DYNAMIC CHARACTERISTICS OF LARGE HIGH-SPEED RECIPROCATING COMPRESSOR SYSTEMS

by:

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This paper presents and illustrates the dynamic characteristics of high-speed reciprocating compressors of higher size and horsepower using measured and predicted data. It also describes and demonstrates the analyses necessary to ensure dynamic integrity of these compressors and their systems. High-speed compressor products have been increasing in size and power, with a corresponding decrease in acoustic and mechanical natural frequencies, and an increase in the frequency at which strong excitation energy exists. This paper characterizes these natural frequencies, their mode shapes, and their response to excitation. The paper shows the role of three-dimensional (3D) shell modeling in correctly predicting important mechanical modes. The paper shows the capabilities and limits of plane-wave acoustics, and where 3D acoustics is needed to predict non-planar modes. The paper identifies the existence of a system mode in which the entire compressor system rotates about a central vertical axis, and a cylinder stretch mode where the cylinder moves along the cylinder axis. The paper shows how 3D finite element analysis can predict these modes, and how these modes respond to excitation from gas loads. Finally, the paper summarizes the process of analysis necessary to ensure avoidance of high amplitude torsional response of the engine-driver system.