SPECIAL LINEAR AND QUADRATIC FRACTIONAL PROGRAMMING PROBLEMS ARISING IN OPTIMAL ROBUST SYNTHESIS IN ℓ_1

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A priori information for robust design includes typically a linear time-invariant nominal model and a model of uncertainty. For model with unstructured uncertainty entering the system in a linear fractional manner, the optimal robust synthesis in ℓ_1 is generally reduced to a special nonconvex quadratic fractional programming problem and becomes much more complicated in the case of poor a priori information.

The gap between robust synthesis and identification is the area of active research for the last two decades. We address this gap from the robust synthesis viewpoint. It means that the control criterion is treated as the estimation criterion and no other assumptions on uncertainties than those accepted in robust synthesis are used. First we consider the problem of optimal errors quantification, which is to find errors bounds that are not falsified by measurement data and provide the minimum value of a given control criterion. For the LFT model with unstructured uncertainty, the optimal errors quantification is reduced to a huge number of nonconvex quadratic fractional programs. This implies that the LFT model structure is not promising for optimal robust synthesis in ℓ_1 under poor a priori information.

Fortunately, the optimal robust synthesis and the optimal errors quantification for the model under coprime factor perturbations are reduced to a special linear fractional programming problem and can be effectively solved. This allows to address to the problem of optimal robust synthesis under unknown errors bounds, which is shown to be a special nonconvex quadratic fractional problem.