

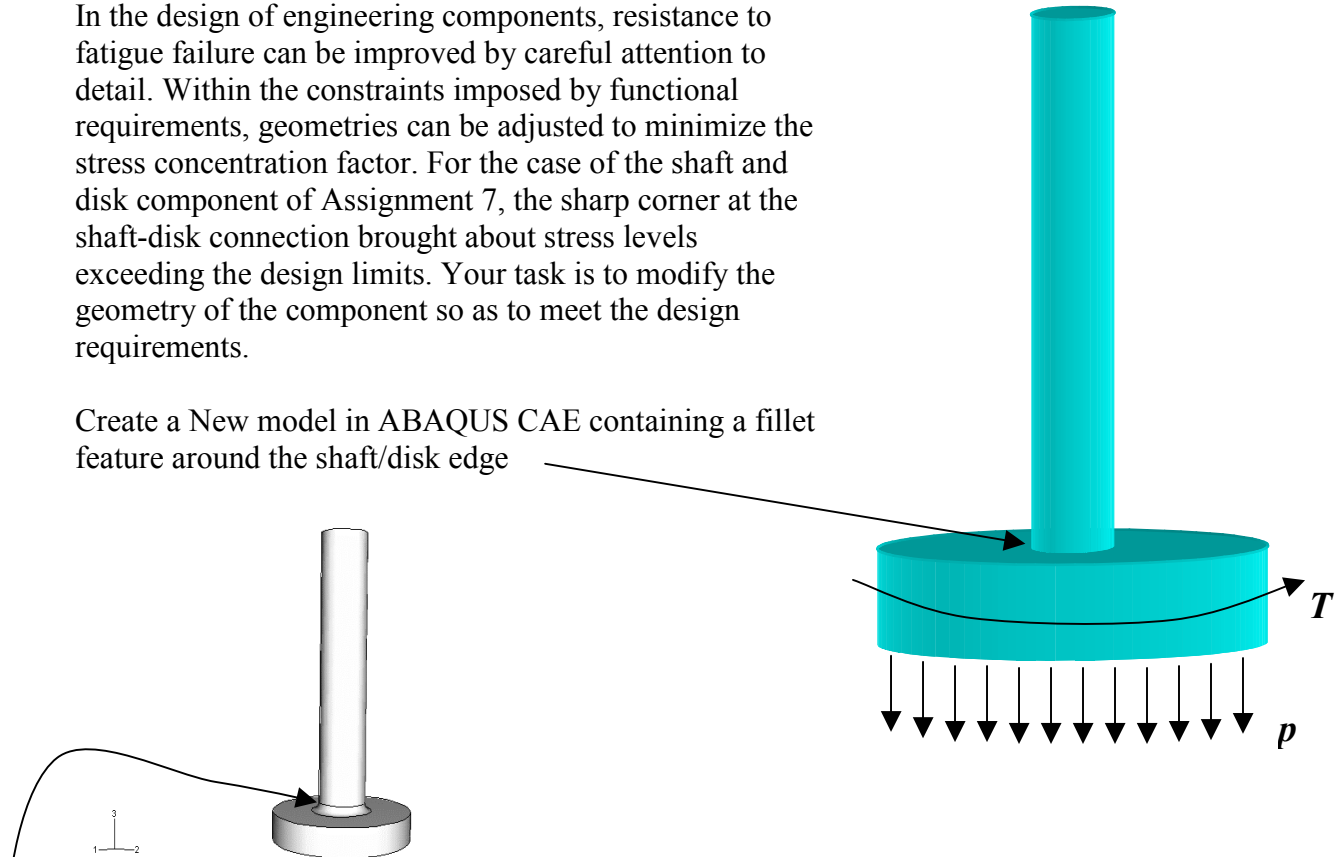
2.31 Project 2 Designing to avoid fatigue failure

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Due October 24

In the design of engineering components, resistance to fatigue failure can be improved by careful attention to detail. Within the constraints imposed by functional requirements, geometries can be adjusted to minimize the stress concentration factor. For the case of the shaft and disk component of Assignment 7, the sharp corner at the shaft-disk connection brought about stress levels exceeding the design limits. Your task is to modify the geometry of the component so as to meet the design requirements.

Create a New model in ABAQUS CAE containing a fillet feature around the shaft/disk edge



The best way to avoid complications is to start from the beginning with a new part. After you created the shaft-disk part, use the Shape→Blend→Round/Fillet tool to create a fillet around the shaft-disk edge. Choose a fillet radius that seems reasonable. Now continue as in the assignment, but you will have to do some extra work to partition the part in order to mesh it. In particular, you will have to create an additional cut plane at the neck of the fillet, and partition the fillet from the rest of the shaft. You will have to define a datum axis parallel to the 3-axis, and then you can create the datum plane by defining a point (on the fillet neck) and normal (your 3-datum axis). This should let you create the mesh. After you are done partitioning (plate/shaft, shaft/fillet, XZ plane, YZ plane) seed the part (0.5) and create the mesh using linear full integration elements.

Study the effects of changing the fillet radius (plot $\sigma_{1\max}$ Vs fillet radius), and obtain a good estimate of the minimum fillet radius necessary to meet the design requirements.

Notice that when you conduct your study, you do not need to repeat every step of creating the model every time you change the fillet radius:
Just go to the part module, and choose Feature→ Edit. Click on the fillet (or choose the fillet (round 1) from the feature list that appears when you click the corresponding **Feature List** button on the right of the dialog window). Now you simply change the fillet radius, go to the mesh module and click on **the mesh part instance** icon to regenerate the mesh. Everything else (loads, BC, properties...) should still be fine and you do not need to change anything. Just rerun the job.

Both teams should conduct this study and write a short report on the results.

For the presentations, I would like to have:

Team 2 presenting and discussing Assignment 7 + showing the class how you create a fillet feature on the model and mesh it.

Team 3 showing the class how you run a parametric study, and discussing the results of the study on changing fillet radius.