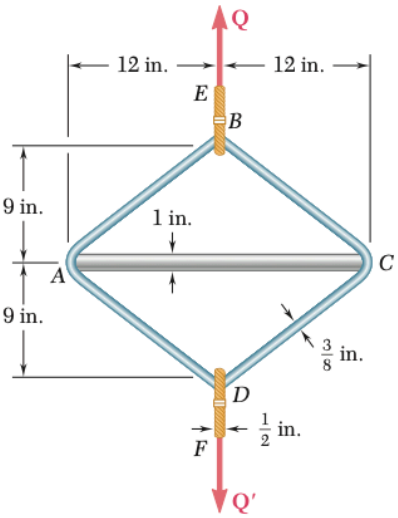
Assignment #2 - Computational Assignment to understand the vairance in a problem.

The purpose of this assignment is to develop a computational tool that can analyze a multi-member system subjected to various real-world scenarios. The tool will allow for the input of different material properties, geometries, and loading conditions, making it a versatile solution for solving problems involving the mechanics of materials.



PROBLEM 1.37

A steel loop *ABCD* of length 5 ft and of $\frac{3}{8}$-in. diameter is placed as shown around a 1-in.-diameter aluminum rod *AC*. Cables *BE* and *DF*, each of $\frac{1}{2}$-in. diameter, are used to apply the load **Q**. Knowing that the ultimate strength of the steel used for the loop and the cables is 70 ksi, and that the ultimate strength of the aluminum used for the rod is 38 ksi, determine the largest load **Q** that can be applied if an overall factor of safety of 3 is desired.

Part 1
Attached is a detailed problem outlining a multi-member structural or mechanical system. Your task is to create a computational code that can solve for stresses, applied loads and safety factors within each member under various conditions. The tool should be robust, adaptable, and user-friendly to accommodate a range of potential applications. It should be able to share your output as a screen shot in a pdf file (or something similar) for the scenarios listed below.

Part 2
Use the code to solve the initial problem given as 1.37 above.

Part 3
Assess the sensitivity of the solution by varying the applied load solved for in part 2 by + and - 1% and recording the % change in the safety factors of each of the members.

Part 4
Assuming that you would like to be efficient with the materials that you are using, adjust the geometry of any of the members of the problem to ensure that all members have a safety factor of approximately 2.5, thereby ensuring that you are not over designing any part of the structure.

Part 5
Assuming that the central members (the steel chord, ABCD, and the aluminum bar, AC) are encased within a welded container, propose a saftey factor required for each member of the problem to ensure that failure occurs outside of the encased structure and in the BE and DF members. Create a geometry to match the proposed safety factors and solve for their values.

Part 6
Repeat part 4, but change the materials of the bar AC to steel with an ultimate strength of 70 ksi.