University of Diyala
College of Engineering
Mechanical Engineering Dep
Class: Third Class

Lecture-4

Turbomachinery

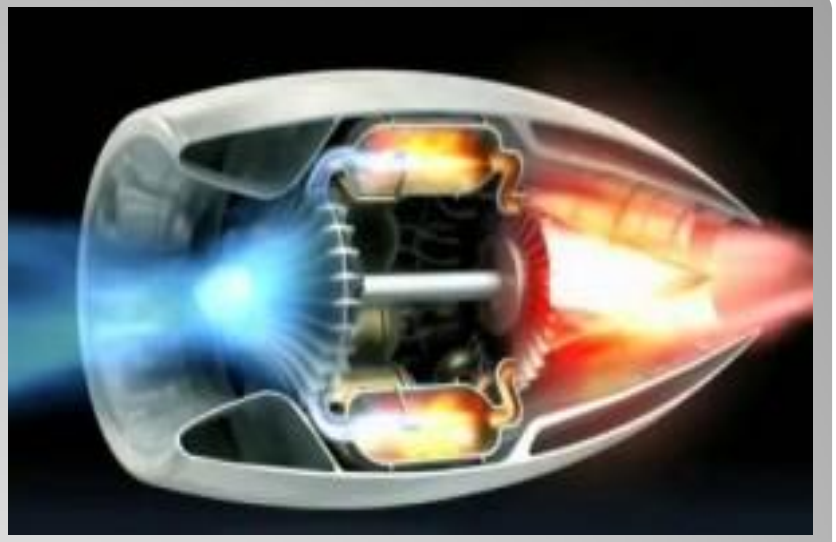
AXIAL FLOW COMPRESSORS AND FANS

By
Assistant Lecturer
Layth Abed Hassnawe

Introduction

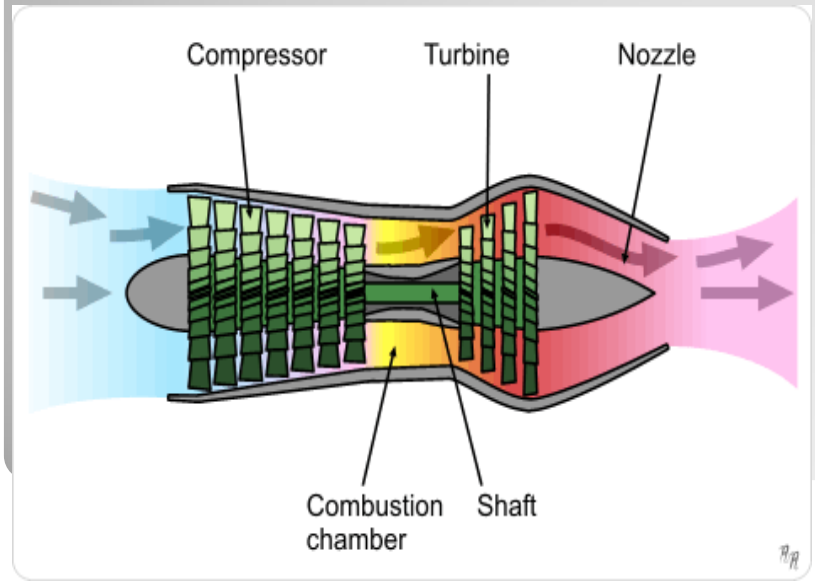
An axial compressor is a pressure producing machine. It is a rotating, airfoil-based compressor in which the working fluid principally flows parallel to the axis of rotation. This is in contrast with other rotating compressors such as centrifugal compressors, axial-centrifugal compressors and mixed-flow compressors where the air may enter axially but will have a significant radial component on exit.

