Rohou, Simon; **Jaulin, Luc**; **Mihaylova, Lyudmila**; **Le Bars, Fabrice**; **Veres, Sandor M.**
Reliable nonlinear state estimation involving time uncertainties. (English) Zbl 1400.93294
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Summary: This paper presents a new approach to bounded-error state estimation involving time uncertainties. For a given bounded observation of a continuous-time nonlinear system, it is assumed that neither the values of the observed data nor their acquisition instants are known exactly. For systems described by state-space equations, we prove theoretically and demonstrate by simulations that the proposed constraint propagation approach enables the computation of bounding sets for the systems' state vectors that are consistent with the uncertain measurements. The bounding property of the method is guaranteed even if the system is strongly nonlinear. Compared with other existing constraint propagation approaches, the originality of the method stems from our definition and use of bounding tubes which enable to enclose the set of all feasible trajectories inside sets. This method makes it possible to build specific operators for the propagation of time uncertainties through the whole trajectory. The efficiency of the approach is illustrated on two examples: the dynamic localization of a mobile robot and the correction of a drifting clock.

MSC:

93E10 Estimation and detection in stochastic control theory
93C10 Nonlinear systems in control theory
93C85 Automated systems (robots, etc.) in control theory
93C41 Control/observation systems with incomplete information

Keywords:

state estimation; time uncertainties; nonlinear systems; tubes; robotics; constraints; contractors

Software:

CAPD

Full Text: DOI

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