Using MATLAB and Programming to Simulate Dynamical Systems

Syllabus

Date	Lecture	Content	Homework
Feb 8	1	Overview, MATLAB Syntax	HW1 out
Feb 15	2	Programming I: Conditionals and Loops	HW1 due-HW2 out
Feb 22	3	In class exercise: Bouncing ball I	HW2 due-HW3 out
Feb 29	4	In class exercise: Bouncing ball II	
Mar 7	5	Programming II: Functions	HW3 due-HW4 out
Mar 14	6	In class exercise: recursion and Tower of Hanoi	HW4 due-HW5 out
Mar 21	7	Algorithm and ODE	HW5 due-HW6 out
April 4	8	In class exercise: mass-spring-damper dynamics	HW6 due
April 11	9	In class exercise: Roller disk	HW7 out
April 18	10	In class exercise: Nonlinear dynamics project I	HW7 due-HW8 out
April 25	11	In class exercise: Nonlinear dynamics project II	
May 2	12	Vibration and eigenvalue problems	HW8 due-HW9 out
May 9	13	Finite element and building vibration	HW9 due

Computation and Programming

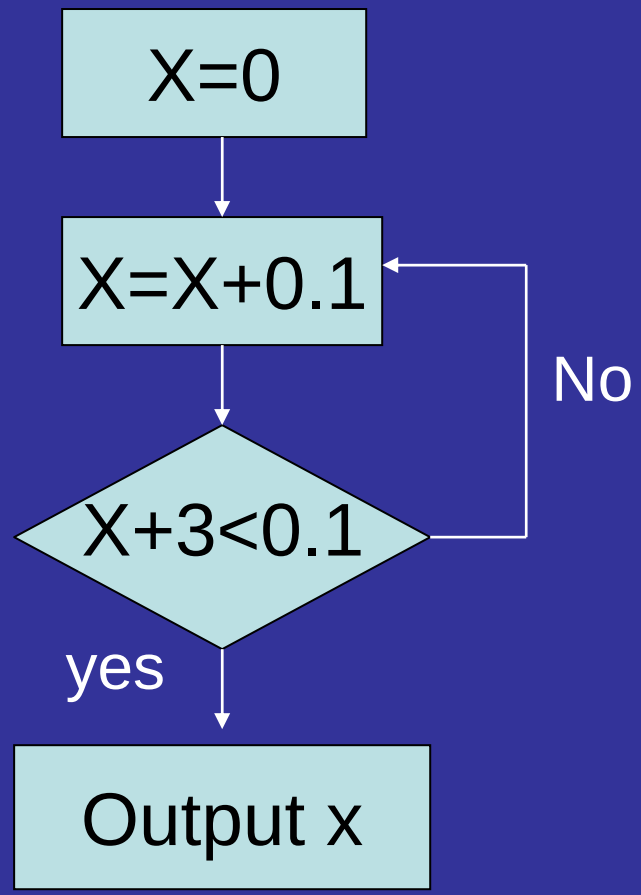
Computation

1+2=3

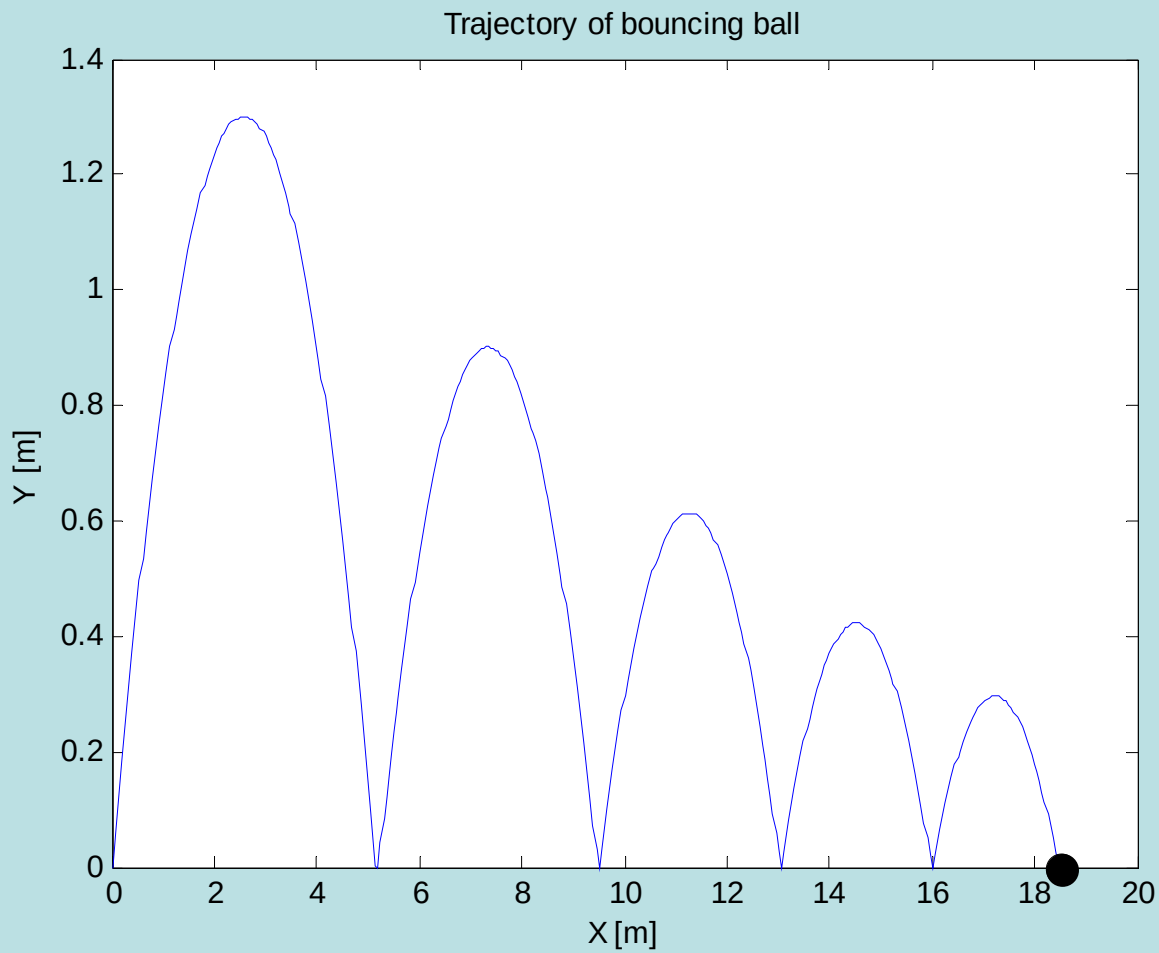
sin(30)=0.5

$$\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} = \begin{bmatrix} 7 & 10 \\ 15 & 22 \end{bmatrix}$$

