AME 522: Nonlinear Dynamical Systems, Vibrations, and Chaos
Prof. P.K. Newton, RRB 221, 740-7782 (newton@usc.edu)
Fall 2018
Time: M 12:30-3:10, OHE 136
Office hours: M 11:00-12:30

The course will serve as a broad introduction at the undergraduate level to the field of nonlinear dynamics and chaos theory for engineers, physical scientists, and applied mathematicians. We will assume students have working knowledge of multivariable calculus, linear algebra, and some knowledge of ordinary differential equations. We will introduce the subject in a sequence of 12 lectures on nonlinear dynamics, starting with one-dimensional flows, emphasizing the geometric point of view and the notion of bifurcations. Then we will discuss two-dimensional flows and phase plane dynamics. The third section of the class will focus on chaotic dynamics in the context of one-dimensional maps, the Lorenz equations, fractal sets and strange attractors. Lecture topics are listed below.

Grading:

• HW 40%
• Midterm 30% (Monday Oct. 15 in class)
• Final 30% (Friday Dec. 7, 11AM-1PM)

Books:

• S.H. Strogatz, *Nonlinear Dynamics and Chaos*, 2nd Ed. Westview Press, (Paperback) **REQUIRED**
• K.T. Alligood, T.D. Sauer, J.A. Yorke, *Chaos: An Introduction to Dynamical Systems*, Springer-Verlag, (Paperback) **RECOMMENDED**
• F.C. Moon, *Chaotic Vibrations: An Introduction for Applied Scientists and Engineers*, Wiley, (Paperback)