

# Physics 524 Week 12 Homework Exercise

Due: Tuesday 11/14/2023 at 10am

## Due date reminder, etc.

Please email your completed assignment to the course TA by Tuesday, 10 am of next week. Assignments that are late by at most one week will receive at most 50% of full credit. We will not grade anything submitted more than one week late.

Your homework submissions—code, cell phone photos, etc. must include enough identifying information for us to tell who you are!

## Problem

Three bars of differing materials (elastic moduli denoted  $E_1$  and  $E_2$ ) but the same cross-sectional shape and area are connected in series. The system is constrained at either end by a rigid wall. The problem parameters are  $E_1 = 120$  Gpa,  $E_2 = 200$  Gpa,  $L = 2$  m,  $A = 0.1$  m<sup>2</sup> and  $P = 20$  kN. Representing this system as a mesh of three 1D rod elements and 4 nodes, use the finite element method to

- Solve for the displacement of the middle two nodes
- Find the signed reaction forces at the left and right walls (positive force points right)
- Plot the displacement and stress over the entire domain as a function of position  $x$ .

Perform calculations by hand and show your work for full credit.

