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Robust synchronization of chaotic systems using sliding mode and feedback control

基于滑模和反馈控制的鲁棒混沌系统同步

Key words: Chaos synchronization, Sliding mode, Feedback control

关键词：混沌同步；滑模控制；反馈控制

- To achieve the synchronization of chaotic systems with modeling mismatches and parametric variations, a new method based on a combination of high-order sliding mode and feedback control is proposed.
- Sliding mode is used to estimate the synchronization error between the master and the slave as well as its time derivatives, while feedback control is used to drive the slave to track the master. So, the proposed method has both strong robustness (of sliding mode) and fast convergence (of feedback control).

- The stability of the proposed design is proved theoretically, and its effectiveness is verified by three simulation examples:
 - In the first example, the proposed method achieves synchronization of two Lorenz systems with parametric mismatches.
 - In the second example, the proposed method achieves synchronization of Duffing and van der Pol oscillation systems with structure mismatches.
 - In the third example, the proposed method achieves synchronization of two biological neuronal networks.

Example 1

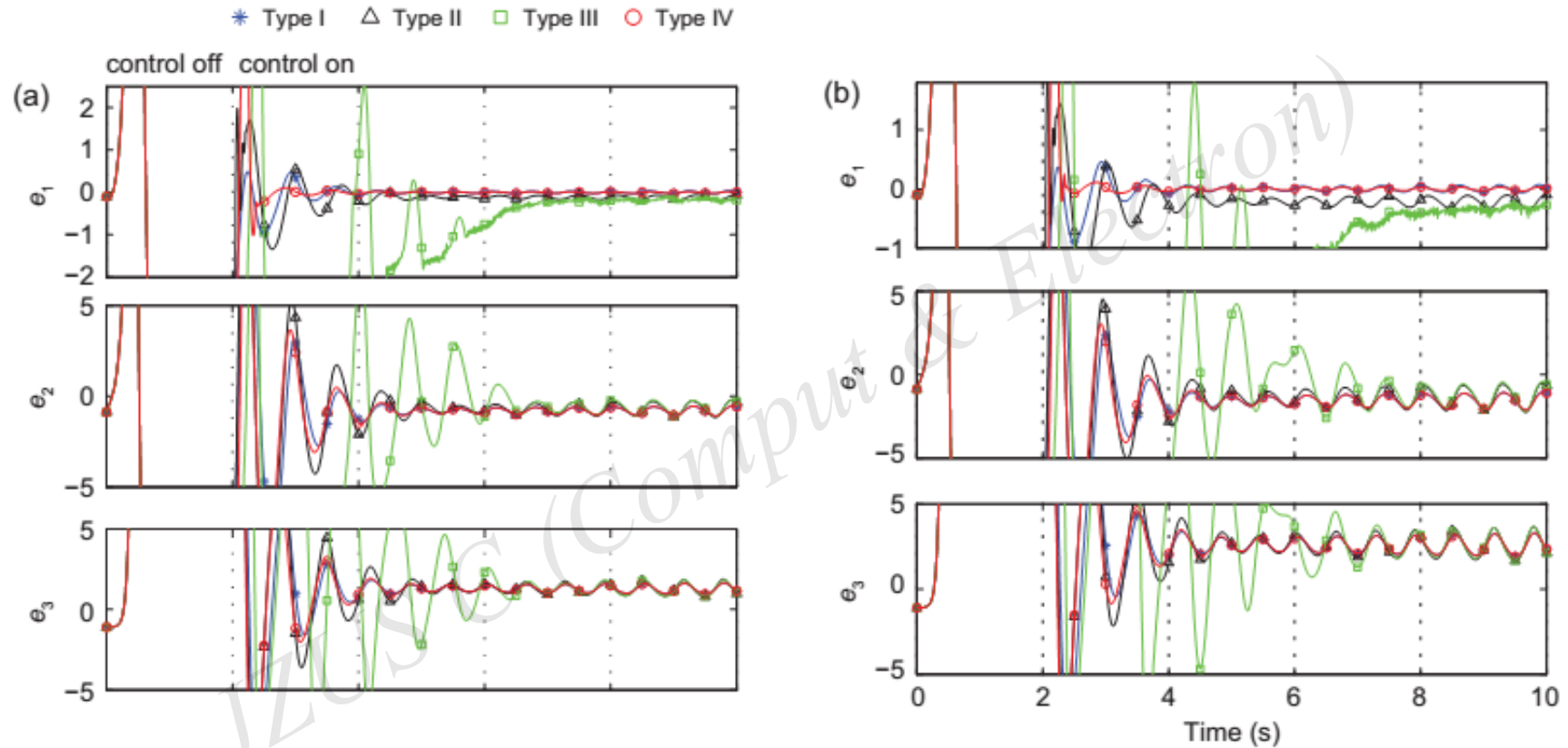


Fig. 1 The synchronization errors between the master and the slave of different methods with 5% (a) and 10% (b) of parameter mismatches

Example 2

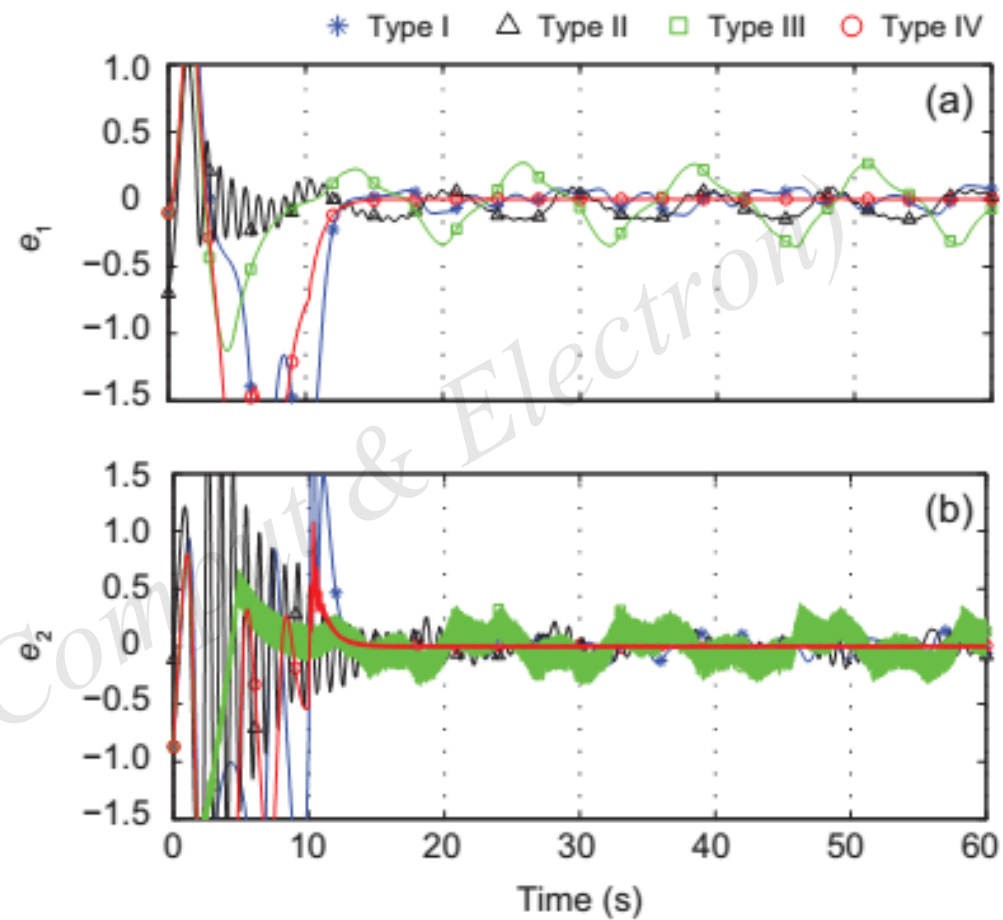


Fig. 2 The synchronization errors between Duffing and van der Pol oscillators with different methods. References to color refer to the online version of this figure

