The surface pressure p_s is therefore enormous by ordinary standards but is a small fraction of the total pressure P_o of the water jet.

The final equation of motion relates the decay of streamwise momentum flux ρu^2 to the shear stress τ on the cutting surface:

$$\frac{d}{ds} \int_0^d \rho\, u^2 \, dn = - \tau \ . \tag{9}$$

Strictly speaking, the integral should contain pressure terms as well, but equation (8) implies that the pressure p is of order $(d/R)\rho u^2$, which is negligible compared with ρu^2 under approximation (5). The neglect of pressure in the streamwise-momentum equation (9) is analogous to the boundary layer approximation in classical fluid dynamics.

Equation (9) can be transformed into a less familiar form, but one better suited to later calculations. Note first that the derivative d/ds with respect to arc-length can be written as $(-1/R)\, d/d\theta$ by virtue of equation (2). The momentum integral appearing in (9), moreover, is exactly the same as the integral in (8), <u>regardless of how u(s,n) may vary with n</u>. The streamwise-momentum equation thus takes the form

$$\frac{d}{d\theta} \left[R(p_s - p_a)\right] = R\tau \ , \tag{10}$$

which will become a differential equation for $R(\theta)$ under appropriate assumptions about τ.