1 Introduction

These lecture notes are an expanded version of the lectures given by the second and the fourth author in the summer school "Open Quantum Systems" held in Grenoble, June 16–July 4, 2003. We are grateful to Stéphane Attal and Alain Joye for their hospitality and invitation to speak.

The lecture notes have their root in the recent review article [JP4] and our goal has been to extend and complement certain topics covered in [JP4]. In particular, we will discuss the scattering theory of non-equilibrium steady states (NESS) (this topic has been only quickly reviewed in [JP4]). On the other hand, we will not discuss the spectral theory of NESS which has been covered in detail in [JP4]. Although the lecture notes are self-contained, the reader would benefit from reading them in parallel with [JP4].

Concerning preliminaries, we will assume that the reader is familiar with the material covered in the lecture notes [At, Jo, Pi]. On occasion, we will mention or use some material covered in the lectures [D1, Ja].

As in [JP4], we will work in the mathematical framework of algebraic quantum statistical mechanics. The basic notions of this formalism are reviewed in Section 3. In Section 4 we introduce open quantum systems and describe their basic properties. The linear response theory (this topic has not been discussed in [JP4]) is described