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Parametric optimization and optimal control using algebraic geometry methods. (English) [Zbl 1133.93337]

Summary: We present two algebraic methods to solve the parametric optimization problem that arises in non-linear model predictive control. We consider constrained discrete-time polynomial systems and the corresponding constrained finite-time optimal control problem. The first method is based on cylindrical algebraic decomposition. The second uses Gröbner bases and the eigenvalue method for solving systems of polynomial equations. Both methods aim at moving most of the computational burden associated with the optimization problem off-line, by pre-computing certain algebraic objects. Then, an on-line algorithm uses this pre-computed information to obtain the solution of the original optimization problem in real time fast and efficiently. Introductory material is provided as appropriate and the algorithms are accompanied by illustrative examples.

MSC:
93C10 Nonlinear systems in control theory
93B25 Algebraic methods
93B29 Differential-geometric methods in systems theory (MSC2000)
93B52 Feedback control
49K27 Optimality conditions for problems in abstract spaces
93B40 Computational methods in systems theory (MSC2010)

Keywords:
algebraic methods; nonlinear model predictive forms; discrete-time polynomial systems

Software:
QEPCAD; Fermat

Full Text: DOI

References:
[1] DOI: 10.1016/S0005-1098(01)00174-1 · Zbl 0999.93018 · doi:10.1016/S0005-1098(01)00174-1