THE STOCHASTIC LIMIT OF THE OPEN BCS MODEL OF SUPERCONDUCTIVITY

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Abstract. We review some recent results concerning the open BCS model of superconductivity as originally proposed by Buffet and Martin. We also briefly analyze some possible generalizations.

1. Introduction

In a recent paper, [2], we have analyzed the open BCS model as first proposed in [6, 7] using the techniques of the stochastic limit (SL), [1]. Among the other results, we have shown that the same values of the critical temperature and of the order parameters can be found using the SL, in a significantly simpler way. This procedure suggested us to use this approach in order to generalize the original model in the attempt to obtain some control on the critical temperature \( T_c \). This has been done in [3], where we have discussed the role of a second reservoir in the definition of the model and its consequences on the value of \( T_c \).

In this paper we review the results of these two papers: in particular, we devote the next section to summarize our results concerning the original model, [2], while in Section 3 we introduce different models with more reservoirs, [3].

2. The Model

The model discussed in [2] consists of the system, which is described by means of spin variables, and the reservoir, which is given in terms of bosonic operators. It is contained in a box of volume \( V = L^3 \), with \( N \) lattice sites. We define, following [6, 7],

\[
H_N^{(sys)} = \frac{\epsilon}{N} \sum_{j=1}^{N} \sigma_j^0 - \frac{g}{N} \sum_{i,j=1}^{N} \sigma_i^+ \sigma_j^-.
\]

(1)