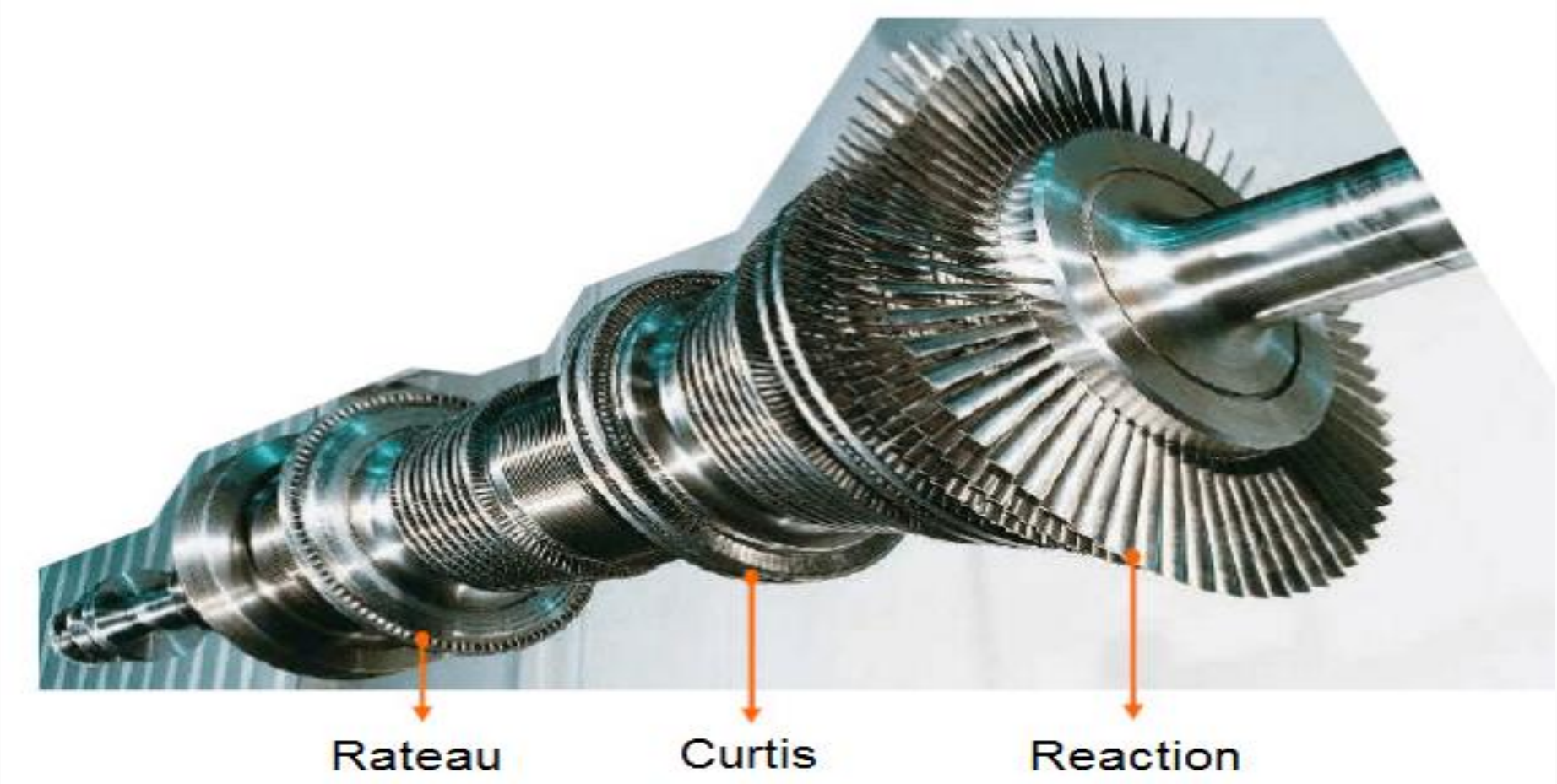
