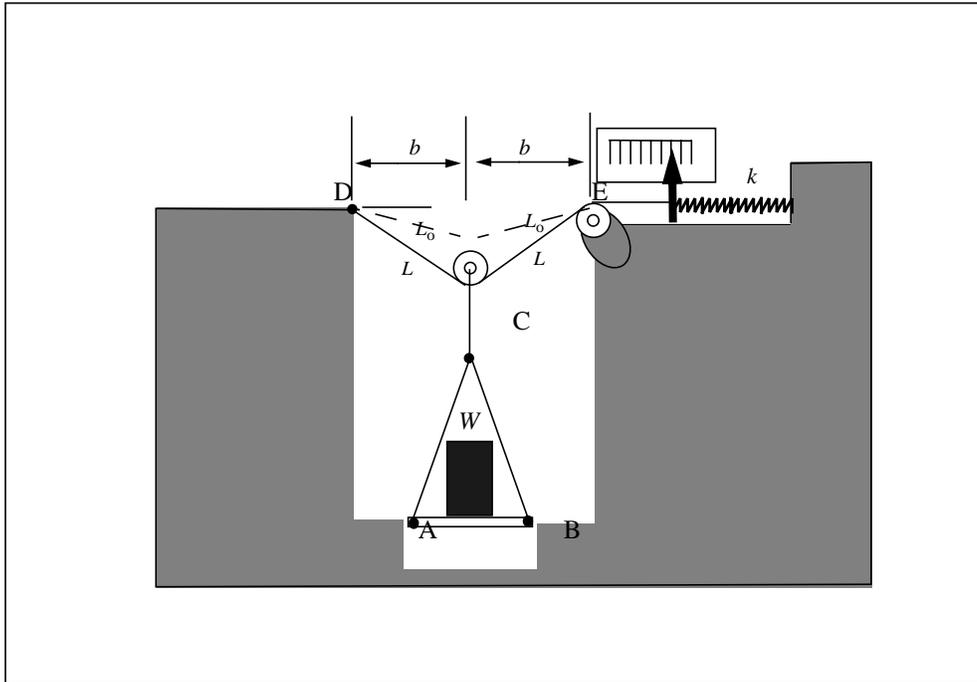


Design Exercise 1

1.050 Solid Mechanics

Fall 2004

Your task is to design a mechanical scale for making rough measurements of the weight of passengers' checked luggage at a local airport located in West Cupcake, Nevada. The boss has



proposed the system shown in the figure. A party's luggage is placed on the platform AB and the cable DCE , originally in the no load configuration indicated by the lengths L_0 , takes up the new state indicated by the lengths L . The circles indicate pulleys meant to offer no resistance to rotation. The spring extends, the pointer moves and a reading is made.

You are given the following specifications and constraints.

- The scale is to be read with the naked eye.
- The measured weight should be accurate to within 5%. Of particular interest is determining the weight of baggage which may be excessive.
- Two springs are available for use - one with a stiffness of 500 lb/in, another of 100 lb/in.
- The dimension b is constrained to be less than 4 feet and must be greater than 1.5 ft.; $1.5 < b < 4$ ft.

Your boss wants to see a *non-dimensional analysis* justifying your choice of spring and of cable geometry as well as a figure showing the details of the scale against which the position of the pointer is read.

If you use a spread sheet, and this is encouraged, you are to label all columns on your print out of same and indicate units, if needed.

Due at the start of class on Wednesday, 22 September.