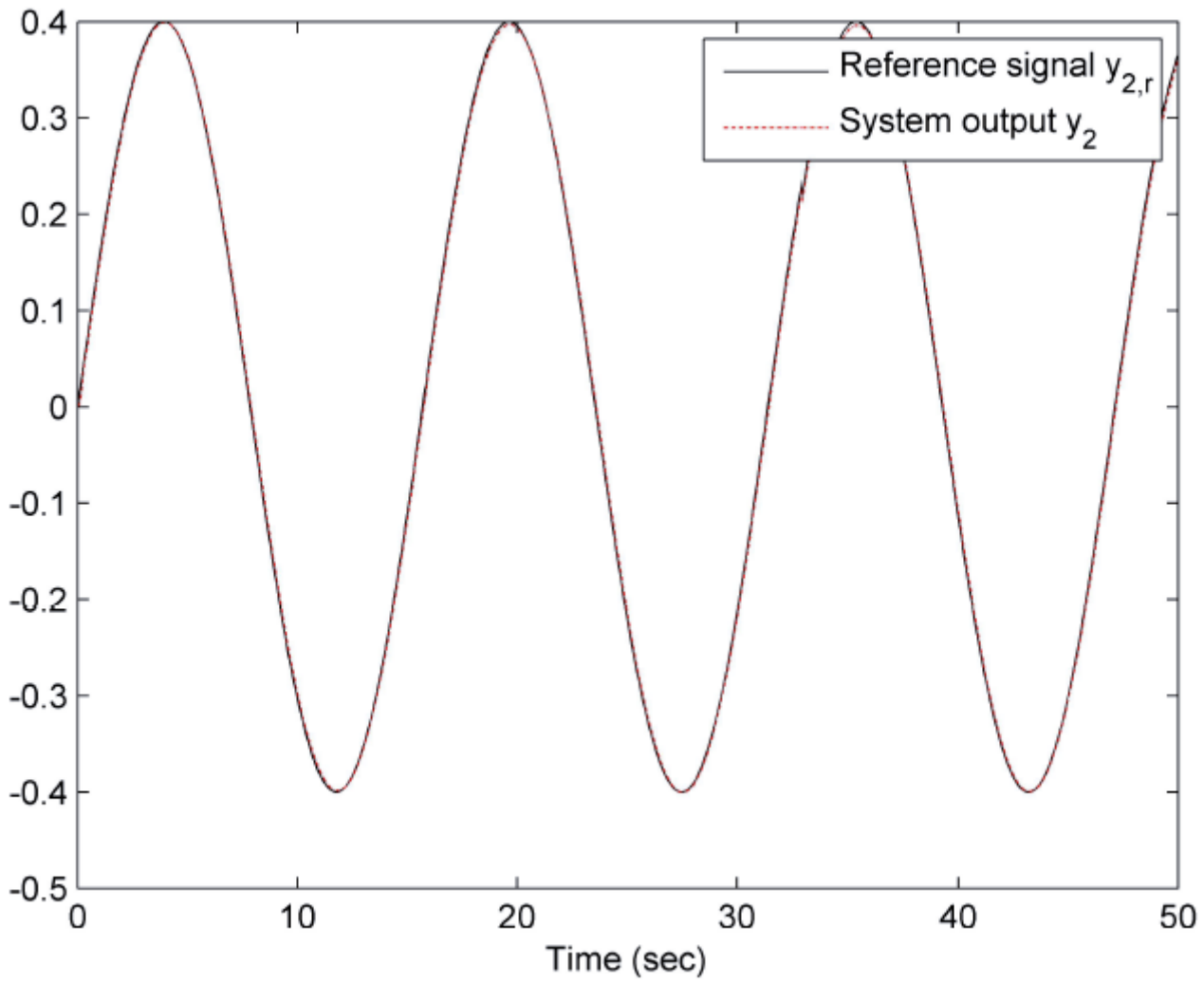
**Figure 1**

The structure diagram of three layer MTN.



