

Set Membership inversion and robust control from data of nonlinear systems

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Abstract - A Set Membership (SM) method for right-inversion of nonlinear systems from data is proposed in the paper. Both the cases where the system to invert is known or unknown and therefore identified from data are addressed. The method does not require the invertibility of the regression function describing the system and ensures tight bounds on the inversion error. In the case of unknown system, the method allows the derivation of a robust right-inverse, guaranteeing the inversion error bound for all the systems belonging to the uncertainty set which can be defined from the available prior and experimental information. Based on such a SM inversion, two methods for robust control of nonlinear systems from data are introduced: Nonlinear Feed-Forward Control (NFFC) and Nonlinear Internal Model Control (NIMC). Both the design methods ensure robust stability and tracking errors for all the systems belonging to the involved uncertainty set. Two applicative examples of robust control from data are presented: NFFC control of semi-active suspension systems and NIMC control of vehicle lateral dynamics.