Conservation of Mass

In Newtonian mechanics, mass is conserved and since we are omitting all relativistic effects from the present text, the first basic principle that we need to apply in our construction of the basic equations of fluid mechanics is the principle of conservation of mass. The resulting equation is known as the "Continuity Equation" and we will develop three different forms of this equation. These three forms are essentially identical but the result is phrased in three different ways, each of which is appropriate to its own set of applications. In addition the three different forms illustrate the three different approaches that can be used in applying other, more complex conservation principles. We called the three approaches, the "Macroscopic Approach", the "Differential Approach" and the "Integral Approach", in order of mathematical complexity.

As the reader peruses each of these approaches, it will become apparent that a critical step that is common to all of the approaches (and to the application of any conservation principle) is the choice of a "Control Volume" (CV for short). We devote a special section to the process of choosing this control volume.