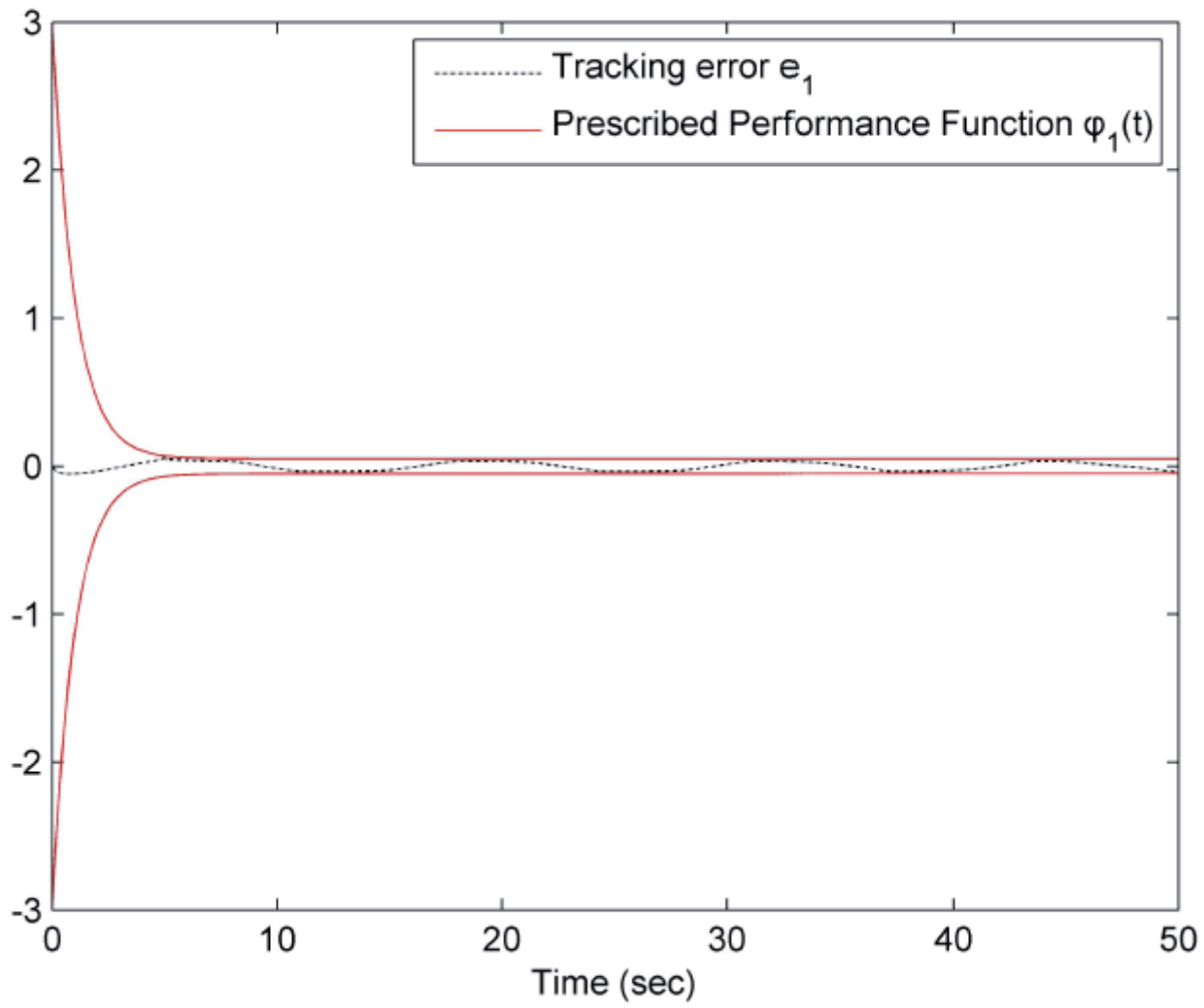
**Figure 2**

The responses of  $y_1$  and  $y_{1,r}$ .



