Faculty of Engineering
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Bifurcation and Control on Hybrid Systems

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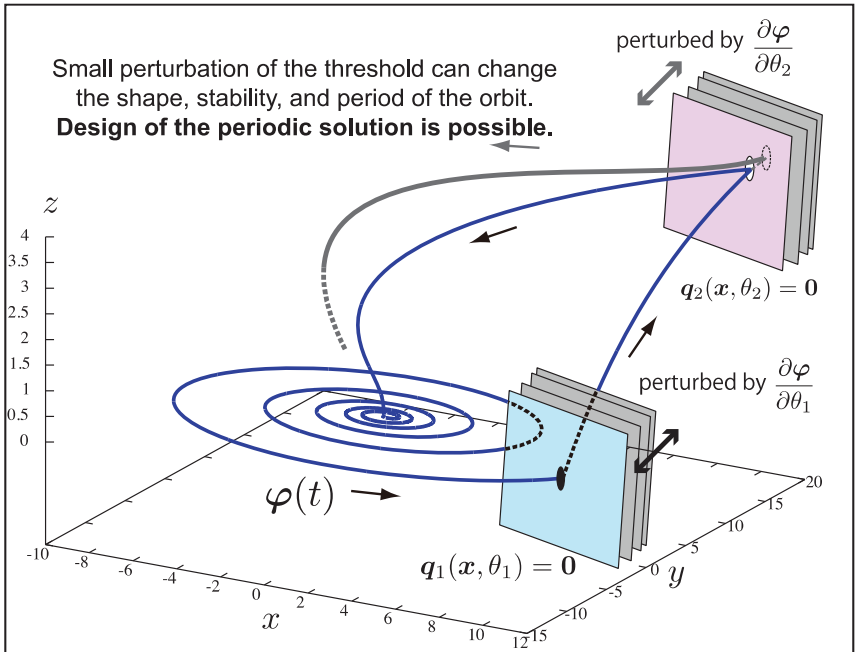

Fig. 1: Generation of attractors by threshold perturbation control

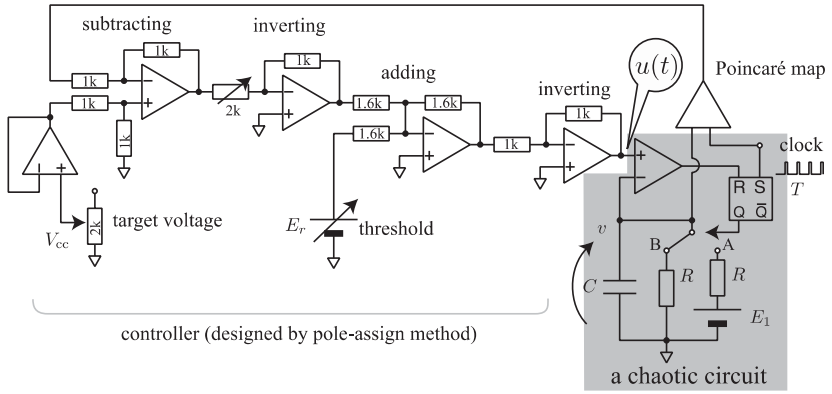

Fig. 2: Controlling chaos by threshold perturbation control

Content:

Nonlinear electric circuits including switching devices (e.g., multiplexer, relay, diode) are composed by both continuous flows and discrete events. These hybrid systems often specify bifurcations of periodic attractors and exhibit chaotic motions. We have developed a numerical analysis methodology for bifurcations in such systems for threshold values by computing variations about it. Bifurcation diagrams of periodic solutions can be obtained accurately. As an application of this technology, we demonstrate generation of periodic attractors (Fig. 1) by combining several switching manifolds, and controlling chaos in hybrid systems (Fig. 2) by using the perturbation of a switching threshold value. The key points of these trials are: (1) all required information is given by numerical integration of variational equations, (2) threshold perturbations are realized by less control energy compared with the conventional control technologies.

Keywords: hybrid systems, bifurcation, chaos, control

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