

Compressor Surge and Stall

A thorough survey and analysis of investigations into instabilities in axial and centrifugal compressors, this book provides a resource for engineers and scientists working in compressor design or wishing to gain an up-to-date understanding of the field. It is suggested for compressor designers and users who appreciate the need for understandable surge lines for a wide range of stall-free, surge-free operation.

Concept of Compressor Stability

- Introduction
- Definition of Stability
- Operational Stability
- Aerodynamic Stability
- Surge Line Characteristic

Compressor Stall

- Background
- Axial Compressor Stall
 - Description of Rotating Stall
 - Investigations into Rotating Stall
 - » Progressive Stall
 - » Abrupt Stall
 - » Detailed Axial Compressor Experiments
 - Transient Behavior
 - Flow within Stall Cell
 - Stall Cell Inception
- Centrifugal Compressor Stall
 - Impeller
 - Vaneless Diffuser
 - Vaned Diffuser
- Summary and Closure

Acknowledgments

References

Appendix: Symbols Lists

Stall Correlations

- Introduction
- Axial Compressors
 - Annulus Blockage
 - Cell Number
 - Cell Propagation Velocity
- Centrifugal Compressors
- Closure

Acknowledgments & References

Compressor Surge

- Introduction
- Axial Compressor Surge
- Centrifugal Compressor Surge
- Summary

Acknowledgments & References

Multistage Compressors

- Introduction
- Stage Matching
- Multistage Compressor Performance
 - NACA 10-Stage Axial Compressor
 - Effect of Receiver Volume
 - Dynamics of the Surge Cycle
 - Effect of Transients
 - Multistage Interactions

- Interstage Performance
 - Single-Stage Analogy
 - Summary
 - Stage Interaction Study
 - Additional Multistage Axial Compressor Data
 - NACA 15-Stage Axial Compressor
 - NACA 16-Stage Axial Compressor
 - NACA 8-Stage Axial Compressor
 - Commentary
 - Multistage Centrifugal Compressors
- ### Acknowledgments & References

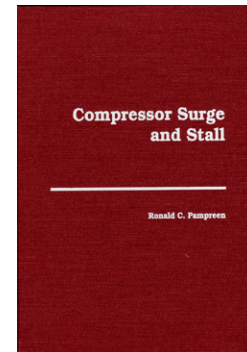
Surge and Stall Theory

- Introduction
- Cell Propagation Speed
 - Emmons Theory
 - Stenning Theory
 - » Effect of Time Delay
 - Marble Theory
 - Kriebel Theory
 - Sears Theory
 - Fabri and Siestrunk Theory
 - Cumpsty and Greitzer Theory
 - Moore Theory

Summary

- Emmons, et al. (1955)
 - » Flow Model
 - » Flow Field Assumptions
 - » Mathematical Approach
 - » Commentary
- Stenning, et al. (1955)
 - » Flow Model and Flow Field Assumptions
 - » Mathematical Approach
 - » Commentary
- Marble (1955)
 - » Flow Model and Flow Field Assumptions
 - » Mathematical Approach
- Kriebel (Stenning and Kriebel, 1958; Kriebel, et al., 1958)
 - » Flow Model and Flow Field Assumptions
 - » Mathematical Approach
 - » Commentary
- Sears (1955)
 - » Flow Model and Flow Field Assumptions
 - » Mathematical Approach
 - » Commentary
- Fabri and Siestrunk (1957)
- Cumpsty and Greitzer (1982)
 - » Flow Model and Flow Field Assumptions
 - » Commentary
- Moore (1984)
 - » Flow Model and Flow Field Assumptions
 - » Mathematical Approach
 - » Commentary

Overall Commentary



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- System Stability
 - Bullock, Wilcox, and Moses
 - Greitzer
 - McQueen
 - Moore and Greitzer
- Stall Cell Prediction
- Stall Inception Prediction
- Stalled Compressor Performance Prediction
- Centrifugal Compressor Instability Analyses
 - Vaneless Diffuser Analyses
 - Impeller Analyses
 - » Axial Compressor Stall Inception - Recent Data
 - » Impeller Stall
 - Surge Line Prediction
 - Closure
- Acknowledgments & References
- Appendix: Symbols Lists

Methods for Extending Stable Operation

- Introduction
- Bleed
 - Axial Compressor Bleed
 - Centrifugal Compressor Bleed
- Variable Inlet Guide Vanes
 - Axial Compressors
 - Centrifugal Compressors
- Other Approaches
 - Diffuser and Rotor Variations
 - Inlet Blockage
 - Casing Treatment
 - Shock Waves
- Twin Spooling
- Closure
- Acknowledgments & References

Bibliography