AME 630: Transition to Chaos in Dynamical Systems
Prof. P.K. Newton, RRB 221, 740-7782 (newton@usc.edu)
Spring 2018
Time: M,W 12:00-1:50, KAP 148

The course will focus on the main ideas and techniques in dynamical systems and chaos theory developed over the past 30 years by introducing examples that have served as useful prototypes. There are 4 parts to the course:

1. Review of basic dynamics
2. Iterated maps
3. Bifurcation theory
4. Evolutionary games

Part 1 will briefly survey some of the main ideas of basic dynamics including phase space techniques, fixed points, stability theory, Lyapunov functions. Part 2 focuses on the dynamics of iterated maps, the simplest setting in which chaotic behavior can occur. This will lead to a discussion of bifurcation phenomena, Feigenbaum scaling theory and Lyapunov exponents in prototype maps such as the logistic map, the 'standard' map, and the Hénon map. Part 3 will outline basic techniques of bifurcation theory related to differentiable dynamics, including discussions of center manifolds, unfolding a bifurcation, and the Hopf bifurcation. Part 4 will focus on the dynamics of evolutionary games using the replicator equations and the prisoner's dilemma game.

Books:
• K.T. Alligood, T.D. Sauer, J.A. Yorke, *Chaos: An Introduction to Dynamical Systems*, Springer-Verlag, (Paperback)