مباحث ویژه - بهینه سازی محدب و کاربردهای آن

Convex Optimization and Applications

General Information

Department of Electrical Engineering,
Amirkabir University of Technology (Tehran Polytechnic)
Winter 2010, 3 credits

Class times: Sun,Tue: 15:00 –16:30 (lecture)
Class location:

Instructor

Behzad Samadi
Office location:
3rd floor, Abourayhan Building,
Department of Electrical Engineering,
Amirkabir University of Technology

Office hours: Sun,Tue: 14:00–15:00 (by appointment)
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Course Content

- Introduction
  - Mathematical optimization
  - Least-squares and linear programming
  - Convex optimization
  - Nonlinear optimization
- Convex sets
  - Affine and convex sets
  - Operations that preserve convexity
- Convex functions
  - Basic properties and examples
  - Operations that preserve convexity
  - The conjugate function
  - Quasiconvex functions
- Convex optimization problems
  - Linear optimization problems
  - Quadratic optimization problems
  - Geometric programming
  - Vector optimization

- Linear Matrix Inequalities (LMI)
  - What are LMI's and what are they good for?
  - Stability: linear time-invariant, time-varying or non-linear systems
- Performance
  - Dissipativity
  - Quadratic performance and specializations (H_1, passivity)
  - H_2 performance and generalizations
- Synthesis
  - State-feedback and estimation problems
  - Output feedback synthesis
- Multi-objective Control
  - Youla parametrization and genuine multi-objective controller synthesis
  - Robust controller design
- Parameter Robust Stability
  - Robust stability against time-invariant and time-varying uncertainties
  - Parameter dependent Lyapunov functions
  - Semi-infinite LMI problems and relaxations
- Robust Optimization and Lagrange Duality
  - Introduction to robust optimization and robust LMI problems
  - Lagrange duality
  - How to construct tractable relaxations
- Dynamic Robustness
  - Linear fractional representations
  - Robust stability tests with multipliers
  - Relations to the structured singular value
- LPV synthesis
  - Linear parametrically-varying controller synthesis
  - Direct approach
  - Multiplier approach
- Polynommial optimization
  - Sum of Square (SOS) optimization

[1, 2, 3]

References

[1] S. Boyd, L. El Ghaoui, E. Feron, and V. Balakrishnan. *Linear Matrix Inequalities in System and Control Theory (Studies in Applied Mathematics)*. SIAM, Philadelphia, 1994.

[2] Stephen Boyd and Lieven Vandenberghe. *Convex Optimization*. Cambridge University Press, Cambridge, 2004.

[3] C. Scherer and S. Weiland. *Linear Matrix Inequalities in Control*. 2005.

Evaluation

Project	30%
Midterm سه شنبه ۱۴ اردیبهشت	30%
Final	40%

Academic Integrity Any kind of academic dishonesty will not be tolerated.

Notes The instructor reserves the right to change this syllabus as needed. All changes will be announced in class.