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An efficient method for multiobjective optimal control and optimal control subject to integral constraints. (English) Zbl 1240.90345

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Summary: We introduce a new and efficient numerical method for multicriterion optimal control and single criterion optimal control under integral constraints. The approach is based on extending the state space to include information on a "budget" remaining to satisfy each constraint; the augmented Hamilton-Jacobi-Bellman PDE is then solved numerically. The efficiency of our approach hinges on the causality in that PDE, i.e., the monotonicity of characteristic curves in one of the newly added dimensions. A semi-Lagrangian "marching" method is used to approximate the discontinuous viscosity solution efficiently. We compare this to a recently introduced "weighted sum" based algorithm for the same problem. We illustrate our method using examples from flight path planning and robotic navigation in the presence of friendly and adversarial observers.

MSC:

90C29	Multi-objective and goal programming
49J30	Existence of optimal solutions belonging to restricted classes (Lipschitz controls, bang-bang controls, etc.)
49L25	Viscosity solutions to Hamilton-Jacobi equations in optimal control and differential games
65K05	Numerical mathematical programming methods

Keywords:

optimal control; multiobjective optimization; Hamilton-Jacobi equation; discontinuous viscosity solution

Software:

NBI

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