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GPU parallel implementation for Asset-Liability Management in insurance companies

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Abstract

In this work we present a stochastic Asset Liability Management (ALM) model for a life insurance company together with its numerical simulation, based in a Monte Carlo balance sheet projection, and we carry out its efficient parallel computation using Graphics Processing Units (GPUs) hardware. The liabilities of the company consist of a portfolio comprising with-profit life insurance policies, that evolve according to the policyholder saving account, surrender and biometric models. On the asset side, we mainly consider bonds, equity and cash, so that appropriate stochastic models are considered for their evolution. We consider some innovations with respect to literature in the modeling of the surrenders of the policyholders. Another important innovative aspect comes from the implementation of ALM in the new high performance computing architectures provided by GPUs technology. Numerical results illustrate the high speed up of the calculus by using GPUs and the coherence of the computations (asset evolution, default probabilities and so on).

Keywords: Asset Liability Management (ALM), life insurance, Monte Carlo balance sheet projection, parallelization, Multi-CPU, GPUs.

1. Introduction

Asset Liability Management (ALM) is a broad denomination for the models that are used to forecast the evolution of a company along time, jointly projecting its assets and liabilities portfolios and computing the predicted cash inflows and outflows in the future. Such a company can be either a bank, an insurance company, or more generally any financial institution, a state pension fund or even a non financial corporation. Depending on the business model of the company, the specific definition of the underlying models for the assets and liabilities may vary. ALM tools aim to cover the liquidity and interest rate risks to ensure the solvency of the company, i.e. its capability to meet all its financial obligations. Another additional relevant goal is to increase the company profit. Thus, ALM can be generally understood as a management tool to maximize the investment returns, while minimizing the reinvestment risks. These models have a particular relevance in the insurance industry, because one central problem in the insurance business is precisely to guarantee the solvency of the company. Some ALM models for life insurance have been presented, for example, in [1] and the references therein. Additional references are [2], [3], [4], [5], [6], [7] and [8], for