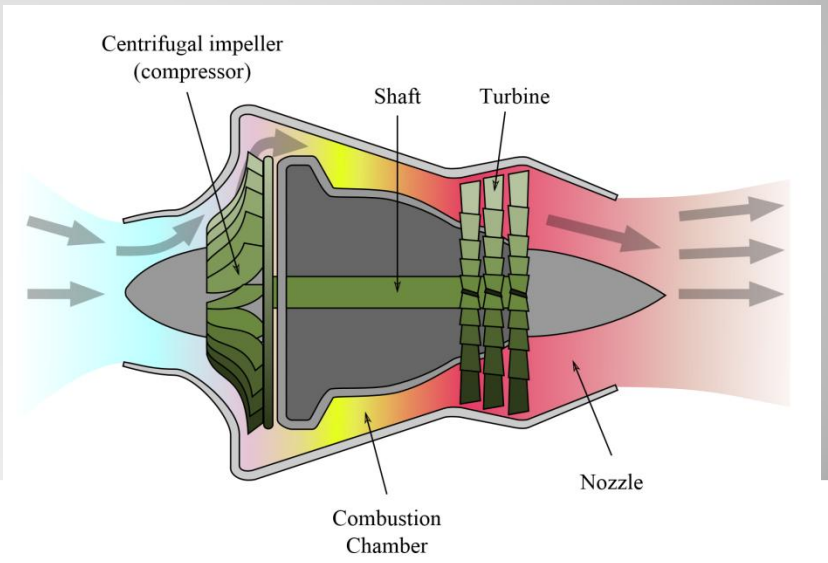
Type of application	Type of flow	Pressure ratio per stage	Efficiency per stage
Industrial	Subsonic	١,٢–١,٠٥	%٩٢–%٨٨
Aerospace	Transonic	١,٦–١,١٥	%٨٥–%٨٠
Research	Supersonic	٢,٢–١,٨	%٨٥–%٧٥

