

Do the following problems from Shutz Chapter 4: 4, 9, 20, 21

1. A rod has a cross sectional area  $A$  and mass per unit length  $\mu$ . Find the stress-energy tensor inside the rod when the rod is under a tension  $F$ . Assume that the tension is uniformly distributed over the cross section.
2. A rope of mass per unit length  $\mu$  has a static breaking strength  $F$ . What is the maximum  $F$  can be without violating the “weak energy condition” that  $T^{00}$  should be observed as positive in all frames. Hint: Use the stress-energy tensor derived in the above problem and find the value of  $T^{00}$  in a boosted frame. Can you estimate numbers for a steel cable, that is, compare this theoretical maximum strength to actual strength of steel cable?