Title: CRACK GROWTH ANALYSIS OF COMPRESSOR BLADES

Ref: BLADE2

Type: Individual

Vacancy: 1 student

Duration: 1 semester

Project Description:

Structural analyses of rotating machinery are quite common in power generation (gas and steam turbines), as well as in aviation industry (aircraft jet engines). Typical designs of this nature exist in compressors and turbines. One important design criterion in any compressor/turbine blade design is to ensure that low cycle fatigue (LCF) due to start up and shut down of the rotating machinery does not cause crack growth and consequent failure of the part. The purpose of this project is to perform a low cycle fatigue and fracture mechanics crack growth analysis of one specific compressor/turbine blade design. The subject design analyses will be conducted using commercially available finite element code ANSYS, drafting tool SolidWorks, and the basic theory of fracture mechanics. The crack propagation can be approximated/simulated using this theory in a MS Excel spreadsheet, Mathcad, or Matlab, as necessary.

Work Description:

1. Literature survey on various jet engine or gas turbine compressor blade designs, the theory of LCF, crack growth, and fracture mechanics.
2. Create a 3-D compressor blade model using drafting software SolidWorks.
3. From the 3-D model, create a finite element (FE) mesh in ANSYS.
4. Using FE mesh, material properties, and boundary conditions, obtain ANSYS plastic solution for stress distribution throughout the blade.
5. Perform crack growth analysis using basic principles of fracture mechanics. Analysis will be conducted in MS Excel spreadsheet to determine the number of cycles before failure.

Qualifications and Skills:

1. Solid knowledge of LCF and crack growth analysis using theory of fracture mechanics.
2. Intermediate-level experience in use of ANSYS code for finite element analysis and SolidWorks for 3-D drafting.
**Important note:** students without any significant knowledge and experience in using both ANSYS and SolidWorks should not apply for this project.