CHAPTER 9

Hydrostatics

Hydrostatics concerns the equivalent force and moment due to distributed pressure on a surface from a still fluid. Pressure increases with depth. With constant pressure, the equivalent force has magnitude = pressure times area, acting at the centroid. For linearly-varying pressure on a rectangular plate the equivalent force is the average pressure times the area acting somewhere between 1/2 and 2/3 of the way down. The net force acting on a totally submerged object in a constant density fluid is the displaced fluid's weight, acting at the centroid.

Hydrostatics is primarily concerned with finding the net force and moment of still fluid on a surface. The surfaces are typically the sides of a pool, dam, container, or pipe, or the outer surfaces of a floating object such as a boat or of a submerged object like a toilet bowl float. Finally, one is sometimes concerned with the force on an imagined surface that separates some water of interest from the other water. Although the hydrostatics of air helps explain the floating of hot air balloons, dirigibles, and chimney smoke; and the hydrostatics of oil is important for hydraulics (hydraulic brakes for example), often the fluid of concern for engineers is water. So, as in the title of the chapter ('hydro'), we often use the word

'water' as an informal synonym for 'fluid.'

Besides the utility of the subject in applications, hydrostatics is also a good introduction to distributed forces and continuum mechanics.