5.A. Introduction

In this chapter, we will derive differential equations of motion for the evolution in time of probability distributions and densities. The connection of these phenomenological time evolution to specific dynamical models will be dealt with in the next chapter. Here, we shall restrict our attention to Markov processes, which are stochastic processes that have memories only of their immediate past.

The equation governing the stochastic dynamics of Markov processes is called the master equation. Its importance lies in its almost universal applicability to far- ranging fields such as chemistry, biology, population dynamics, laser physics, Brownian motion, fluids, semiconductors, etc. We shall restrict ourselves to processes that tend to some equilibrium (steady) states after a long enough period of time.

Other topics discussed include the Langevin equation and the Fokker- Planck equation formulations of the Brownian motion.