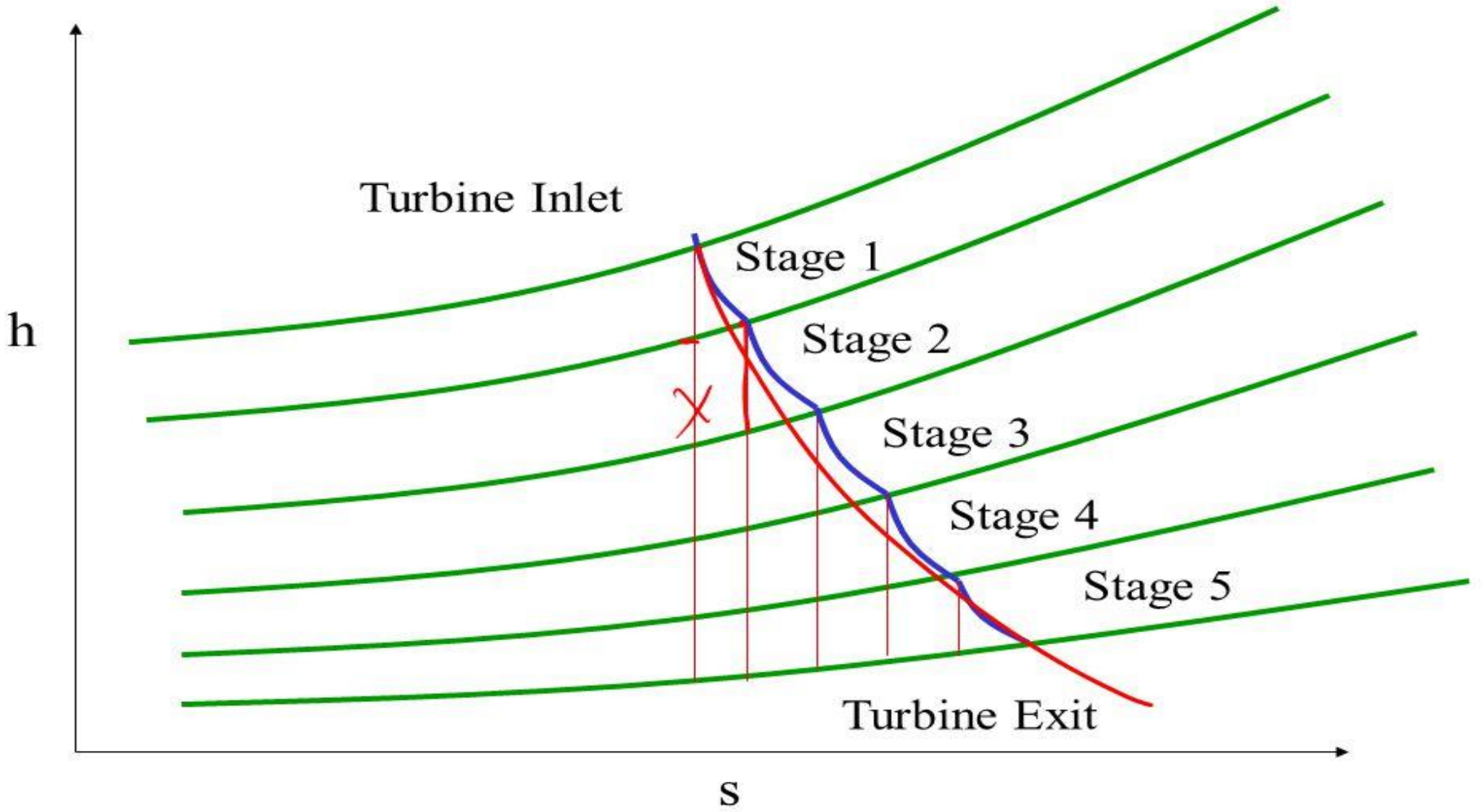
UNIT-4