Programming

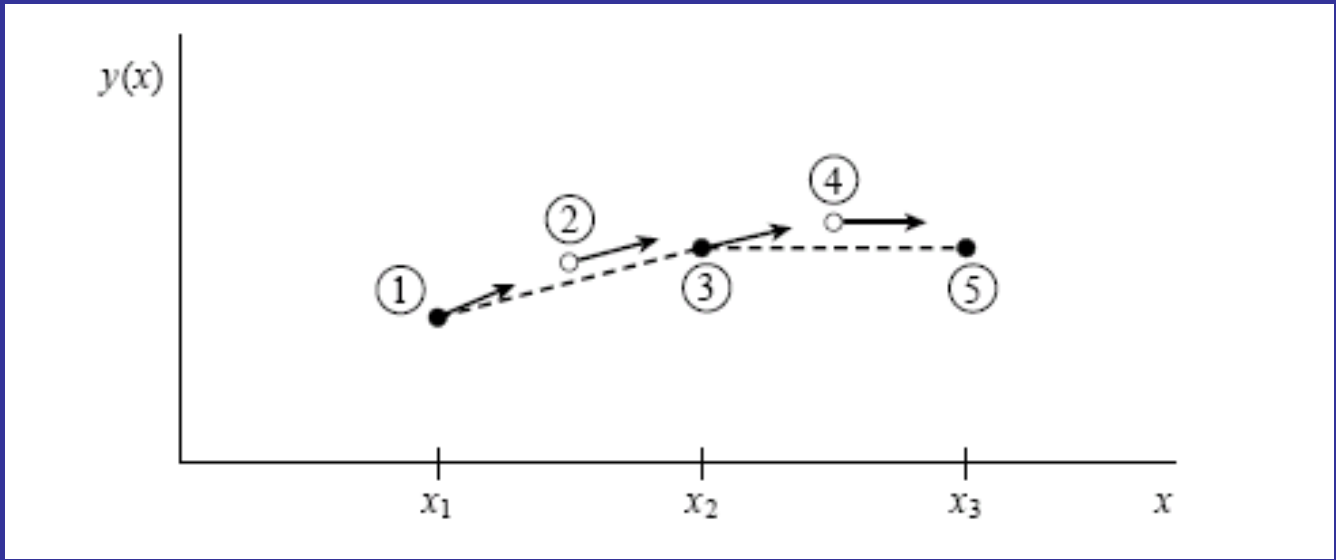


Modeling Bouncing Ball with Nonlinear Air Drag

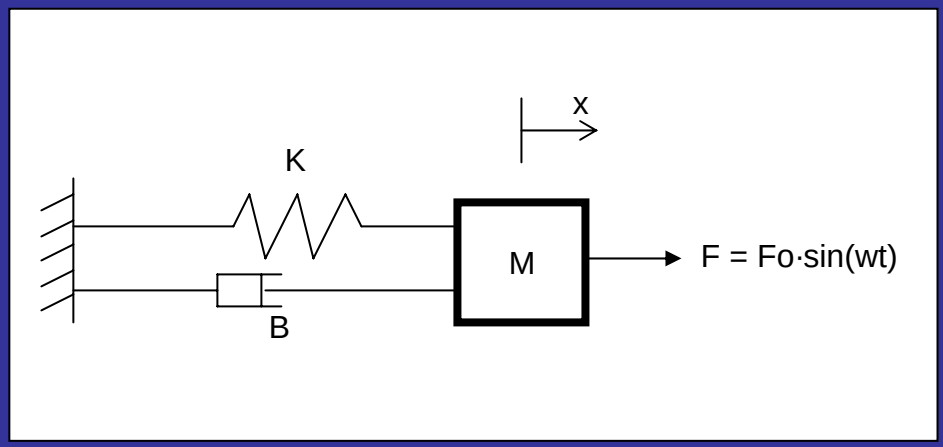


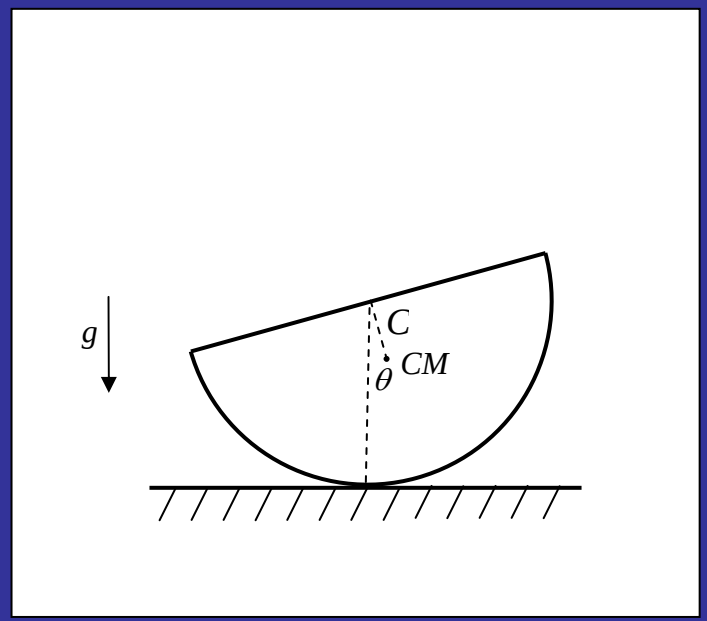
Tower of Hanoi

ODE and Simulating Dynamics Numerically

