# SELECTED TOPICS

# In Aerospace Engineering

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IIUM Press

INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA

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Published by:
IIUM Press
International Islamic University Malaysia

First Edition, 2011


Perpustakaan Negara Malaysia Cataloguing-in-Publication Data

ISBN: 978-967-418-145-1

Member of Majlis Penerbitan Ilmiah Malaysia – MAPIM
(Malaysian Scholarly Publishing Council)

Printed by :
**IIUM PRINTING SDN.BHD.**
No. 1, Jalan Industri Batu Caves 1/3
Taman Perindustrian Batu Caves
Batu Caves Centre Point
68100 Batu Caves
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# *COMPRESSOR MODELS*

The prediction of the compressor behavior during rotating stall requires a 2D mass flow description. Due to system hysteresis effect, the recovery from rotating stall is usually difficult. This explains the interest in predicting rotating stall for compressors.

## 6.1 Moore Model

Moore (Moore, 1984) developed a theoretical framework for analysis of rotating stall in multi-stage axial compressors. It describes the kinematic features of full-span stall and formulates conditions under which a traveling wave can exist even though upstream and downstream static pressure is constant. He did not study rotating stall inception. Rotating stall is seen as an eigenmode of the system with wavelength $\pi D/n$ where $n$ indicates the number of stall cells and $D$ is the mean compressor diameter. The stalled region is modeled as a steady flow disturbance in a reference frame which is fixed to the stall cell and moves with propagation speed $f\ U$. In addition, the following assumptions are done:

- Compressor has a constant speed characteristic.
- The static pressure rise in a rotor or stator row is given by:

$$\frac{\Delta p}{\frac{1}{2}\rho U^2} = F(\phi) - \tau(\phi)\,\dot{\phi} \tag{6.1}$$

  where $F(\phi)$ is the quasi-steady pressure rise of a row and $\tau(\phi)\,\dot{\phi}$ accounts for hysteresis effects.
- Negligible radial effects.
- Incompressible flow in the entire system.
- Uniform flow upstream of the compressor.