

1 The Continuum Viewpoint and the Equation of Motion

- 1.1 On the molecular origin of fluid behavior and its analytical difficulties.
- 1.2 The continuum viewpoint and the concept of properties as fields; Eulerian vs Lagrangian methods of description. The importance of reference frame in the Eulerian description; steady and unsteady flows.
- 1.3 Material particles, material volumes, and control volumes. The physical laws which govern the behavior of continua, expressed in terms of material volumes.
- 1.4 Forces acting on a continuum: body forces and surface forces.
- 1.5 Rheological properties of materials. E.g. elastic solids, Newtonian fluids and viscosity, non-Newtonian fluids, viscoelastic fluids. The defining attribute of a "fluid."
- 1.6 Pascal's principles and the concept of pressure in a static (or otherwise shear-free) fluid.
- 1.7 Thermal equation of state for fluids of constant composition (the equilibrium density-pressure-temperature relation).
- 1.8 Net surface force on a fluid particle in a pressure field.
- 1.9 Acceleration of a fluid particle expressed in terms of the (Eulerian) velocity field: the material (or substantial, or total) time derivative. The rate of change of with time of a fluid property seen by an observer moving through a continuum at an arbitrary velocity.
- 1.10 The equation of motion of a fluid in differential form.

Read: Fay Chapt. 1
 Chapt. 2, pp 39-44
 Chapt. 3, pp 89-97
 Chapt. 4, pp 128-132

Problems: Handout: Sounding rocket problem