Lecture 14 Review

Chaos Intro w/ driven, damped pendulum.

Chaos Identification

- *Chaotic* motion is motion w/o any apparent regularity.
- Chaotic motion is NOT random motion.
- Random motion means you cannot predict future motion from present, even in principle.

➢ However, relevant chaotic ODE tells you how to get from present to future.

➢ IF you start w/ identical ICs, you always get the same final state.

➢ It is extreme sensitivity of a chaotic ODE to initial conditions that makes practical prediction of far future motion impossible.

➢ Change ICs slightly for chaotic system, very different final state.

Consider the example of the logistic map.

Chaos Identification (2)

$$x_{N+1} = \alpha x_N (1 - x_N)$$

Set $\alpha = 4.0$

Pick $x_1 = 0.700\ 000\ 000$

$= 0.700\ 000\ 001$

two different ICs

Find iteration N where the 2 solutions have clearly diverged.

N = ??