Bertin, Etienne; Brendel, Elliot; Hérissé, Bruno; dit Sandretto, Julien Alexandre; Chapoutot, Alexandre
Prospects on solving an optimal control problem with bounded uncertainties on parameters using interval arithmetic. (English) Zbl 07363707
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Summary: An interval method based on Pontryagin’s Minimum Principle is proposed to enclose the solutions of an optimal control problem with embedded bounded uncertainties. This method is used to compute an enclosure of all optimal trajectories of the problem, as well as open loop and closed loop enclosures meant to validate an optimal guidance algorithm on a concrete system with inaccurate knowledge of the parameters. The differences in geometry of these enclosures are exposed, and showcased on a simple system. These enclosures can guarantee that a given optimal control problem will yield a satisfactory trajectory for any realization of the uncertainties. Contrarily, the probability of failure may not be eliminated and the problem might need to be adjusted.

MSC:
65G30 Interval and finite arithmetic
49K15 Optimality conditions for problems involving ordinary differential equations

Keywords:
optimal control; Pontryagin’s principle; interval arithmetic; bounded uncertainties; penalization

Full Text: DOI