Summer 2007 Math 331: Week 4

Linear Second Order Equations with Constant Coefficients

Key concepts:

- Physical Application: The motion of a mass attached to a spring (pages 159, 160 and 193 (2nd: 155, 156 and 189)) leads to the equation

$$m\,y'' + b\,y' + k\,y = 0 \quad \text{where:} \quad \begin{array}{ll} m & \text{is the mass attached to a spring,} \\ b & \text{is the coefficient of damping,} \\ k & \text{is the spring constant} \end{array}$$

- Finding the general solution of the equation $a\,y'' + b\,y' + c\,y = 0$ using the characteristic polynomial $a\,s^2 + b\,s + c = 0$.

  Section 3.6:

  - page 325 (2nd 317) A free gift from the Math Dept (ignore systems and vector solutions),
  - pages 327-328 (2nd 319-320) Solving initial-value problems,
  - page 328 (2nd 320) Complex eigenvalues (that is complex roots of the characteristic polynomial, ignore vector solutions),
  - page 329 (2nd 321) The Method of the Lucky Guess
  - page 334 (2nd 326) A critically damped oscillator (that is the characteristic polynomial has only one root).

- A Classification of Harmonic Oscillators (pages 330-336 (2nd 322-328)). Ignore vector solutions.

Exercises

- page 168 (2nd 164): 21, 22, 23; page 198 (2nd 194): 15-18 (find the general solutions); page 289 (2nd 281): 21, 22
- Section 3.6: A selection from 1 - 28 and 38, 39, 40
- In all these exercises ignore references to systems and phase portraits.