

22.103 Microscopic Theory of Transport
(Fall 2003)

Problem Set No. 2

Due: September 29, 2003

Read Boon-Yip, Chap 1 and selected parts of Chaps 2, 3, and 4 (those sections dealing with the velocity autocorrelation function and the Van Hove self correlation function)

Problem 1

Evaluate the following thermal averages for a simple fluid,

$$\langle n(\underline{r}, t) \rangle, \langle n_s(\underline{r}, t) \rangle, \langle V(0) \rangle$$

$$G_s(\underline{r}, 0), G(\underline{r}, 0), f_s(\underline{r}, \underline{v}, 0)$$

Problem 2

Calculate $G_s(\underline{r}, t)$ for the following models,

- (1) An ideal gas by direct evaluation using its definition
- (2) A fluid by direct solution of the time-dependent diffusion equation
- (3) An oscillator

Problem 3

Discuss the connection between the mean square displacement function, the velocity autocorrelation function, the Van Hove self correlation function, and the corresponding phase-space distribution function.