**Class 28** – **Boundary Value ODEs (Chp. 24)**

ChE310\_SecB\_S2019 / 4.23.19

<http://www.reuelgroup.org/numerical-methods-che-310.html>

Announcements:

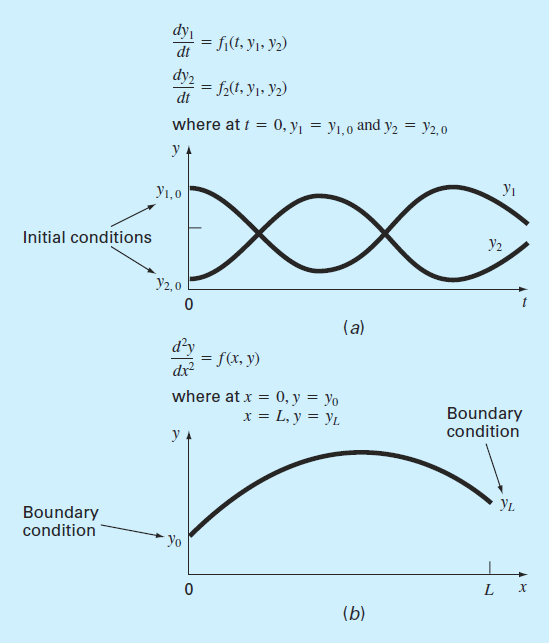
* Class project due 4.30 for demo – rubric online
* Last PSET posted today (shorter, w/ EC problem)
* Course evaluations (ISU + RMP)
* Final 5.7.19 (Tuesday) noon to 2:00 PM w/ Jared

**Warm Up Group Activity:** submit to Jared by **2:25 pm**.

Use a built in stiff ODE solver to plot the van der pol equation from the problem statement at end of lecture 27 (E23.6.1). Compare this solution to **ode45**. Does rk4sys work in this case?

**Outline for Class 27 Lecture**

1. Boundary Value Problems vs. IVP



Boundary values

* + Constants (*Dirichlet Boundary Conditions)*
  + Rates (flux, gradient, insulated)
  + *Neumann Boundary Conditions*
  + Two ways to solve numerically:
  + Shooting method
  + Finite difference method (mesh w/ nodes)

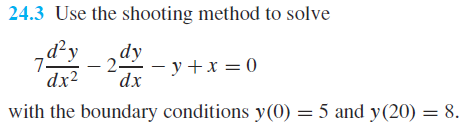
1. Shooting Method

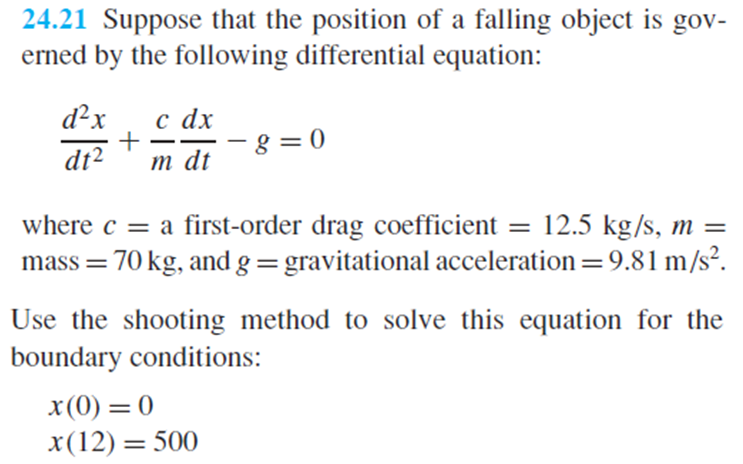
“For linear ordinary differential equations can use interpolation. For nonlinear you can use root finding.”