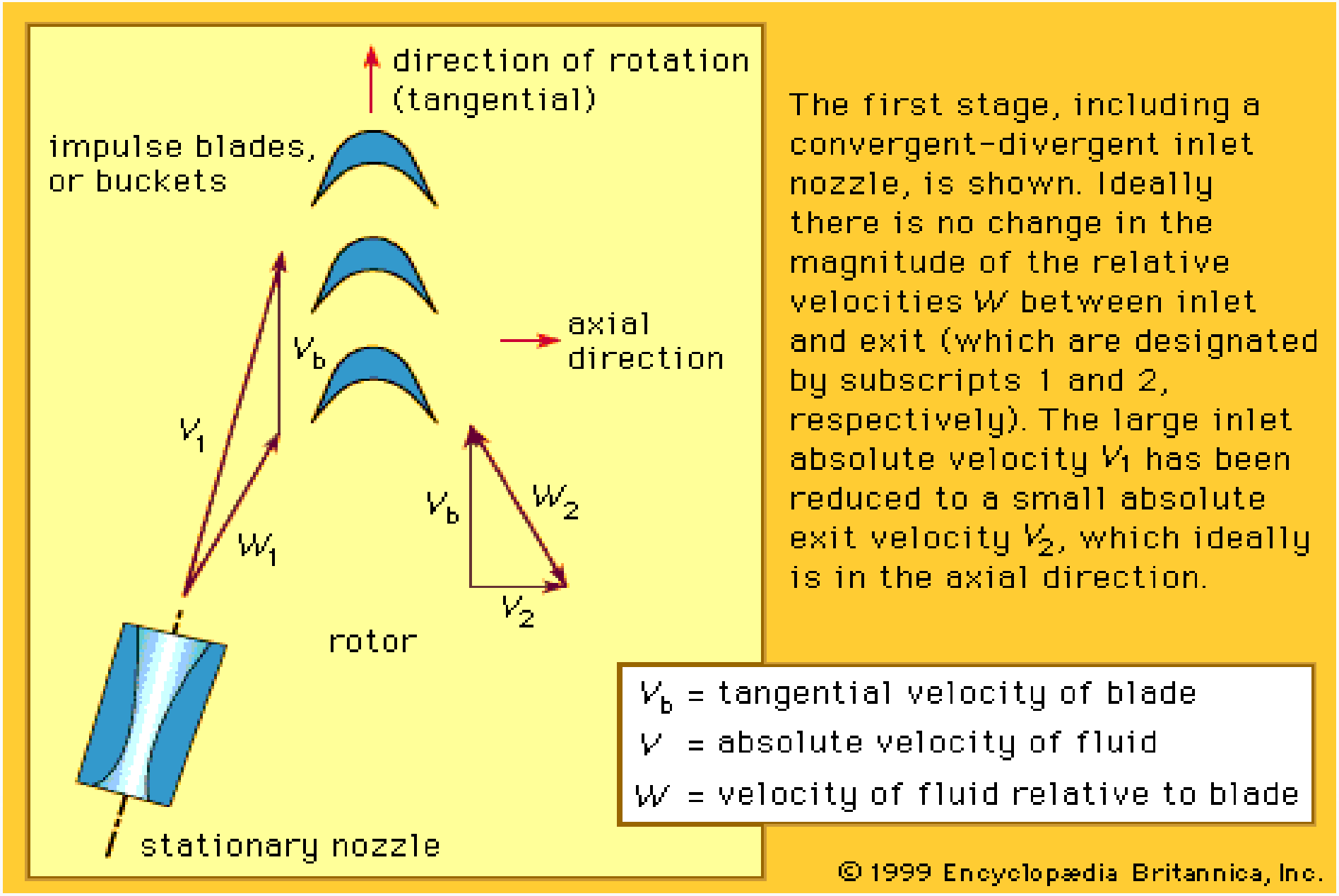
STAGING AND EFFICIENCY OF STEAM TURBINE

In an impulse turbine, the stage is a set of moving blades behind the nozzle. In a reaction turbine, each row of blades is called a "stage." A single Curtis stage may consist of two or more rows of moving blade. They hold the vane-shaped nozzles and seals between the stages