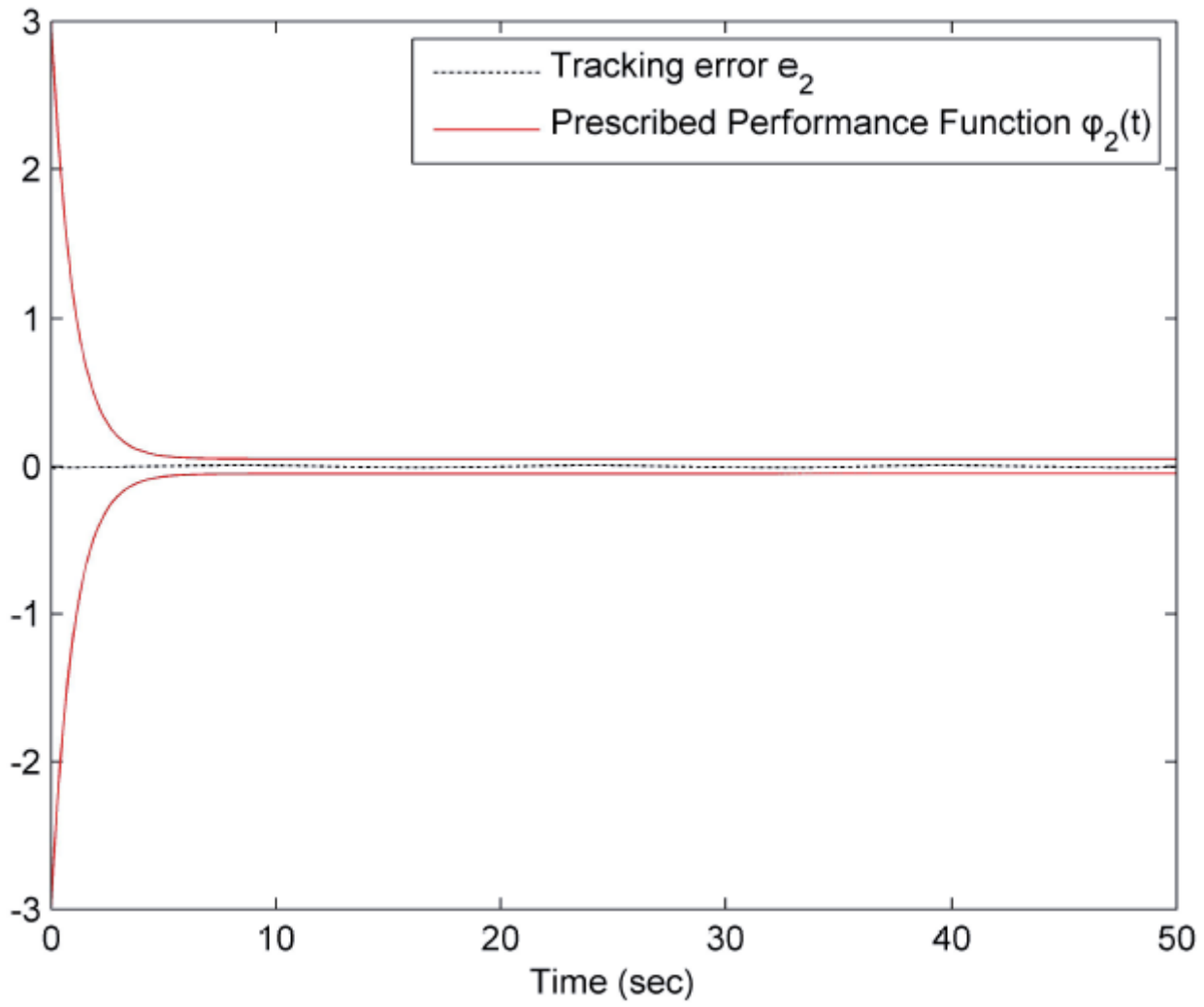
**Figure 3**

The responses of  $y_2$  and  $y_{2,r}$ .



