Control system analysis and synthesis via linear matrix inequalities

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A wide variety of problems in systems and control theory can be cast or recast as convex problems that involve linear matrix inequalities (LMIs). For a few very special cases there are "analytical solutions" to these problems, but in general they can be solved numerically very efficiently. In many cases the inequalities have the form of simultaneous Lyapunov or algebraic Riccati inequalities; such problems can be solved in a time that is comparable to the time required to solve the same number of Lyapunov or Algebraic Riccati equations. Therefore the computational cost of extending current control theory that is based on the solution of algebraic Riccati equations to a theory based on the solution of (multiple, simultaneous) Lyapunov or Riccati inequalities is modest. Examples include: multicriterion LQG, synthesis of linear state feedback for multiple or nonlinear plants ("multi-model control"), optimal transfer matrix realization, norm scaling, synthesis of multipliers for Popov-like analysis of systems with unknown gains, and many others. Full details can be found in the references cited.