Enthalpy Entropy Diagram for Multistage Turbine





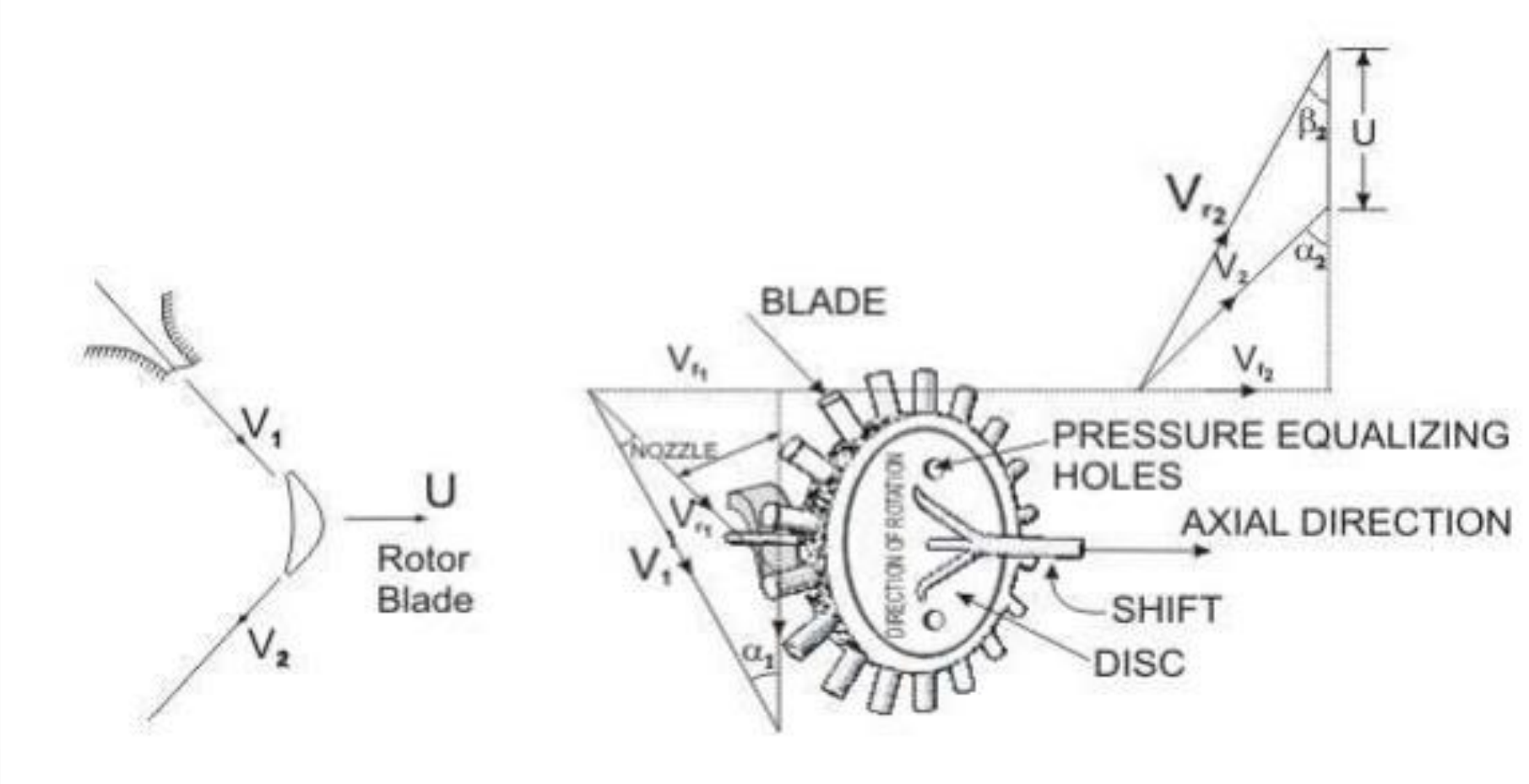
The first stage, including a convergent-divergent inlet nozzle, is shown. Ideally there is no change in the magnitude of the relative velocities W between inlet and exit (which are designated by subscripts 1 and 2, respectively). The large inlet absolute velocity V_1 has been reduced to a small absolute exit velocity V_2, which ideally is in the axial direction.

