ABSTRACT

Title of Dissertation: CHAOTIC SYSTEMS: PREDICTABLE UNPREDICTABILITIES AND SYNCHRONIZATION

Mitrajit Dutta, Doctor of Philosophy, 2000

Dissertation directed by: Edward Ott, Professor,
Department of Physics

James A. Yorke, Professor,
IPST & Departments of Mathematics and Physics

This thesis may be broadly divided into two parts. The first part, comprising chapters 2 and 3, discuss systems with certain novel kinds of unpredictabilities that are more severe than the relatively simpler form of unpredictability arising from the extreme sensitivity to initial conditions exhibited by all chaotic systems (including the ones described here). In particular, chapter 2 discusses piecewise smooth systems and border collisions involving them, while chapter 3 discusses unshadowable physical systems. The second part of the thesis comprising chapters 4, 5 and 6, revolves around synchronization of chaos. Chapter 4 presents a novel algorithm that synchronizes any two identical chaotic systems using almost any scalar signal. Chapter 5 extends the method to the case of simultaneously synchronizing multiple pairs of pairwise-identical chaotic systems using just a single scalar signal. Finally, chapter 6 presents a new synchronization-based method

for finding shadowing trajectories corresponding to noisy trajectories of a known chaotic system.