

Increasing speed and accuracy in the front and middle office with Sobol sequence generators

In almost every quantitative subject of study, the Monte Carlo method can be applied. Engineering, physical sciences, statistics and more recently machine learning have benefited from this methodology. Monte Carlo simulations are at the centre of pricing and risk management systems for accurate and efficient valuation of their financial derivatives. An increased interest in Quasi Monte Carlo methods has been observed in the financial services industry in the last two decades due to their much higher rate of convergence in comparison with Monte Carlo. Unlike Monte Carlo which is based on using random numbers, Quasi Monte Carlo methods makes use of the Low Discrepancy Sequences (LDS).

There are a number of LDS, but studies have shown that Sobol LDS are, in many aspects, the most efficient type and also that the most effective Quasi Monte Carlo method for applications in financial engineering are based on Sobol LDS.

BRODA Ltd. has been developing, testing and distributing high-dimensional Sobol sequence generators for more than 20 years and are now industry leading with more than 50 financial institutions benefitting.

All BRODA's generators were developed jointly with Prof. Sobol.

Sobol sequence generators can be applied to many business cases to achieve both accuracy and efficiency.

Pricing

One of the most practical applications of Quasi Monte Carlo methods and Sobol generators is the valuation of financial derivatives (Options) with complex contingencies, MBS/ABS, CDOs, etc. In the insurance sector, the use of Quasi Monte Carlo is common also on the pricing of Liabilities, pension plans, etc.

Both the front and middle office as well as Quant teams, Validation teams, Methodology teams at institutions including banks, insurers, asset manager and energy companies can leverage this methodology in pricing and valuation.

CCR/CVA/XVA

Market and Counterparty risk measures, based on multi-dimensional, multi-step Monte Carlo simulations are currently leveraged by the Front Office for XVA sensitivities and pricing as well by the Middle office for measuring risk and capital allocation.

Banks with internal models for Market and Counterparty Credit Risk can use Monte Carlo scenario engines adopting variance reduction techniques. Quasi Monte Carlo and Sobol generators are one of the most common and accurate approaches in the market.

Solvency II

There is an increased demand for performance improvements from Insurers implementing group-wide Economic Capital solutions with full Monte Carlo (MC) valuation. A typical example is the estimation of Solvency II with an Internal Model.

Credit

Across the Sell Side and Buy Side, Financial institutions are required to estimate Default and Migration Credit risk. Furthermore, they may require integration between Market and credit risks as in the following cases:

- Credit Economic Capital/Pillar II
- Wrong Way Risk
- Integration of Market and Credit
- DRC (IMA - FRTB)

In all these calculations, Financial Institutions need to run a significant number of scenarios in order to capture the default and migration risk. The number of scenarios can exceed 100,000. In some calculations, e.g. Wrong Way Risk for CVA/PFE, also we need to run Market and Credit scenarios so the convergence rate is important. Therefore we advise using Sobol to improve convergence and reduce scenarios.

The Broda Sobol Sequence Generator advantage

Regulatory and market demands for increased granularity and frequency of calculations are causing corresponding cost increases for risk and finance teams. Quasi Monte Carlo simulations and their faster rate of convergence is an excellent and proven methodology to achieve accurate results more efficiently. The reduced number of simulations required and increased performance lead to a lower total cost of ownership. Applications based on Broda Sobol Generators converge in orders of magnitude faster without loss of accuracy than the commonly used Monte Carlo methods.

The combination of knowledge capital and technology superiority between SS&C Algorithmics and Broda Ltd is unsurpassed in the market.

Comparison tests show that BRODA's SobolSeq generators outperform all other known generators both in speed and accuracy.^{1,2}

1. <https://www.broda.co.uk/doc/COMPARISON%20OF%20BRODA%20AND%20JOEKUO%20SOBOL'%20SEQUENCE%20GENERATORS.pdf>

2. I. Sobol', D. Asotsky, A. Kreinin, S. Kucherenko. Construction and Comparison of High-Dimensional Sobol' Generators, 2011, Wilmott Journal, Nov, pp. 64-79 http://www.broda.co.uk/doc/HD_SobolGenerator.pdf