ENAE 788X PROBLEM SET 2 – FALL, 2014

HANDED OUT 10/28/14 – DUE 11/11/14

You are to do the preliminary design of a small rover, which is intended to follow astronauts around and provide video coverage of their activities on the moon. The payload of the rover is a rectangular box 0.5 m wide by 0.75 m long by 0.25m tall. At the center of the box is a 3 m tall mast with cameras and antennae. The payload has a total mass of 50 kg, and the center of gravity is 1 meter above the bottom of the box on the centerline.

Your task is to create a mobility platform to carry this payload. Your mobility requirements include:

- Minimum top speed of 10 km/hr on level ground
- Ability to travel at 5 km/hr up 15^o slope
- Statically stable on 30^o slope in any orientation
- Able to traverse 30 cm obstacles

(1) Use the static stability criteria to select the lateral and fore-aft position of the wheels

(2) Given your answer to (1), what slope could you handle safely if braking downhill at 2.5 m/sec^2?

(3) If driving laterally across a 15^o slope, what is the maximum velocity at which you could turn along a 10 m radius uphill?

(4) Assume that the mass of a wheel is proportional to the volume of the wheel. For a four-wheeled system, find the wheel diameter and width to provide non-negative drawbar pull at minimum mass. (Note: this will be an approximate numerical optimization)

(5) Find the steering angles versus turn radius down to a zero-length turn

(6) Find suitable values for springs and damper parameters for an independent suspension system.

(7) Do a nice sketch (CAD preferred, but clean hand sketching is acceptable) of your rover design

I plan to add some additional details, and perhaps another question or two, in the next couple of days. In the meantime, you can get started on this.