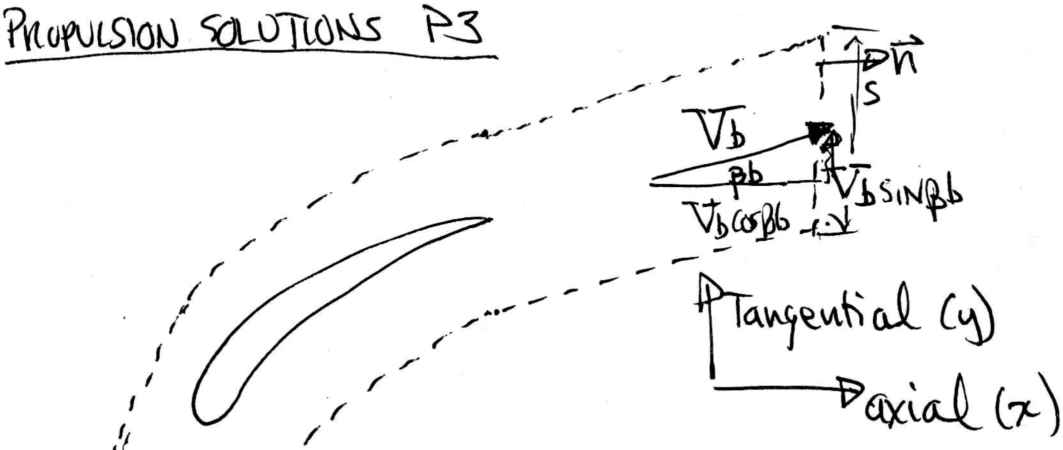

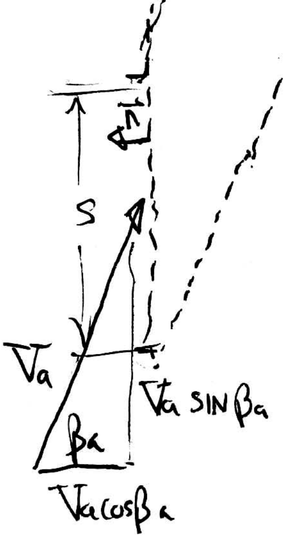

a) SINCE THE MASS FLOW IS THE SAME AT INLET AND OUTLET, THEN THE <u>AXIAL COMPONENT OF VELOCITY MUST BE THE SAME</u> AT INLET AND AT OUTLET. HOWEVER, THE TANGENTIAL (SWIRL) COMPONENT OF VELOCITY DECREASES ACROSS THE BLADE ROW

b) THE AXIAL FLUX OF TANGENTIAL MOMENTUM IS EQUAL TO THE MASSFLOW RATE TIMES THE TANGENTIAL MOM. PER UNIT MASS (i.e. THE TANG. VEL.)

AXIAL FLUX OF TANG. MOM. $= \dot{m} u_y$

IT DECREASES ACROSS THE BLADE ROW. THE FLOW HAS LESS SWIRL VELOCITY LEAVING THE BLADE ROW.

c) SINCE THE FLOW IS INCOMPRESSIBLE & THE MAGNITUDE OF THE VELOCITY DECREASES, THEN THE ~~MAGN~~ PRESSURE INCREASES.

d) $\Sigma F_x = R_x + \underset{\text{in } x}{\text{pressure forces}} = \int_S \rho u_x \vec{u}\cdot\vec{n}\, dS$

- By symmetry, pressure forces on top & bottom streamlines are the same and thus balance. ∴ Only need to consider pressure forces on left and right of c.v.
- Since upper & lower surfaces of c.v. are streamlines there is no flux across them. ∴ Only need to consider fluxes at inlet & outlet.

$$R_x + p_a S - p_b S = \rho V_a \cos\beta_a(-V_a\cos\beta_a)S + \rho V_b \cos\beta_b (V_b\cos\beta_b)S$$

$$\text{mass flow} = \rho V_a \cos\beta_a S = \rho V_b \cos\beta_b S$$

$$\therefore\ R_x = (p_b - p_a)S = \text{force ON C.V.}$$

$p_b > p_a$ so R_x is IN (+) x-direction

∴ FORCE FELT BY BLADES IS $\leftarrow$ (−) x

$$\Sigma F_y = R_y + \cancel{\underset{\text{in } y}{\text{pressure forces}}}^{\,0} = \int_S \rho u_y \vec{u}\cdot\vec{n}\, ds$$

$$R_y = \rho V_a \sin\beta_a(-V_a\cos\beta_a)S + \rho V_b \sin\beta_b (V_b\cos\beta_b)S$$

$$R_y = \rho S V_a \cos\beta_a (V_b \sin\beta_b - V_a \sin\beta_a) \quad < 0$$

$$= \text{FORCE ON C.V.}$$

∴ FORCE FELT BY BLADES IS IN $\uparrow$ +y direction