Predicting the damping associated with underplatform dampers remains a challenge in turbomachinery blade and friction damper design. Turbomachinery blade forced response analysis methods usually rely on nonlinear codes and reduced order models to predict vibration characteristics of blades. Two academic blade geometries coupled with underplatform dampers are presented here for comparison of these model reduction and forced response simulation techniques. The two blades are representative of free-standing turbine blades and exhibit qualitatively similar behavior as highly-complex industrial blades. This thesis fully describes the proposed academic blade geometries and models; it further analyzes and predicts the blades’ forced response characteristics using the same procedure as industry blades. This analysis classifies the results in terms of resonance frequency, vibration amplitude, and damping over a range of aerodynamic excitation to examine the vibration behavior of the blade/damper system. Additionally, the analysis investigates the effect variations of the contact parameters (friction coefficient, damper/platform roughness and damper mass) have on the predicted blade vibration characteristics, with sensitivities to each parameter. Finally, an investigation of the number of modes retained in the reduced order model shows convergence behavior as well as providing additional data for comparison with alternative model reduction and forced response prediction methods.

Major: Mechanical Engineering

Educational Career:
Bachelor's of Mechanical Engineering, BS, 2015, University of Central Florida

Committee in Charge:
Jeffrey L. Kauffman, Chair, Mechanical & Aerospace Engineering
Yuanli Bai, Mechanical & Aerospace Engineering
Ali Gordon, Mechanical & Aerospace Engineering

Approved for distribution by Jeffrey L. Kauffman, Committee Chair, on April 28, 2017.

The public is welcome to attend.