

## ME 459/659 Sound & Vibration Measurements – Spring 2019

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Thursday, April 11 2019  
5:30-6:45 pm JCAIN 206

# Investigation of a Rotordynamic Instability in a High Pressure Centrifugal Compressor Due to Damper Seal Clearance Divergence

by

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### Abstract

The case study describes a rotordynamic instability resulting from excessive distortion of a honeycomb damper seal under high differential pressure in a centrifugal compressor and the corrective action. A strong negative stiffness can result, dropping the first natural frequency into a region of negative effective damping. The paper shows the need to manage seal clearance profile and inlet swirl to avoid this condition, and to optimize damper seal contribution to stability. The paper presents predicted seal distortion, resulting dynamic characteristics, and their influence on rotor stability. Field vibration data confirm that seal distortion under pressure can cause damaging, self-excited sub-synchronous vibrations, and that an appropriate seal clearance profile predictably corrects this condition. The case study shows that optimum stability requires uniquely different clearance profiles for low and high-pressure compressors.

### Presenter Bio



Dr. Jeffrey Moore is an Institute Engineer in the Machinery Section at Southwest Research Institute. He holds a B.S., M.S., and Ph.D. in Mechanical Engineering from Texas A&M University. His professional experience over the last 28 years includes engineering and management responsibilities related to centrifugal compressors and gas turbines at Solar Turbines Inc. in San Diego, CA, Dresser-Rand in Olean, NY, and Southwest Research Institute in San Antonio, TX. His interests include advanced power cycles and compression methods, rotordynamics, seals and bearings, computational fluid dynamics, finite element analysis, machine design, controls and aerodynamics. He has authored over 40 technical papers related to turbomachinery and has three patents issued and two pending. Dr. Moore has held positions as the Vanguard Chair of the Structures and Dynamics Committee and Chair of Oil and Gas Committee for IGTI Turbo Expo, and the Associate Editor for the Journal of Tribology. He is also a member of the Turbomachinery Symposium Advisory Committee, the IFToMM International Rotordynamics Conference Committee, and the API 616 and 684 Task Forces. Dr. Moore is the principal investigator of the DOE Sunshot program described in this paper.