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ROBUST SYNTHESIS METHODS FOR COOPERATIVE SYSTEMS

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Abstract

Cooperative systems, like any other dynamic systems, suffer in performance because of uncertainty yet there is an added layer of uncertainty due to the communication among agents. Therefore, analytic solution to these problems are hard if not impossible. With the advancements in the linear and non-linear methods, i.e. linear matrix inequalities (LMI) and non-linear transformations, robust performance analysis and controller synthesis for cooperative systems can be reformulated as optimization problems with LMI constraints as has been done in the last two decades. Another aspect of the problem becomes visible as the cooperative system grows larger and that necessitates faster solution methodologies to solve the aforementioned problem. Based on this context, the general objectives of this research are to develop computationally efficient analysis and synthesis methods for cooperative systems with uncertainties, which are

- Develop computationally efficient linear parameter varying (LPV) and Linear Time Invariant (LTI) synthesis framework and regarding tailored optimization techniques for cooperative systems, which suffer performance because of uncertainties using integral quadratic constraints.
- Develop computationally efficient linear parameter varying controller synthesis method that accommodates uncertainty analysis in a distributed fashion and provide a framework to synthesize a robust cooperative system starting from a single agent
- Develop a robust cooperative system synthesis method that consider uncertainty analysis in edge weight synthesis
- Develop a cooperative system synthesis method that is formulated in distributed fashion to improve computational efficiency and suitable for distributed optimization. ◦ develop implementation strategies for cooperative synthesis methods to state of the art applications such as cooperative docking and bipedal walking