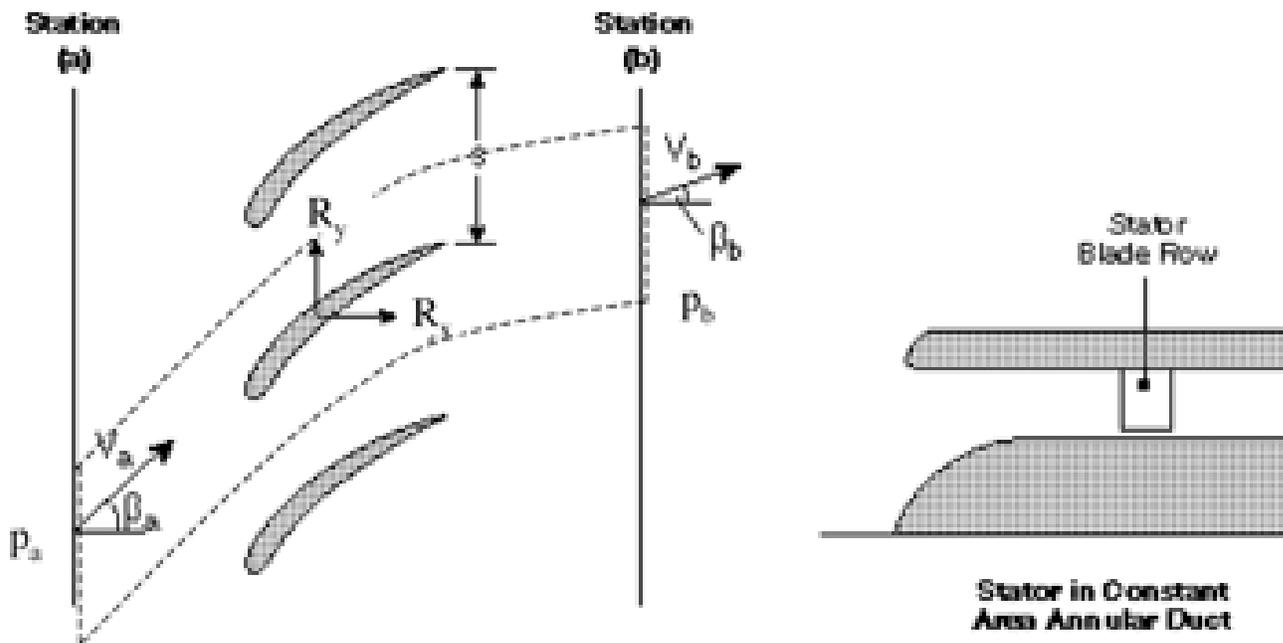


Unified Engineering Spring Term 2004

Problem P3. (Propulsion) (LO A & B)

An incompressible fluid flows steadily through a two-dimensional infinite row of fixed airfoils (e.g. a stator blade row). The blade row is contained in a constant area annulus, as shown on the right side of the figure below. The spacing between the airfoils is s . Assume that the velocities and pressures V_a , V_b , p_a , p_b , are constant at stations (a) and (b), and that the flow angles are given by β_a and β_b .



- Does the magnitude of the flow velocity increase/stay the same/decrease across the stator and why?
- Using the control volume shown above (the upper and lower surfaces are streamlines), apply conservation of mass and momentum to determine the forces R_x and R_y that must be applied to the fluid (these are equal and opposite to the forces needed to keep each vane in place).