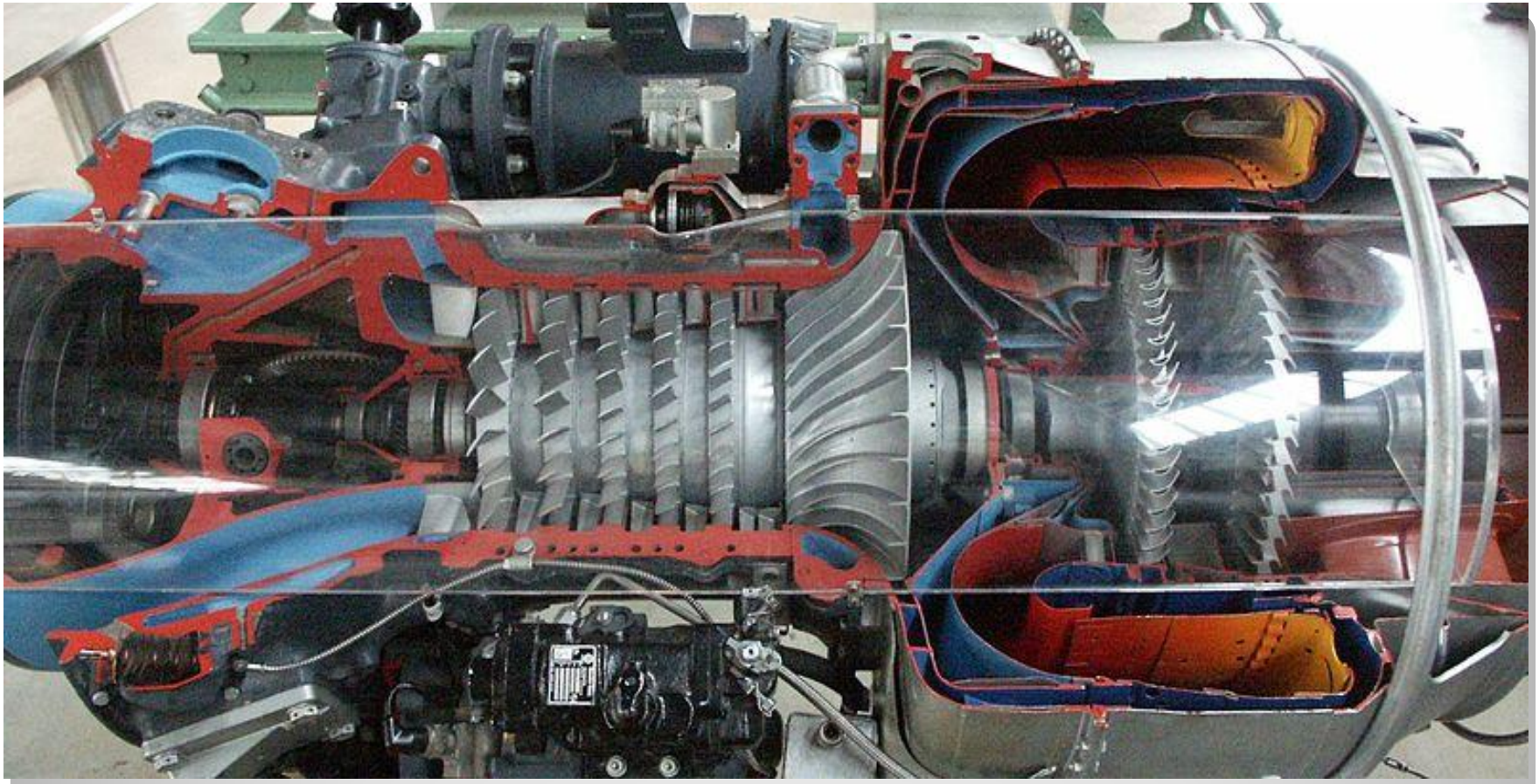


axial-centrifugal compressors

centrifugal compressors



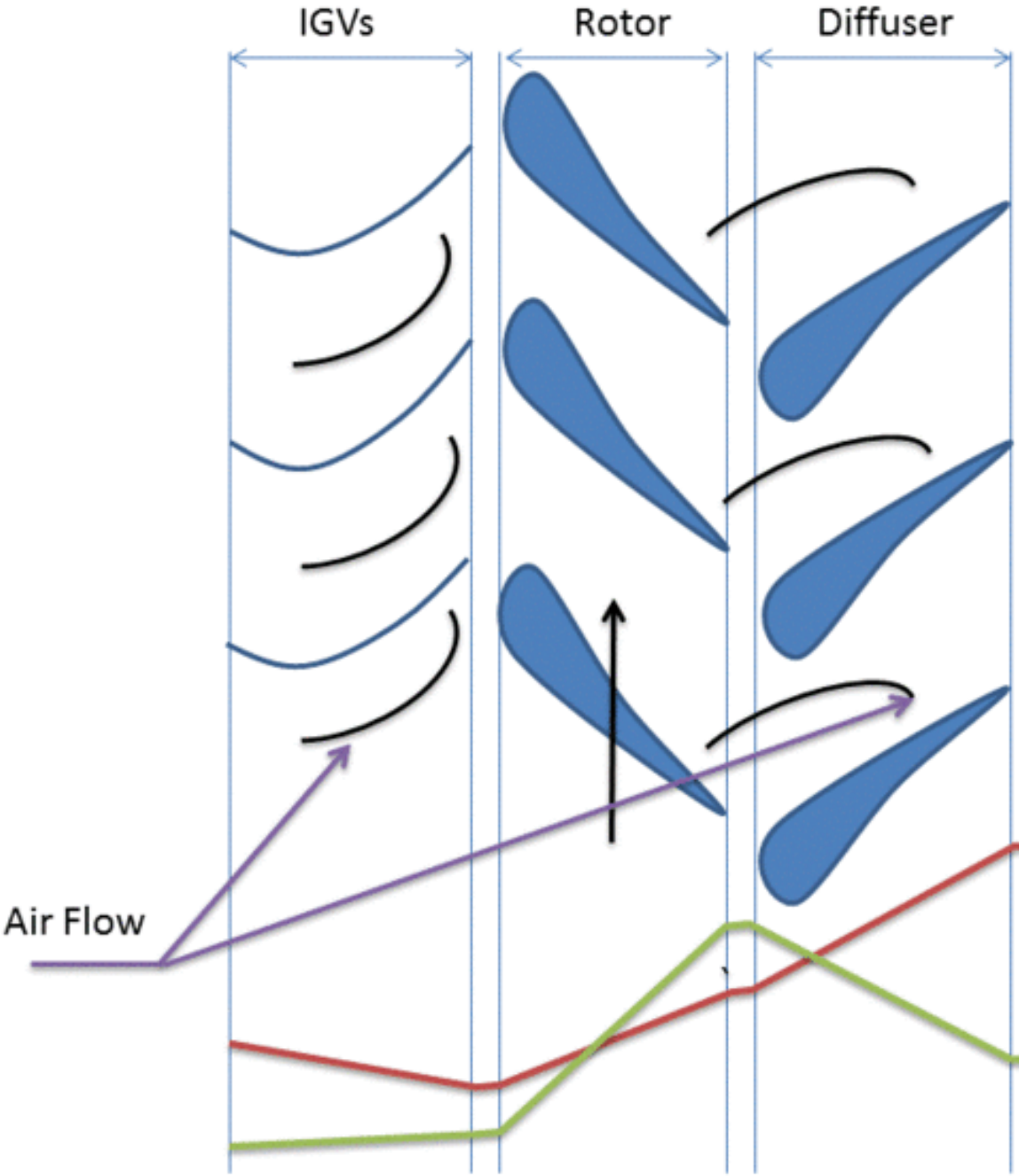


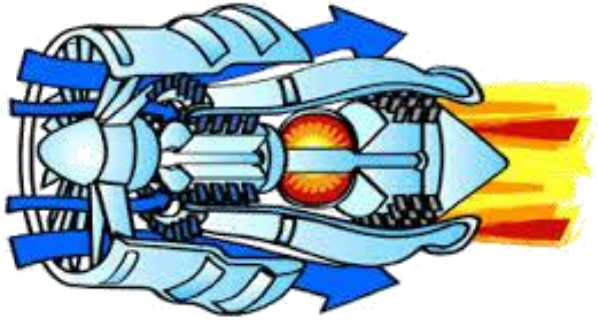


mixed-flow compressors

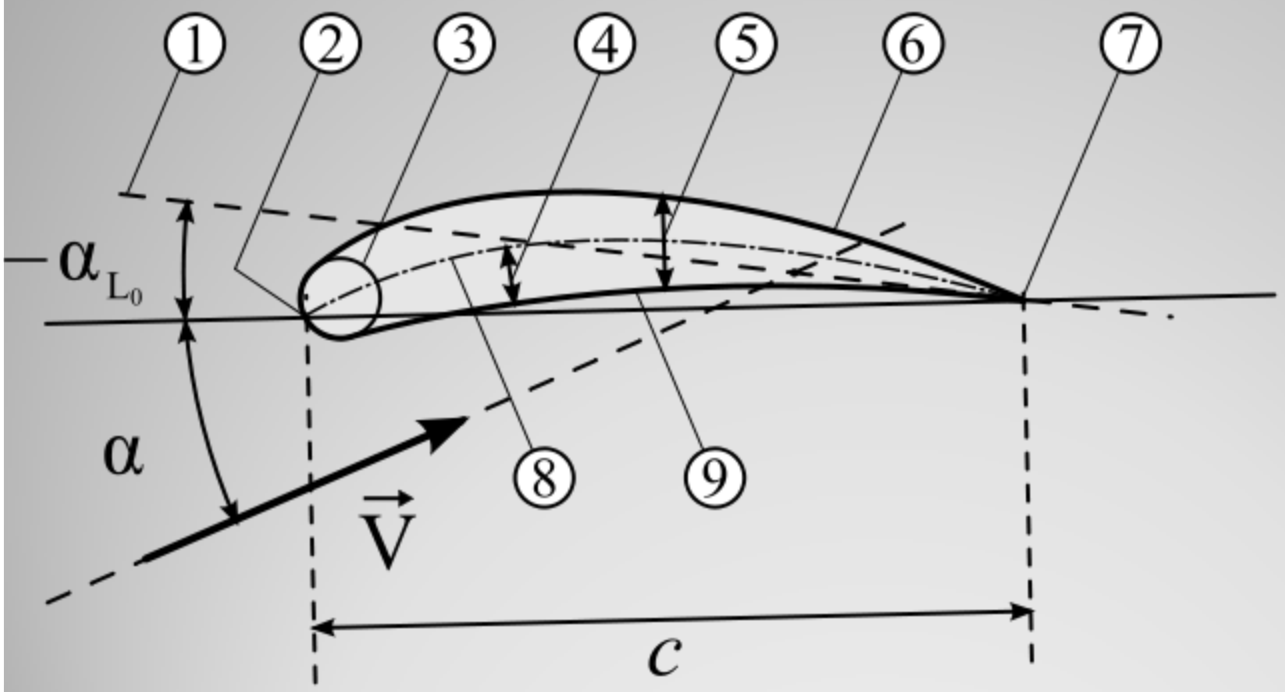
Antonov An-225 *Mriya*

