Tensor Product Model Transformation in Polytopic Model-Based Control (Automation and Control Engineering)

Péter Baranyi, Yeung Yam, Péter Várlaki

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Tensor Product Model Transformation in Polytopic Model-Based Control offers a new perspective of control system design. Instead of relying solely on the formulation of more effective LMIs, which is the widely adopted approach in existing LMI-related studies, this cutting-edge book calls for a systematic modification and reshaping of the polytopic convex hull to achieve enhanced performance. Varying the convexity of the resulting TP canonical form is a key new feature of the approach. The book concentrates on reducing analytical derivations in the design process, echoing the recent paradigm shift on the acceptance of numerical solution as a valid form of output to control system problems. The salient features of the book include:

- Presents a new HOSVD-based canonical representation for (qLPV) models that enables trade-offs between approximation accuracy and computation complexity
- Supports a conceptually new control design methodology by proposing TP model transformation that offers a straightforward way of manipulating different types of convexity to appear in polytopic representation
- Introduces a numerical transformation that has the advantage of readily accommodating models described by non-conventional modeling and identification approaches, such as neural networks and fuzzy rules
- Presents a number of practical examples to demonstrate the application of the approach to generate control system design for complex (qLPV) systems and multiple control objectives.

The authors' approach is based on an extended version of singular value decomposition applicable to hyperdimensional tensors. Under the approach, trade-offs between approximation accuracy and computation complexity can be performed through the singular values to be retained in the process. The use of LMIs enables the incorporation of multiple performance objectives into the control design problem and assurance of a solution via convex optimization if feasible. **Tensor Product Model Transformation in Polytopic Model-Based Control** includes examples and incorporates MATLAB® Toolbox TPtool. It provides a reference guide for graduate students, researchers, engineers, and practitioners who are dealing with nonlinear systems control applications.

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