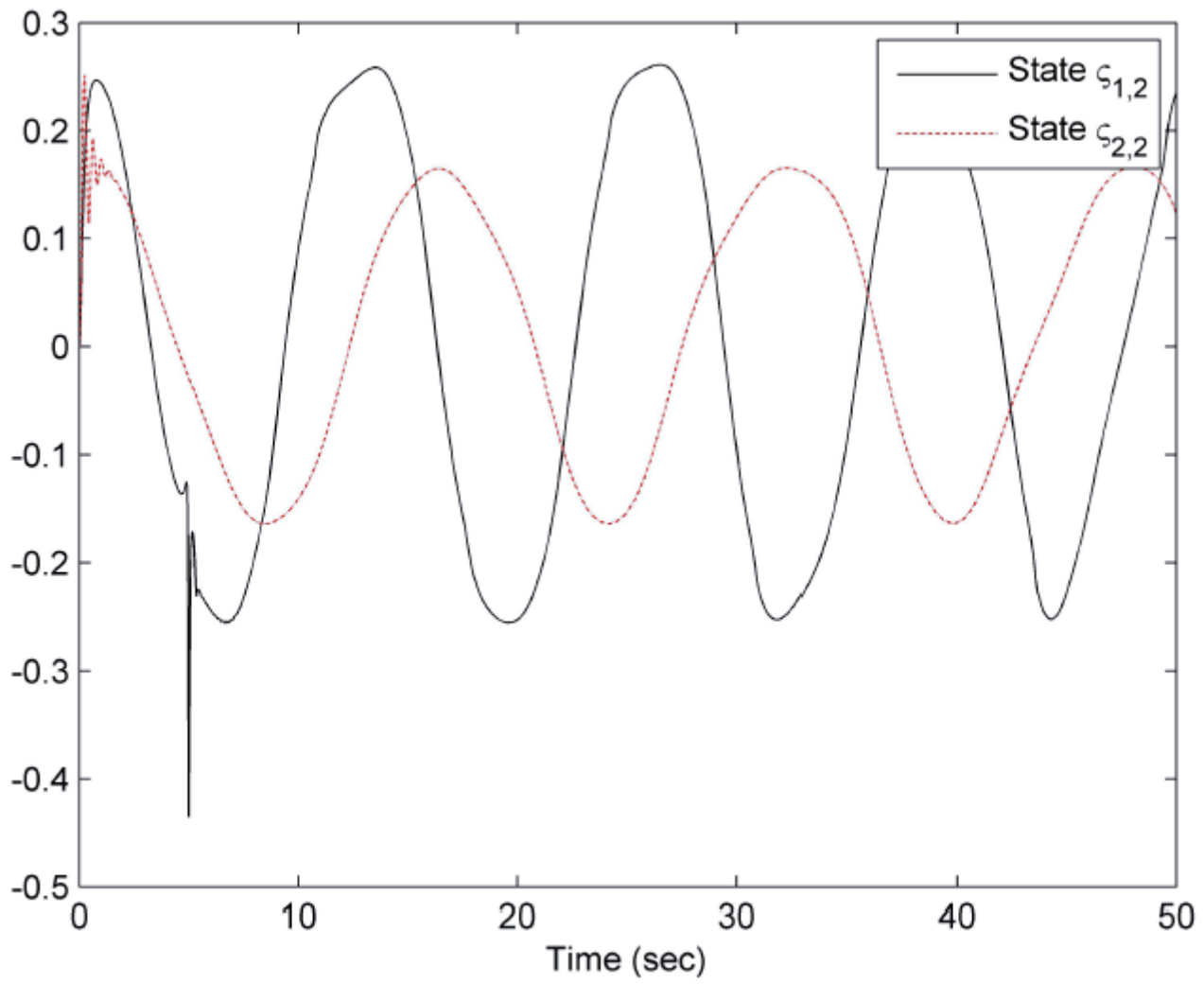
**Figure 4**

The responses of  $e_1$  and  $\varphi_1(t)$ .



