Survey on Offline and Online Methods for Optimal Control and Differential Game Problems with Applications in Industrial Engineering

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First an overview of the state of the art of numerical methods for optimal control problems is given, by which optimal solutions can be computed for a wide range of problems governed by systems of ordinary or differential-algebraic equations including different kinds of constraints. Several applications from the fields of aerospace engineering, robotics, process engineering, and vehicle dynamics are given.

Methods for online computations are not as well developed as offline methods. An overview of different approaches is given, here with the emphasis on sensitivity and synthesis methods by which closed-loop controls can be approximated from the open-loop controls along (bundles of) trajectories. The latter of these methods has been applied to zero-sum differential game problems, too. Using this approach, optimal control problems under uncertainties can be modelled for worst case scenarios when assuming that the uncertainties are controled by an antagonistic second player. Applications from aerospace engineering and vehicle dynamics are given.