Abstract

The limit order book is prevalent in more than half of the world's financial market. With the rise in algorithmic trading, the study of the order positions in a limit order book allows the trader to make a more informed decision. This thesis examines the dynamics of order positions and related queues in the limit order book with the order arrivals governed by the Poisson process. In the first part of the thesis, we study the fluid limit and diffusion limit for the processes under the assumption of a common order arrival rate. This assumption is then generalised to different rates for different types of orders, and we study the related dynamics through the use of simulations. The order arrival rates are then calibrated with real data for realistic simulations.

In this thesis, we derive explicit analytical expressions for the fluid and diffusion limits of the order positions as well as the best bid/ask queues. We propose an algorithm that can be used for simulation to reconstruct the evolution of the order position and queues in the limit order book. Through the simulations, we can obtain many important aspects of the dynamics, such as the time required for an order position to be executed, the behaviour of the queues as well as its diffusion. We also apply the simulations to a real stock from the Singapore Exchange by calibrating the order arrival rate. However, we find that the actual data does not fit a Poisson process and we explore the possible reasons and discuss other alternative approaches.