

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

DEPARTMENT OF OCEAN ENGINEERING

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

13.013J/1.053J Dynamics and Vibration

Fall 2002

Problem Set 9

Issued: Day 23

Due: 11 am, Day 26

(a) Problem 6.45 : In this problem, derive

- the nonlinear equations of motion with the direct and indirect methods,
- static equilibrium positions,
- linearized equations of motion around each static equilibrium position,
- linearized stability analysis around each static equilibrium position.
- Assume that the unstretched length of the spring is known to be equal to D .
- This quantity is needed in the derivation of the nonlinear ODE of motion (but not in the linear ODE around $\theta = 0$).

(b) Problem 6.52 :

- Only linearized ODE (small motions) is required. Use the direct and indirect methods.

(c) Problem 6.75 :

- Large motion (energy method).

(d) Problem 6.92 :

- Only linearized ODE (small motions) is required. Use the direct and indirect methods.

(e) Problem 6.102 :

- Derive ODEs of motion using the direct and indirect methods.

(f) Self Evaluation in another sheet following the instructions in the first class.

All students are supposed to work on all the problems assigned.