Axial-flow Compressor

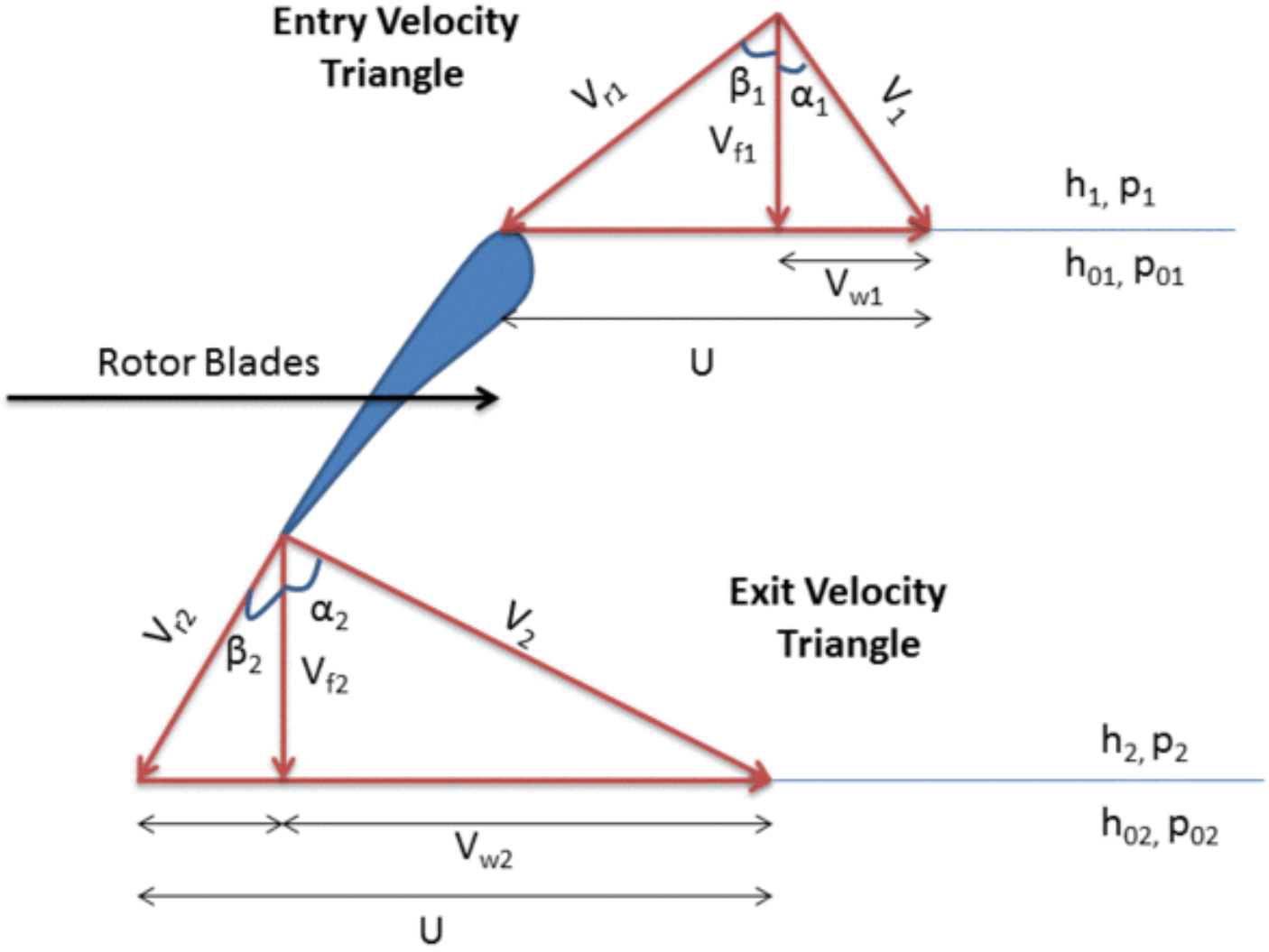




Aerofoil Geometry



1: zero lift line
2: leading edge
3: nose circle
4: camber
5: thickness
6: upper surface
7: trailing edge
8: main camber line
9: lower surface


Entry Velocity Triangle
V_{r1}
β_1
α_1
V_1
