

1116-K5-2870 **Matthew A Morena*** (mamorena@yhc.edu) and **Kevin M Short**. *Music Synthesis from Controlled Chaos*.

Sound synthesis is a field that bridges the disciplines of music, physics, mathematics, and psychoacoustics. Many synthesis techniques utilize a dynamical systems approach, whereby sounds, rhythms, and melodies can be created from iterated mappings or from differential equations. The goal of our present work is to synthesize the sounds of musical instruments by way of controlling a chaotic dynamical system onto its periodic orbits. The control method is adapted from one developed by Hayes, Grebogi, and Ott, and the resulting (stabilized) orbits are known as *cupolets* (*C*haotic, *U*nstable, *P*eriodic, *O*rbit-*L**E**T**S*). Cupolets exhibit the interesting property that a given set of controls will uniquely identify a cupolet, independent of its initial condition. We demonstrate how cupolets can be made to produce periodic waveforms whose harmonic spectra contain the overtones that give musical instruments their distinctive qualities. Thus, a set of controls may be used to produce cupolets that sound like a harpsichord or a banjo, while other cupolets may be generated that share tonal qualities with an electric piano. (Received September 22, 2015)