

Partial Control and Beyond: Forcing Escapes and Controlling Chaotic Transients with the Safety Function

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Abstract: A new control algorithm based on the partial control method has been developed. The general situation we are considering is an orbit starting in a certain phase space region Q having a chaotic transient behavior affected by noise, so that the orbit will definitely escape from Q in an unpredictable number of iterations. Thus, the goal of the algorithm is to control in a predictable manner when to escape. While partial control has been used as a way to avoid escapes, here we want to adapt it to force the escape in a controlled manner. We have introduced new tools such as escape functions and escape sets that once computed makes the control of the orbit straightforward. The partial control method aims to avoid the escape of orbits from a phase space region Q where the transient chaotic dynamics takes place. The technique is based on finding a special subset of Q called the safe set. The chaotic orbit can be sustained in the safe set with a minimum amount of control. We have developed a control strategy to gradually lead any chaotic orbit in Q to the safe set by using the safety function. With the technique proposed here, the safe set can be converted into a global attractor of Q .

Keywords: partial control, transient chaos, safety function, controlling transient chaos

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