V_{f1}
h_1, p_1
h_{01}, p_{01}
V_{w1}
U
Rotor Blades
Exit Velocity Triangle
V_{r2}
α_2
β_2
V_2
V_{f2}
h_2, p_2
h_{02}, p_{02}
V_{w2}
U

V_1 and V_2 are the absolute velocities at the inlet and outlet respectively.

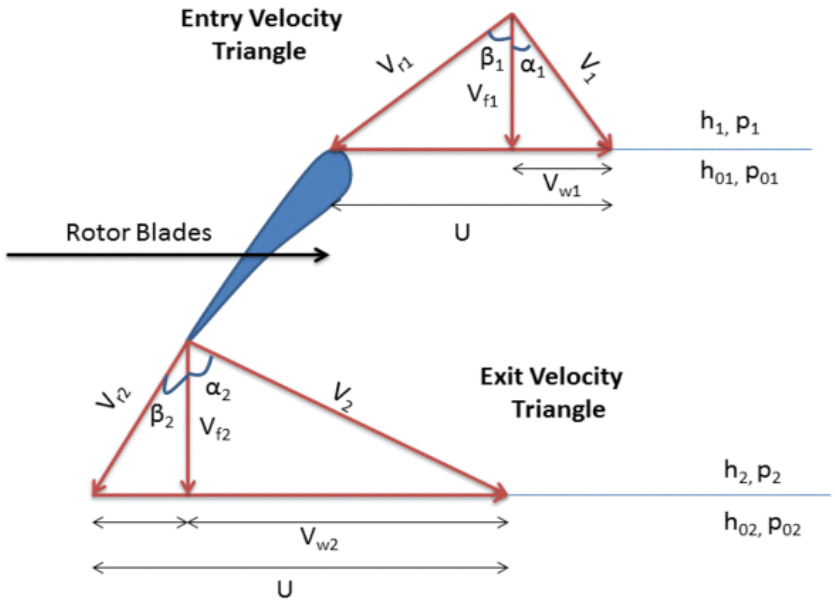
