

Submit paper copies of your solution and email the codes to the instructor and the TA.

Question 1 (30 points + 20 extra points as bonus)

Choose a compliant gripper design from <https://mecheng.iisc.ac.in/m2d2/CMcollection/>. There are 19 of them there. Each student should choose a different one. You are to analyze the mechanical advantage (MA) of the gripper.

- (a) Draw the $k_{ci} - k_{co} - n$ diagram for the chosen compliant gripper as it undergoes large displacements. Use the nonlinear beam FEA code to generate the data. Apply force that is large enough to close the gap completely. Superimpose on the same diagram the $k_{ci} - k_{co} - n$ obtained using the linear FEA code. Comment on the differences between the two.
- (b) Draw MA1 and MA2 graphs for the compliant gripper you have chosen using finite element analysis (Matlab linear beam code that gives reaction forces). Superimpose the same obtained using the SL parameters (both linear and nonlinear)
- (c) Draw also MA3 for the compliant gripper using Matlab linear beam code. Superimpose the same obtained using the SL parameters (both linear and nonlinear). What is the MA sensitivity of your gripper to workpiece stiffness?
- (d) 10 Extra points if you also analyze MA1 and MA2 using COMSOL Multiphysics software using linear and geometrically nonlinear options.
- (e) 10 extra points if you get $k_{ci} - k_{co} - n$ using COMSOL and compare with what you got using the Matlab codes.