Title:

In turbomachinery, a common failure mode is cracking of welds at the equipment and piping connection point. Each incidence of these cracks cause a forced shutdown to perform repairs that cost millions of dollars. This type of failure is predominately seen in small bore piping, which has a nominal diameter of 2 inches and smaller. This thesis addresses the failure prediction analysis of small bore piping, specifically in turbomachinery applications. Performing failure analysis to predict the potential cracking of welds will allow for replacement of the piping during a planned shutdown which in the long term saves money due to costs such as expediting materials, overtime pay, and extended downtime. This analysis uses real-world applications of a chemical plant in Louisiana. The piping analyzed was connected to centrifugal compressors and steam turbines. The data used from these pieces of equipment included the material of construction, the piping schedule, lengths, nominal diameter, and running speeds. Based on research that shows welding the connection point with a full penetration weld greatly increases the life expectancy of the connection, this thesis uses full penetration welds in the analysis. The piping was analyzed using the software ANSYS to perform a finite element analysis, specifically examining the stress and strain due to the induced harmonic forces and structural velocities. The expected minimum life, based on vibration cycles, was also predicted and reported. It is a common fact that having fewer supports on a vibration pipe induces greater stresses and strains on the weld connections. Furthermore, supports installed closer to the equipment show exceptionally greater life expectancy than that of a supports only a foot further away. Tables are developed to relay the expected time to failure of the welds based on the location of the support and the observed amplitudes of vibration in the field.

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The public is welcome to attend.