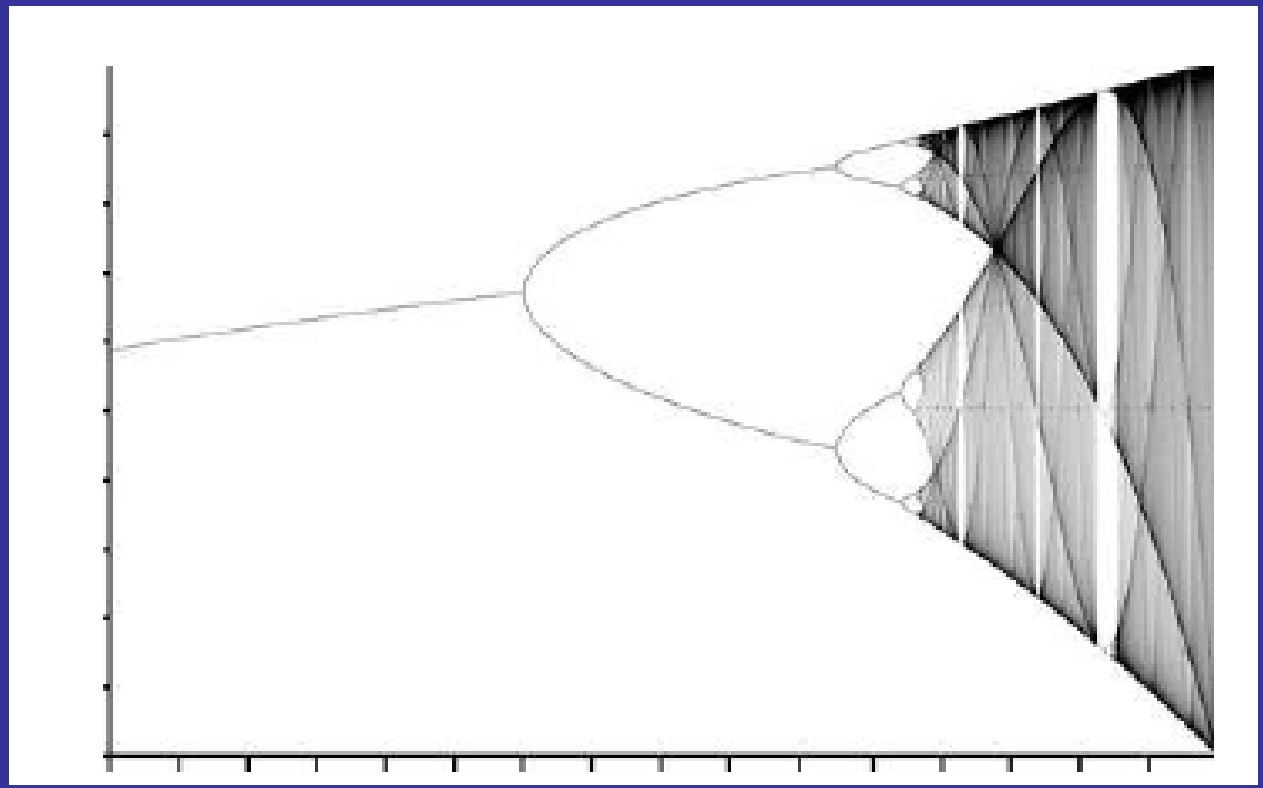


Simulating Dynamics of Mechanical Systems



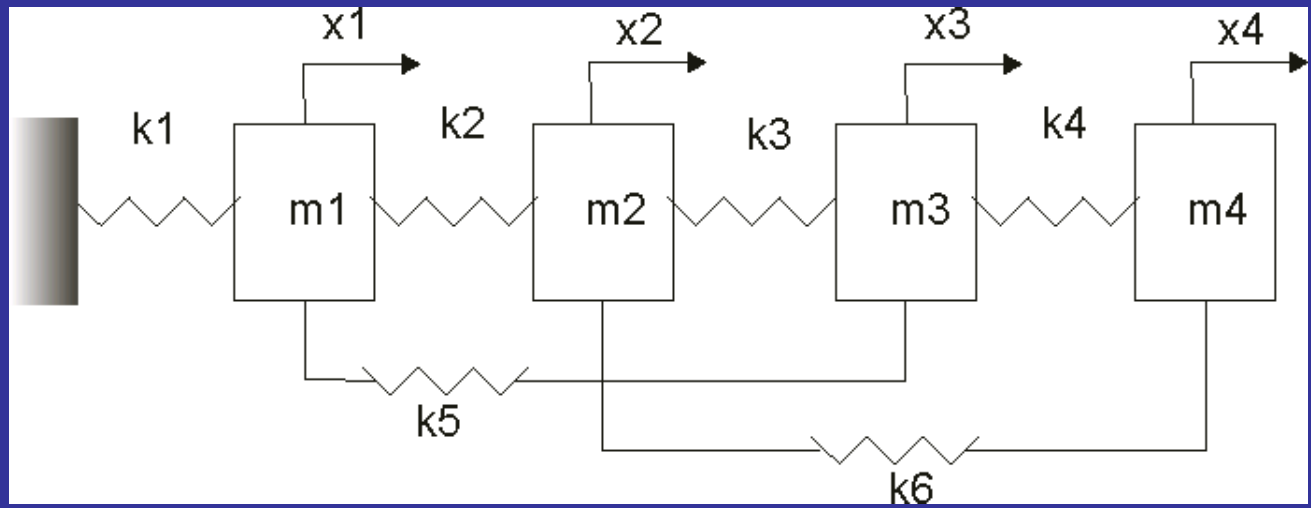


Simulating Dynamics of Nonlinear Systems



Choice of projects: (1) pendulum with elastic spring, (2) Population dynamics for wolfs and rabbits, (3) ?

MATLAB Programming – Eigenvalue Problems and Mechanical Vibration



$$A \cdot x = \lambda x \quad (A - \lambda I) \cdot x = 0$$

Modeling the Swinging of a Building in the Wind