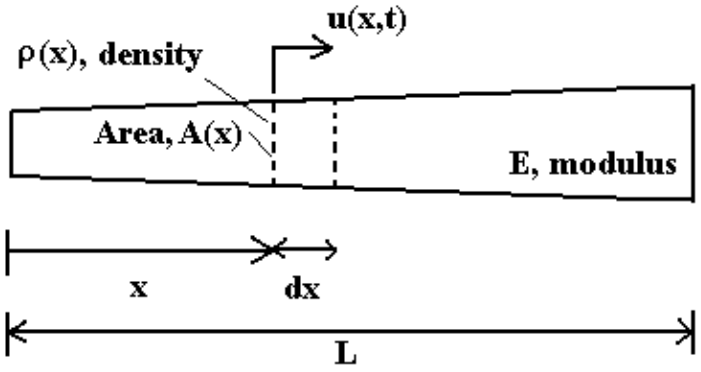
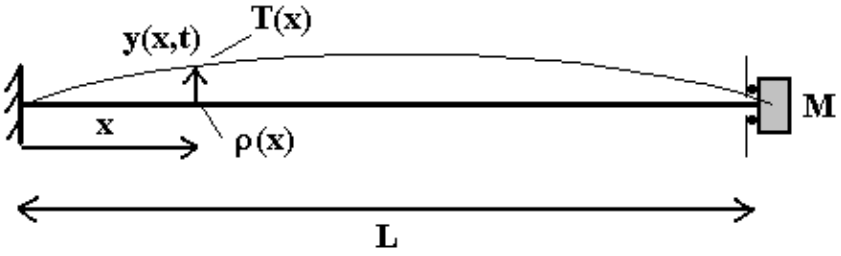
ME 563 HOMEWORK # 4 Fall 2010

PROBLEM 1: (35%)
Derive the unforced equations of motion for the continuous vibrating rod below with cross sectional area, $A(x)$, modulus of elasticity, E, and density, $\rho(x)$. The rod is free to vibrate at both ends (HINT: $P(x)=EA(x)\varepsilon=EA(x)\partial u/\partial x$).



FREE-FREE CONTINUOUS ROD

PROBLEM 2: (35%)
Derive the unforced equations of motion for the continuous vibrating string below with tension, $T(x)$, and linear density, $\rho(x)$. The string is fixed at one end and has a concentrated mass at its other end. Ignore forces due to gravity.



CONTINUOUS VIBRATING STRING W/ CONCENTRATED MASS

PROBLEM 3 (30%)

Use ten lumped masses, M_i , to model the continuous vibrating system in PROBLEM 1 above with uniform cross sectional area, A. Compare your results with those from PROBLEM 1. Explain why, when, and how the two results are similar.