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Optimal control and Hamilton-Jacobi-Bellman equations: Numerical methods and Applications

HJB Quasi-Variational Inequalities in Portfolio Optimization and their Discretization by Finite Elements

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Abstract: Portfolio optimization problems arising in financial mathematics can lead to a variety of different HJB equations with some characteristics that need special care. Problems with purely stochastic control typically generate optimality conditions with degenerate second order differential operators. Through the introduction of fixed transaction costs, a nonlocal algebraic operator describing impulse controls enters the optimality system. Consequently, the classical HJB equation is converted into a Hamilton-Jacobi-Bellman Quasi-Variational Inequality (HJBQVI).
In this presentation we focus on portfolio optimization problems which lead to HJBQVIs. We briefly discuss algorithmic options such as value iteration, policy iteration and optimal iterated stopping. In the literature such problems are usually discretized by finite difference methods. The main focus in this talk is however on a discretization by finite elements. We give interpretations of both approaches. Numerical examples are also presented.