V_{f1} and V_{f2} are the axial flow velocities at the inlet and outlet respectively.

V_{w1} and V_{w2} are the swirl velocities at the inlet and outlet respectively.

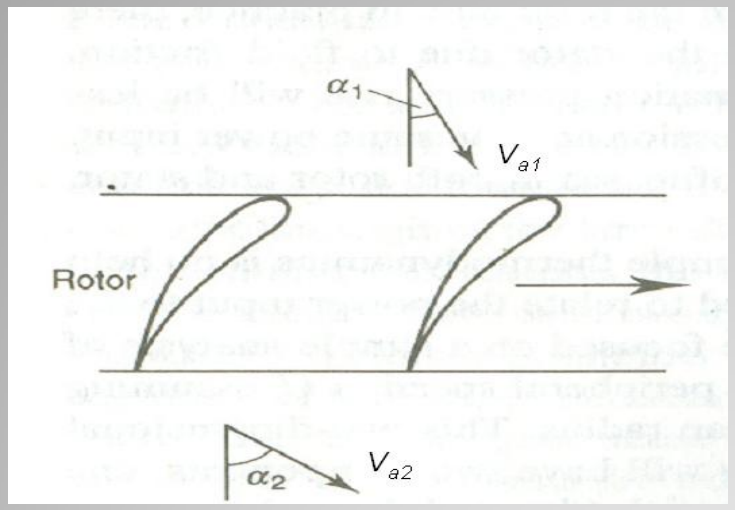
V_{r1} and V_{r2} are the blade-relative velocities at the inlet and outlet respectively.

