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Computing the deltas; efficiency-accuracy trade offs in solving Black Scholes equations

Pricing functions for financial options are routinely computed as numerical solutions of partial differential equations of Black Scholes type. The risk associated with issuing an option can be reduced by various hedging strategies for portfolio management. In theory, a zero-risk strategy is possible, which requires continuously modifying the portfolio. These modifications depend on the derivatives of the dynamically changing price function, *i.e.* the so-called delta hedging parameters. In practice, the ideal hedging strategy may be approximately followed which results in the issuer incurring some risk.

We will look at finite element computation of pricing functions $V(S_1, S_2, t)$ that depend on two underlying assets, and estimation of the the gradient from the numerical solution for hedging parameters. The goal is to determine

a) a level of accuracy that incurs an acceptable risk

b) techniques of meshing and gradient estimation which can efficiently meet the accuracy requirement of a).