**Figure 5**

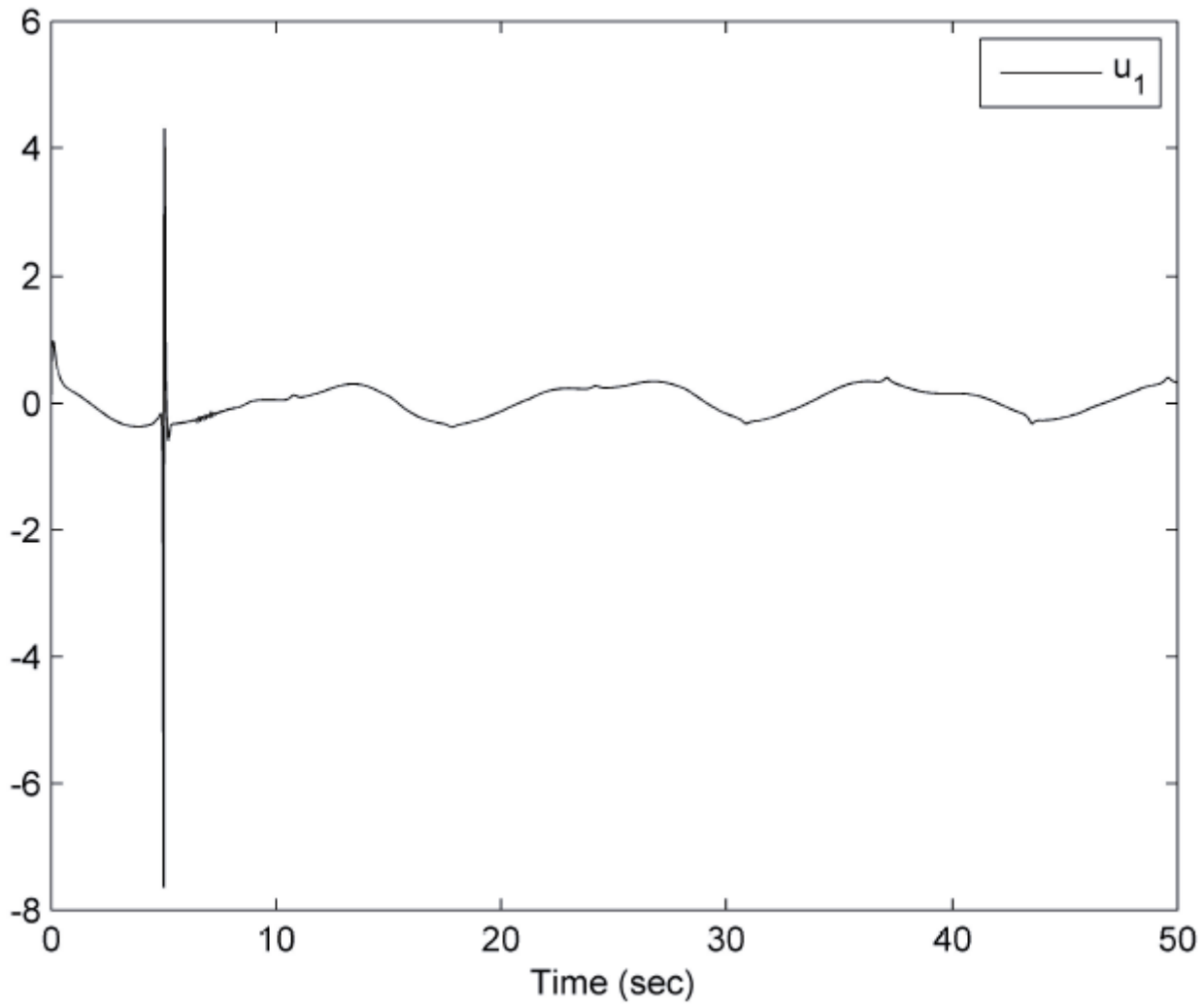
The responses of  $e_2$  and  $\psi_2(t)$ .



