Chaotic Control Systems

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Abstract: Generally speaking, it is relatively easy to design a feedback controller to eliminate the possibility of chaos in a nonlinear dynamical system. Here we examine chaotic control not from the prospective of eliminating chaos, but from the prospective of producing chaotic motion in order to take advantage of the random like "free ride" a chaotic attractor provides. The idea is stay with this free ride until the system moves into a target containing a desired fixed point. Once inside this target, feedback control is applied that provides asymptotic stability for the fixed point. A basic requirement with this approach is to determine an appropriate target. It must be a subset of the domain of attraction to the fixed point under state variable feedback control. In addition, the target must be large enough so that the time it takes for the system to reach it, under chaotic control, is not unreasonably large. After addressing the question as to why this might be a desirable approach for nonlinear control system design, the focus of this paper is on the presentation of a general method for applying chaotic control and then demonstrating its use in controlling an inverted pendulum and a bouncing ball.

Keywords: *Chaos; control; inverted pendulum; bouncing ball.*

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