API Standard Paragraphs Rotordynamic Tutorial: Lateral Critical Speeds, Unbalance Response, Stability, Train Torsionals, and Rotor Balancing

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Suggested revisions are invited and should be submitted to the Standards Department, API, 200 Massachusetts Avenue, Suite 1100, Washington, DC 20001, standards@api.org.

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1 Scope

1.1 Introduction

This document is intended to describe, discuss, and clarify the API Standard Paragraphs (SP) Section 6.8 which outlines the complete lateral and torsional rotordynamics and rotor balancing acceptance program designed by API to ensure equipment mechanical reliability. Background material on the fundamentals of these subjects (including terminology) along with rotor modeling utilized in this analysis is presented for those unfamiliar with the subject.

The standard paragraphs are introduced with references to the appropriate background material to enhance the understanding. This information is intended to be a primary source of information for this complex subject and is offered as an introduction to the major aspects of rotating equipment vibrations that are addressed during a typical lateral dynamics analysis. It is not intended to be a comprehensive guideline on the execution of rotordynamics analyses but is intended to:

a) provide guidance on the requirements for analysis;

b) aid in the interpretation of rotordynamics reports;

c) provide guidance in judging the acceptability of results presented.

1.2 Organization

The document is divided into six sections:

1. Overview
2. Lateral Dynamic Analysis
3. Stability Analysis
4. Torsional Analysis
5. Balancing of Machinery
6. Standard Paragraphs

The individual sections have been prepared in a stand alone manner. As a result, necessary material may be repeated in a succeeding section to provide sufficient clarity to the discussion.

Sections two through four have a parallel organization:

— Modeling criteria

— Analysis techniques and results

— Machine specific considerations

— Testing

— Applications and examples