

TAM 674

Applied Multibody Dynamics

Spring Term 2003, Mon & Wed 10:10-11:00, 202 Thurston Hall, 3 credits.

Homework assignment 8

Consider a planar four-bar mechanism with a crank of length $a = 0.18$ m, a connecting bar $b = 0.45$ m, and an output rocker $c = 0.45$ m. The fixed base length is $d = 0.7$ m. The connecting bar and the output rocker are modeled by slender rigid bars with a uniformly distributed mass of respectively 5 kg and 8 kg. The mass of the rigid crank can be neglected whereas the moment of inertia is 140 kgm^2 . The initial angular velocity of the crank is 2π rad/s CCW with the crank in the upright position and the output rocker to the right rotating in the same sense from an upright position. We assume no friction and zero gravity.

Determine the motion of the mechanism by numerical integration of the equations of motion. Derive these equations by using the method of coordinate partitioning. Use the orientation of the crank as the independent coordinate for the problem. Try not to derive the equations of motion in an explicit form but evaluate your equations step by step.

- a. Describe your algorithm in words and formula's.

Show for one revolution of the crank as a function of time:

- b. The angular speed of the crank.
- c. The angular speed of the output rocker.
- d. The angular speed of the connecting bar with respect to the angular speed of the output rocker.
- e. The normal force and the shear force as exerted by the connecting bar on the crank.

Briefly discuss your results.