2.25

7 Similarity and Dimensional Analysis

7.1 Definition of similarity.

7.2 Similarity derived by inspectional analysis of underlying equations and boundary conditions. Examples.

7.3 Similarity derived by dimensional analysis. Physical quantities; fundamental and derived quantities; systems of units; the steps of dimensional analysis; Buckingham's Pi-theorem.

7.4 Flow regimes and typical phenomena associated with various Reynolds numbers.

7.5 Examples of applications, including universal curves of drag or lift coefficients v.s. Reynolds number, small scale modeling of flows with and without gravitational influence (e.g. surface ships), etc. Typical modeling parameters and their physical significance (Reynolds number, Froude number, Strouhal number, Weber number, Mach number, etc.).

Read: Handout: A. A. Sonin, "The Physical Basis of Dimensional Analysis" (Read *at least* Sections 1 and 3)

Fay: Chapter 10.

Problems: 7.2, 7.3, 7.5, 7.9, 7.11, 7.14, 7.16, 7.18.