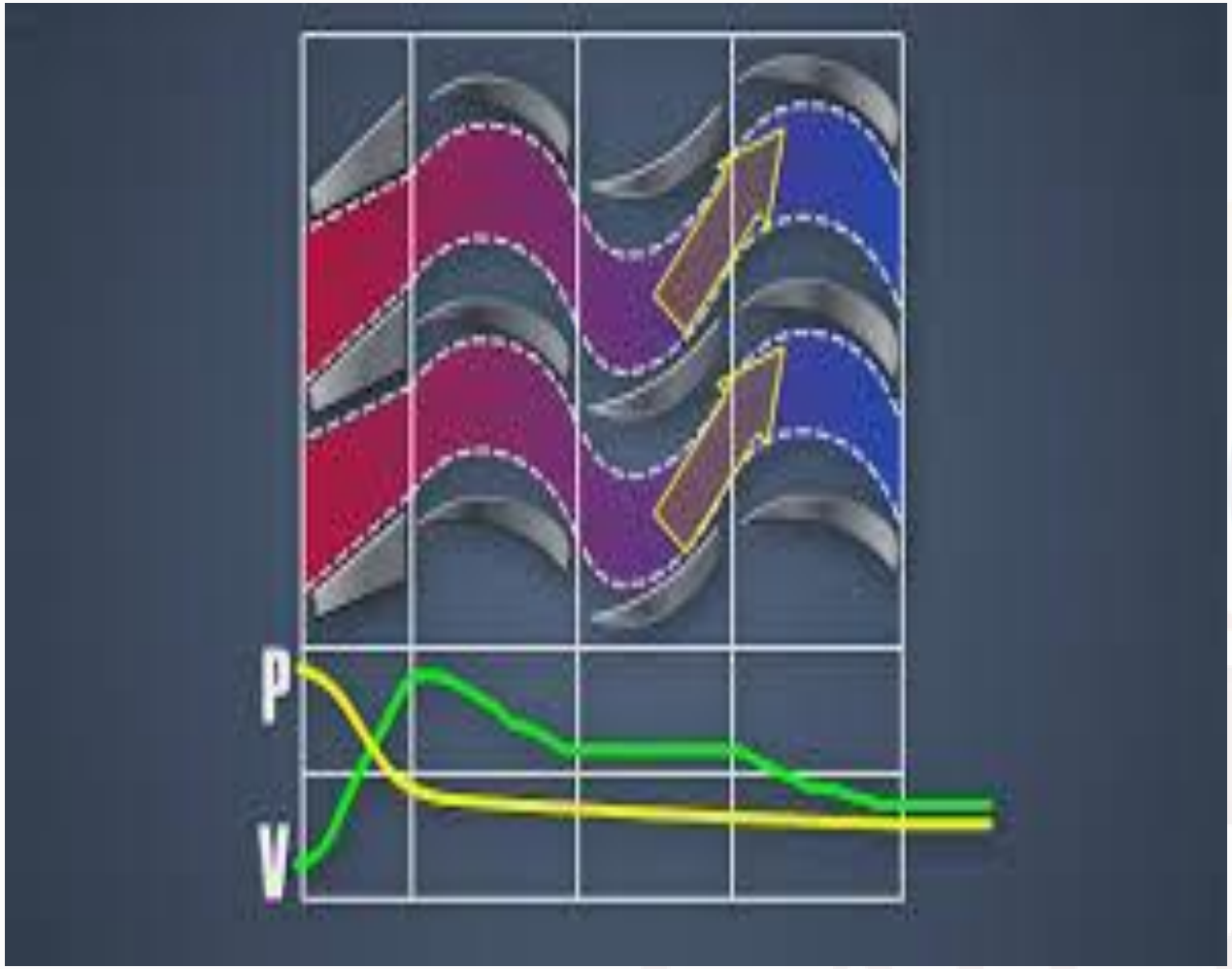
V_b = tangential velocity of blade

V = absolute velocity of fluid

W = velocity of fluid relative to blade

VELOCITY TRIANGLE DIAGRAM





Steam Flow Path in a Multi Stage Impulse Turbine

- Global available enthalpy for Power:

$$\Delta h_{g,av} = h_3 - h_{4s}$$

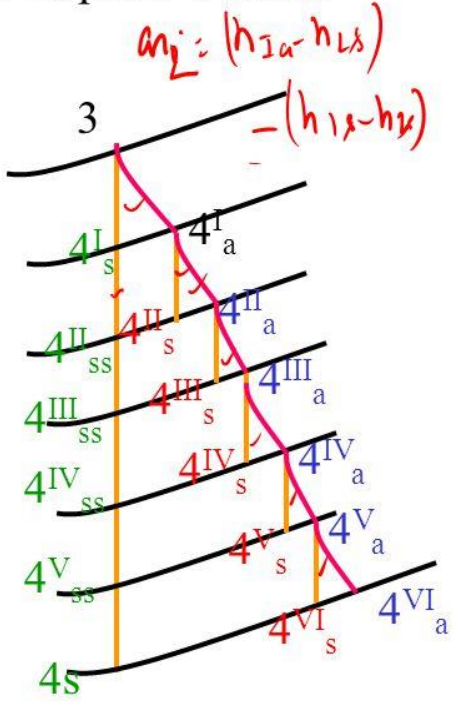
- Internally available enthalpy for Power:

$$\Delta h_{\text{int},av} = \sum \Delta h_{stage,av}$$

$$= h_3 - h_{4s}^I + \sum_2^n h_{4a}^{i-1} - h_{4s}^i$$

- Total actual stage work output per unit mass:

$$w_{act} = h_3 - h_{4a}^I + \sum_2^n h_{4a}^{i-1} - h_{4a}^i$$



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