

# Hydrodynamics of Pumps

This unique text focuses on those special problems and design issues associated with pumps: the potential for cavitation, the damage and vibration problems which result from cavitation, and the possibility of large unsteady flows and forces on the machine. The book provides a coherent and unified treatment of the hydrodynamics of pumps with an emphasis on the underlying physical phenomena. An important reference text for engineers and scientists, it is also appropriate for graduate courses in turbomachinery.

## Introduction

- Subject
- Cavitation
- Unsteady Flows
- Trends in Hydraulic Turbomachinery
- Book Structure

References

## Basic Principles

- Geometric Notation
- Cascades
- Flow Notation
- Specific Speed
- Pump Geometries
- Energy Balance
- Idealized Noncavitating Pump Performance
- Several Specific Impellers and Pumps

References

## Two-Dimensional Performance Analysis

- Introduction
- Linear Cascade Analyses
- Deviation Angle
- Viscous Effects in Linear Cascades
- Radial Cascade Analyses
- Viscous Effects in Radial Flows

References

## Other Flow Features

- Introduction
- Three-Dimensional Flow Effects
- Radial Equilibrium Solution: An Example
- Discharge Flow Management
- Prerotation
- Other Secondary Flows

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## Cavitation Parameters and Inception

- Introduction
- Cavitation Parameters
- Cavitation Inception
- Scaling of Cavitation Inception
- Pump Performance
- Types of Impeller Cavitation
- Cavitation Inception Data

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## Bubble Dynamics, Damage, and Noise

- Introduction
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- Mechanism of Cavitation Damage
- Cavitation Noise

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## Cavitation and Pump Performance

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- Typical Pump Performance Data
- Inducer Designs
- Inducer Performance
- Effects of Inducer Geometry
- Analyses of Cavitation in Pumps
- Thermal Effect on Pump Performance
- Free Streamline Methods
- Supercavitating Cascades
- Partially Cavitating Cascades
- Cavitation Performance Correlations

References

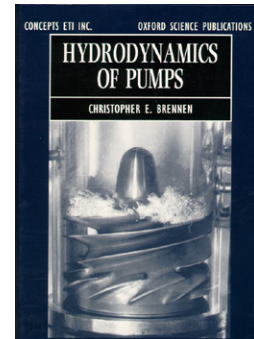
## Pump Vibration

- Introduction
- Frequencies of Oscillation
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- Acoustic Resonances
- Blade Flutter
- POGO Instabilities

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## Unsteady Flow in Hydraulic Systems

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- Wave Propagation in Ducts
- Method of Characteristics
- Frequency Domain Methods
- Order of the System
- Transfer Matrices



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- Distributed Systems
  - Combinations of Transfer Matrices
  - Properties of Transfer Matrices
  - Some Simple Transfer Matrices
  - Fluctuation Energy Flux
  - Non-Cavitating Pumps
  - Cavitating Inducers
  - System with Rigid Body Vibration
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## Radial and Rotordynamic Forces

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