**Figure 6**

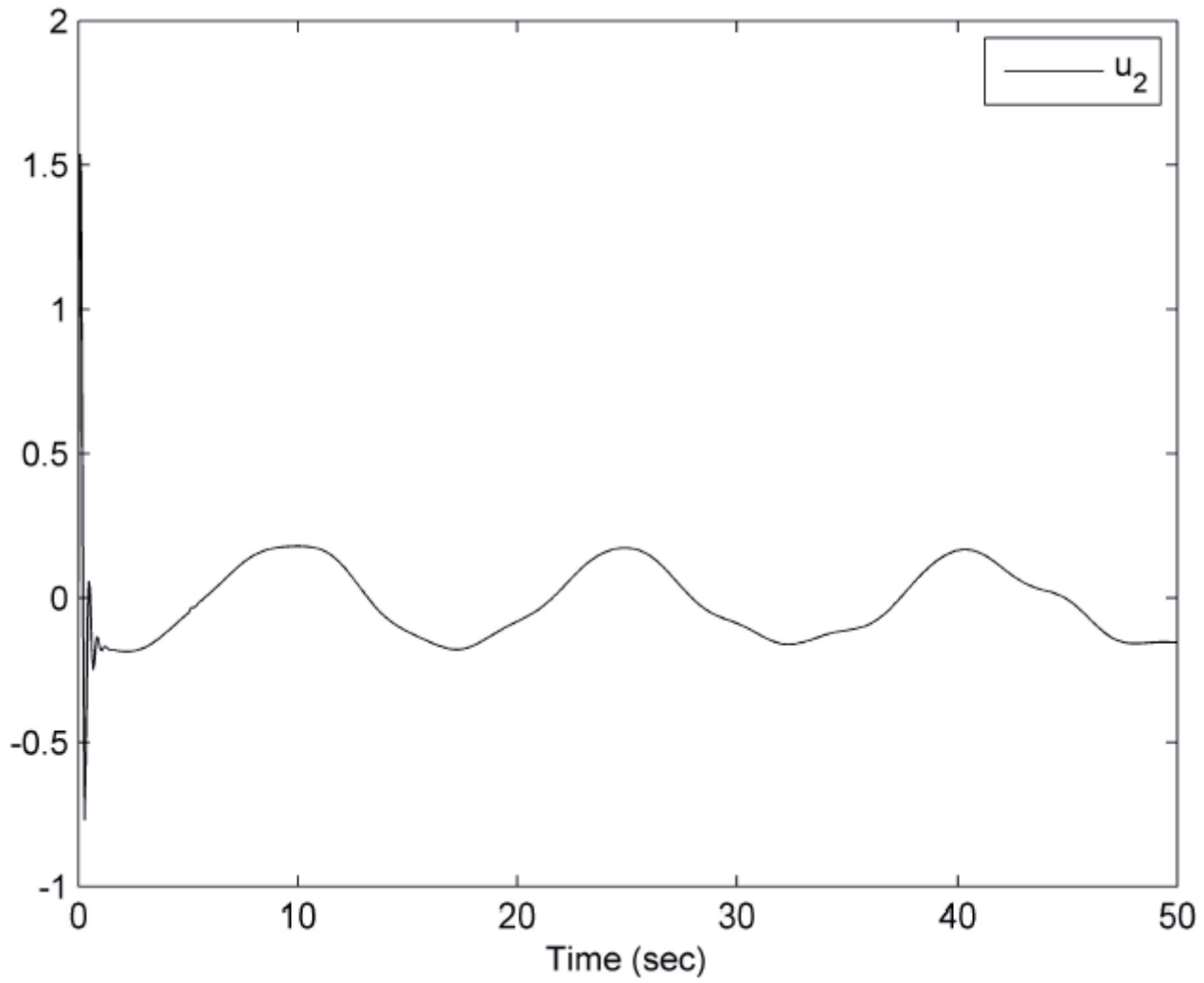
The responses of  $\zeta_{1,2}$  and  $\zeta_{2,2}$ .





**Figure 7**

The response of  $u_1$ .



**Figure 8**

The trajectories of  $u_2$ .