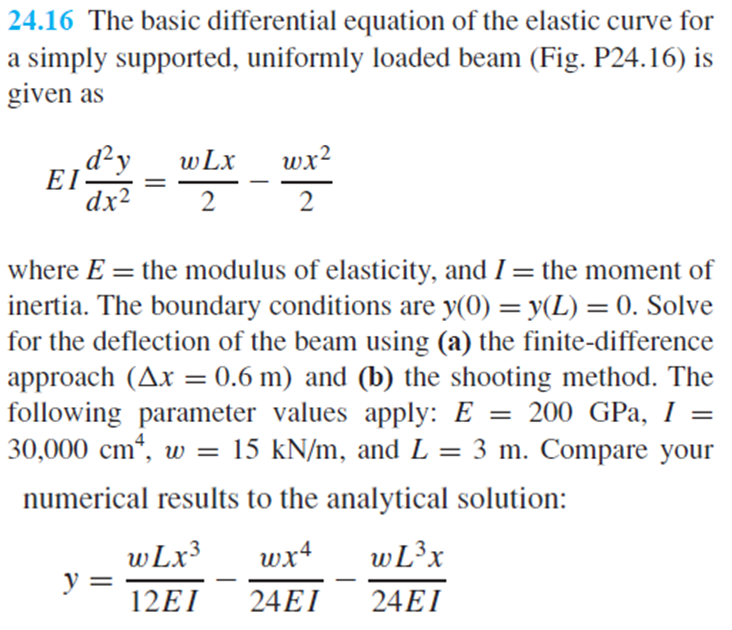
DEMO - <https://phet.colorado.edu/sims/projectile-motion/projectile-motion_en.html>

(interpolation as linear, doesn’t work w/ air resistance)

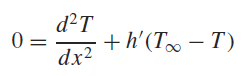
Examples:





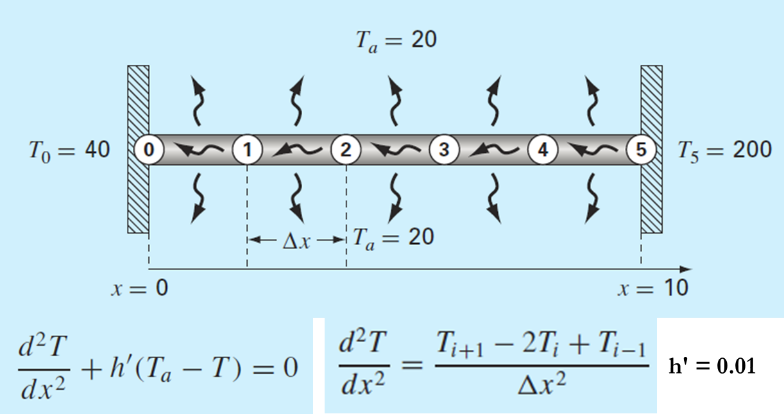


1. Finite Difference Method: ODE🡪 sys of eqns.

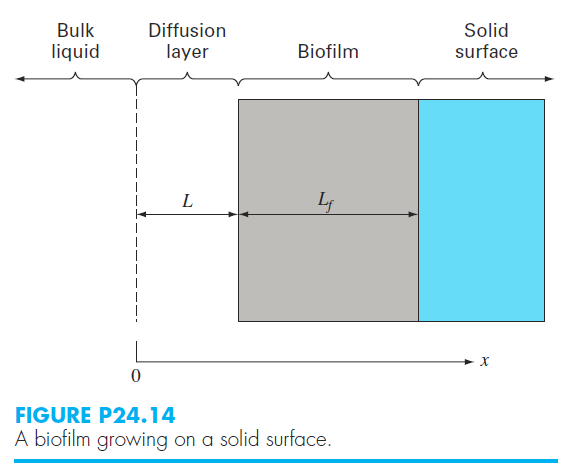


* 1. These result in sparse matrices (**tridiag**)

Example (return to the heated rod)



Another example of Neumann Boundary value problem solved with finite difference method (24.14)

24.14 (book)