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High-order semi-Lagrangian schemes for static Hamilton-Jacobi-Bellman equations

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Abstract

A standard tool for the solution of optimal control problems is the application of the Dynamic Programming Principle proposed by Bellman in the 50's. In this context, the value function of the optimal control problem is characterized as the viscosity solution of a first-order and fully nonlinear Hamilton-Jacobi-Bellman (HJB) equation. A major advantage of the approach is the existence of a feedback mapping connecting the current state of the system and the associated optimal control. However, since the HJB equation has to be solved in a state space of the same dimension as the system dynamics, the approach is only feasible for low dimensional dynamics and it strongly relies on the use of efficient numerical approximations. In this talk, we present a high-order semi-Lagrangian scheme for the approximation of stationary HJB equations. The resulting nonlinear discrete system is solved via a fixed point approximation scheme. The convergence of the fixed point operator is justified by an ϵ-monotonicity argument.

Key words: Hamilton-Jacobi equations, fixed point approximation schemes, ϵ-monotonicity, high-order methods, semi-Lagrangian schemes
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