

# PHY422/820: Classical Mechanics

FS 2020

Exam Preparation

December 1, 2020

## Problem P17 – Suspended Rod

A very thin uniform rod of length  $l$  and mass  $m$  ( $I = ml^2/12$ ) hangs from two ideal springs with constants  $k$ . The coordinate  $\eta$  is the vertical displacement of the rod's center from its equilibrium position. The displacement of the rod ends are  $\eta_1 = -l/2 \sin \theta$  and  $\eta_2 = l/2 \sin \theta$ . Consider only the vertical motion of the rod-spring system and assume small displacements.

Construct the Lagrangian in terms of  $\eta$  and  $\theta$  and determine the normal modes.