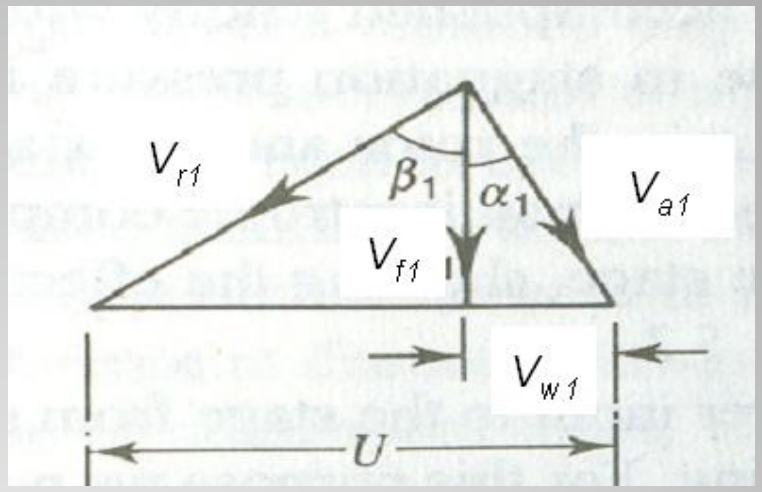
U is the linear velocity of the blade.

α is the guide vane angle and β is the blade angle.

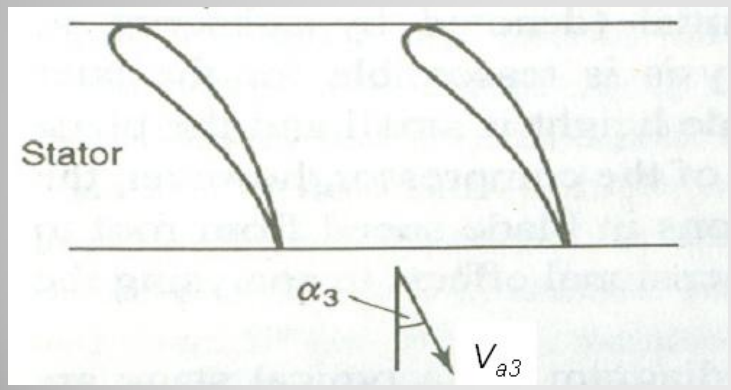


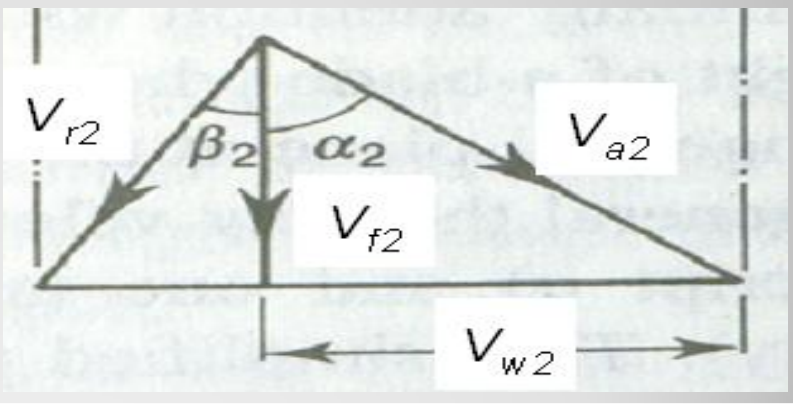
Kinematics of An Axial Flow Compressor Stage





Inlet Velocity Triangle





Outlet Velocity Triangle