MEEG 301-18f

Machine Design – Kinematics

Homework #8 – Kinetics of Mechanism

One hardcopy due by noon on 11 December in the drop box located in 131 SPL. For Problem 2 below, use MATLAB to solve the systems of equations, ***and do NOT*** *use the software provided in the book. All calculations are to be turned in, along with screenshots of your M code and the output window where appropriate. Additionally, upload your M code file(s) to Canvas by midnight on 11 December.*

1. Figure 1 shows a very common two-link cooperative robotic elbow manipulator used in manufacturing and made by Robotiq. The middle size in Figure 1 is the same robot currently being used by a Senior Design team working with Agilent Technologies in Wilmington, DE. The robot is grounded at the bottom and the wrist is attached to the free end of the link chain. Assuming there is a force acting at the tip of the second link oriented at a 270 degree angle w.r.t the positive x-axis, model this robot as a two link chain, and ignore the mass of the gripper. Draw the free body diagram for each link taken separately and write out the equations of motion for each link, assuming there is a torque, T, applied to link 2 about the ground point. You do not have to solve for any of the forces or torques!

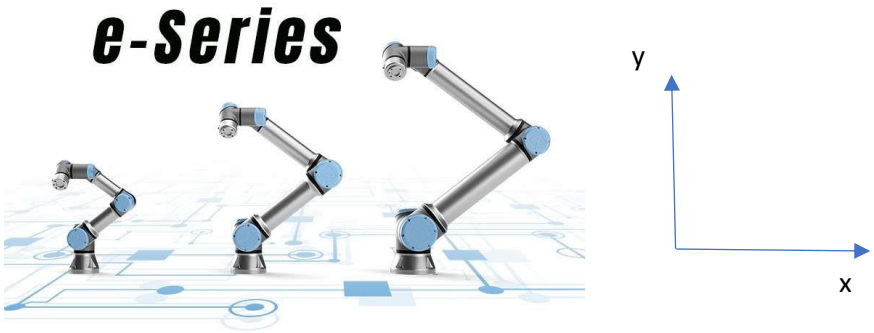

Figure 1. E-series cooperative robot made by Robotiq (www.robotiq.com)

2. Solve Problems 11-5 and 11-6 in the book using data row a. Perform all calculations for these two problems using Matlab.

3. For Problem 11-5, also determine the total magnitude and direction of the shacking force and moment acting on the ground. Use of MATLAB is optional for this problem.

4. Use the W.L. Gore presentation on Canvas (given in class on 29 November) regarding the bobbin winder cam drive system (slides 17 thru 27) to explore the following design issue.

Based on the performance of the system running at 480 RPM, Gore may want to increase production by increasing the operating speed of the servomotor (i.e. the input angular velocity) to 600 RPM. Would this speed increase result in cam jump (float) for the current design? Also, what changes would you recommend to the system to insure at least 1 lb_f is exerted on the cam throughout the duty cycle while keeping maximum cam force as low as possible? Limit your system modifications to the compression spring (i.e. preload and/or stiffness) and/or the mass of the cam follower.

Show all work to prove if cam jump will occur, and all work regarding recommended changes to the system.