Example 3

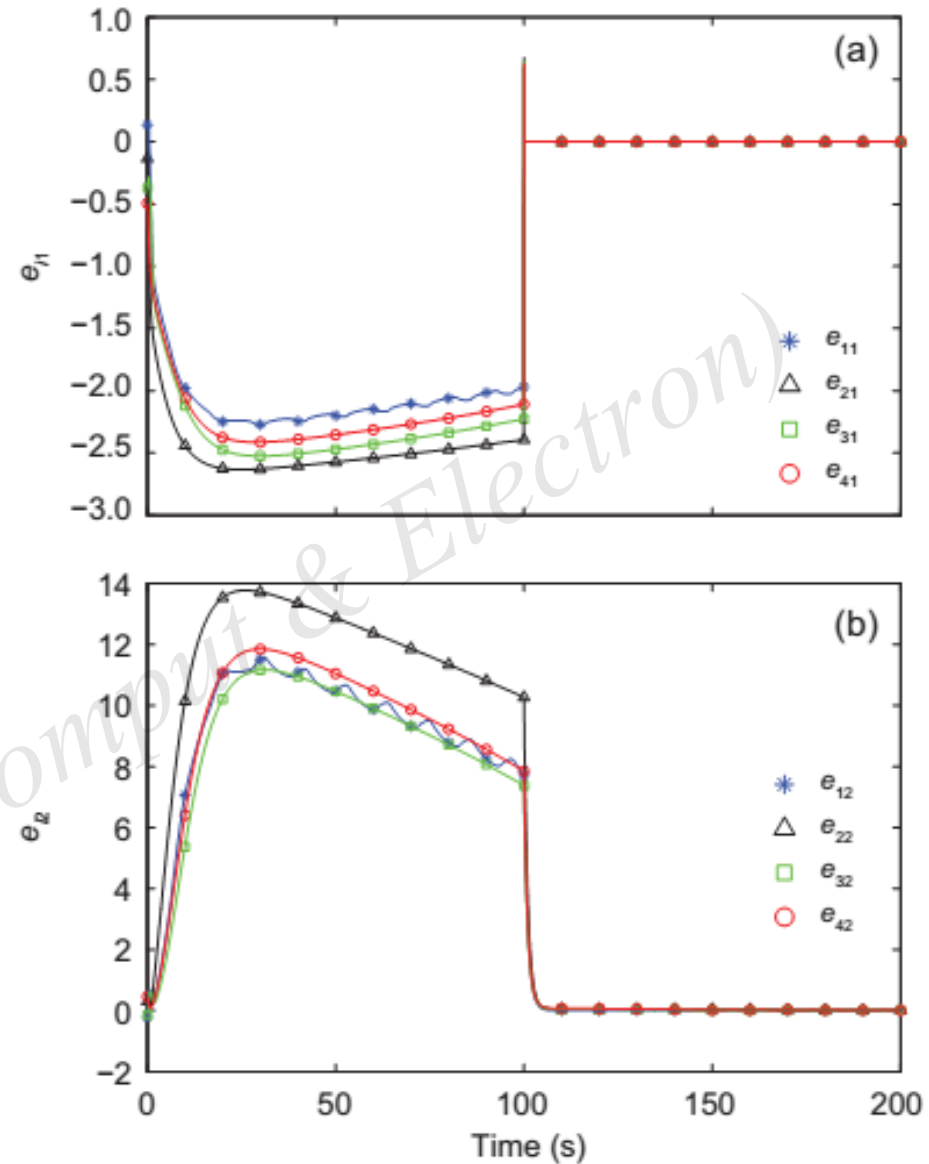


Fig. 4 Synchronization errors e_{i1} (a) and e_{i2} (b) ($i = 1, 2, 3, 4$) of subnet I. References to color refer to the online version of this figure