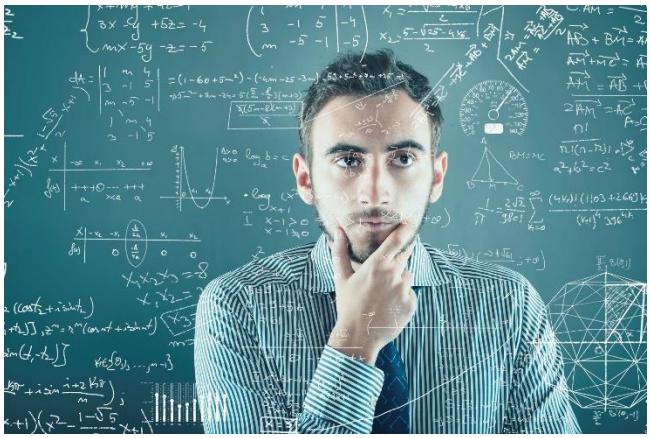
Boosted Interpolation Grids

The power of Deferred Object Loading



A central challenge that FRTB is bringing to banks is how to utilise existing infrastructure in the context of the P&L Attribution Test (PLAT); in particular, how to improve interpolation grids for fast pricing. The new MoCaX functionality, Deferred Object Loading, provides an ideal solution. MoCaX technology delivers an interpolation scheme that is guaranteed to converge ultra-fast with the original pricing function. This means that a MoCaX "smart" grid needs very few points to give ultra-high pricing accuracy. With the newly added functionality, MoCaX can create these smart grids without the need for any specific information of the particular trade at stake; the same way banks currently create standard-interpolation grids.

This solution is ideal for existing interpolation grid infrastructures because all the inter-systems communications operate in exactly the same way and, in addition, it also delivers ultra-accurate pricing. Hence, PLAT can be passed (high accurate pricing) and infrastructure costs decrease (fewer calls to the pricer are needed).

The Challenge

A central problem of FRTB is the trade-off between pricing precision and infrastructure cost-effectiveness. Linear and Spline interpolation methods are common in the industry for fast pricing. Typically, a risk engine that sits in the Front Office is asked to give the price of a trade in a few "Anchor" points for the interpolating grid.

The problem is that all typical interpolation methods converge very slowly to the original pricing function. As a result, typical methods fail the PLAT for non-linear products unless the granularity of the grid is increased to levels that yield no more computational savings.

What would be the ideal fix? The answer: an interpolation framework that…

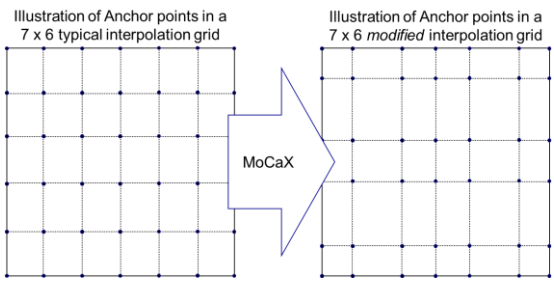
1. operates, from an IT standpoint, in exactly the same way as existing interpolation frameworks; and
2. is guaranteed to converge so fast to the original pricing function that only a few calls to it are needed to build the value surface

The Solution

The new MoCaX functionality, Deferred Object Loading, offers precisely that.

Agnostic to Trade Information

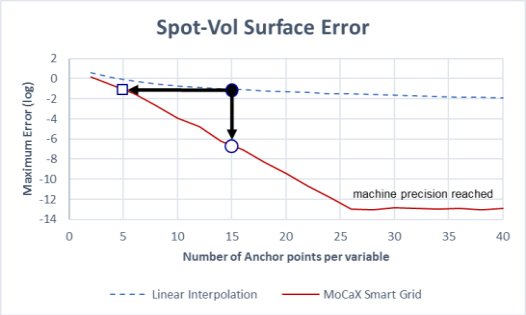
Many IT grid construction frameworks use the same Anchor points configuration regardless of the trade specifics that it refers to. Now, MoCaX grids can operate like that too.



A key point of MoCaX algorithms is that they use a pre-determined *non-equally spaced* configuration of Anchor points. Given a range of values and a number of Anchor points per variable, that configuration is always the same.

Ultra-fast Convergence

The following exhibit shows the maximum error delivered by a linear interpolation grid and a MoCaX "Smart" Grid for an option in a spot-volatility value surface.



In the example, if the linear-interpolation grid has 15 x 15 = 225 Anchor points, it delivers a maximum error of around 10^{-1}. The MoCaX version of that grid (15 x 15 points) delivers a maximum error of 10^{-7}, hence maximising chances of a PLAT pass.

Alternatively, if we are happy with the 10^{-1} pricing precision but we want to save in computational load when pricing the Anchor points, MoCaX Smart technology can produce that same precision with only 5 x 5 = 25 points in the grid.

This is an example run with one option for illustrative purposes; the same behaviour will be observed in any portfolio of options as the ultra-fast convergence is mathematically guaranteed.

If a user wants to benefit from the ultra-fast convergent properties of MoCaX Smart Grids, they can do so in a generic manner, **without having to create a specific configuration per trade** (the same way it can do so in a linear-interpolation grid without any trade information)

How it is Possible?

How can we ensure ultra-fast convergence in such a general framework?

MoCaX Smart Grid technology comprises two fundamental steps

1. it creates the grid configuration in a specific manner (i.e. the Anchor points); and
2. it implements a tailored interpolation framework

What makes the overall result deliver the ultra-fast convergence is not each of those steps separately, but the *combination of both together*. This strong result is obtained because the mathematical theory behind the framework extends the approximated functions to the complex space; depending on how that extension is done, one can guarantee the desired ultra-fast convergence. Further details can be explained under NDA.

Extras

In addition to the explained functionality, one of the extra benefits that MoCaX Smart Grids deliver is ultra-precise Greeks (Delta, Gamma, Vega, Volga, Vanna, etc.). These Greeks can be obtained by the user without any additional Anchor points; they come "for free" in the MoCaX Smart Grids framework.

Practicalities of Implementation

Market risk engines need to interact with Front Office (FO) pricing engines in an automated manner to:

1. detect the risk factors that affect a given trade (e.g. USDEUR spot and volatility)
2. price the trade in the FO pricing engine in the Anchor points of the USDEUR risk factor
3. create an interpolating object for fast pricing in the risk engine

The MoCaX Smart Grid configuration operates in exactly the same way. In the first step, the user partially builds an Object using only the risk factor desired ranges for interpolation and the number of Anchor points. Next, the in-house system would query FO pricing at those Anchor points. Finally, these price values are added to the MoCaX Object. This delivers the Smart interpolating Object.

All this can be done without any trade-specific information**. Consequently, integration of MoCaX technology into existing grid-based pricing frameworks is extremely non-intrusive.**

How can a Bank use MoCaX?

MoCaX can be delivered in two ways. It can be given in a software library that contains all the functionality. Alternatively, it can be implemented in-house; we are happy to explain the methodology as its Intellectual Property is protected with a number of pending patents.

Contact

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