Oakland University student develops dynamic stress model to optimize stresses at brazed joints for engines high pressure fuel pipe

The Oakland University and School of Engineering and Computer Science communities are invited to attend Issam Mashal's defense of his Ph.D. dissertation. Seating is limited. RSVP with Katie Loodeen at loodeen@oakland.edu.

ANALYTICAL AND EXPERIMENTAL STUDY OF HIGH PRESSURE FUEL PIPE BRAZED JOINTS AND OPTIMIZATION PROCESS WITH TUNED MASS DAMPER

Committee: LianXiang Yang, Ph.D., (Chair), Randy Gu, Ph.D., Jing Tang, Ph.D., Turgay Bengisu, Ph.D.

Time: **9:30 – 11:30 a.m.**
Date: **Friday, October 5th, 2018**
Location: **347 EC**

A V6-engine high pressure fuel pipe experienced several failures during dyno high speed engine durability validation test at brazed joints primarily due to dynamic engine vibration loads. The braze fillet experiences high local stress concentration with large gradients and it was critical to test strain and contour at this joint to properly understand the failure and propose solutions. A whole field optical experiment method Digital Image Correlation (DIC) was utilized to successfully test strain and contour at area of interest and results feedback to validate and calibrate Finite Element Analysis (FEA) and optimize design was developed to propose a solution

In this dissertation, a process combining experimental testing and analytical simulation has been developed to measure and analyze the strain contour at braze fillets and a new design was optimized to reduce stresses significantly at braze joints. The experimental and simulation results matched very well and validated the FEA model, which was used to run many analytical iterations and optimize a new design utilizing tuned mass damper (TMD). The new design reduced dynamic stress by ~ 63% and resolved the braze failure issues. The detailed experimental and simulation procedures are demonstrated and the results are also analyzed and correlated for baseline and optimized designs.