Shanghai Electric 2 Generator Retaining/Center Ring Redesign

Overview
Operating commercial power plants require the use of large generators to convert rotational energy into usable electric power. Large generator rotors require a retaining and centering assembly to ensure reliable performance. Under constant stress, these assemblies can be very expensive to design and produce.

Objectives
The objective of the project was to reduce the cost of the generator rotor retaining/center ring assembly.

Approach
- Concepts were generated to help identify possible areas of interest in the assembly.
- AutoCAD and Solidworks software were used to illustrate different concepts.
- By recommendation of the sponsor, certain concepts were selected as possible solutions.
- A concept was selected to move to the analytical phase of design.
- Because the assembly was so large, a physical prototype and test fixture were determined to be outside of the feasibility limits of the project.
- As an alternative to a physical prototype and test fixture, the chosen concept was subjected to intense Finite Element Analysis (FEA).
- To simulate real service operation conditions, the FEA analysis tested the assembly at 0, 3000, and 3600 rpm.
- Multiple concepts were tested in ANSYS to determine highly stressed regions.
- The ANSYS results showed that the existing design yielded the lowest stress concentrations.
- Hand calculations and ABAQUS FEA software were used in addition to ANSYS to verify the results.

Outcomes
As the project progressed, the group determined that using the existing retaining/center ring geometry the width of the center ring could be modified to optimize and ultimately reduce the stresses in the assembly:

- The new center ring thickness was determined to be 38 mm.
- The new center ring reduces the amount of material used by 21%.
- The new design features a lower stress than the existing design.