

אגוד ישראל לבקרה אוטומטית — איב"א

ISRAEL ASSOCIATION for AUTOMATIC CONTROL

National Member Organization of:



הזמנה ליום עיון בנושא:

Modern Gain-Scheduling Control by Convex Optimization

שייערך במלון "דניאל", הרצליה

יום ב', 21 למאי, 2018

There are numerous applications where uncertainties and deviations from equilibria are too much for a single linear controller to handle. Gain-scheduling, where the controller is selected from a family of controllers pre-designed for different operating points / uncertainty areas, is a viable—and battle-tested—approach to cope with such conditions. Although the idea is rather old, research efforts on its theoretical justifications have started a couple of decades ago and might not yet be widely accessible to practicing control engineers. The workshop will provide a tutorial introduction to the modern gain-scheduling methods and their theoretical foundations and shall be of interest to industrial and academic communities alike.

The main speaker is Professor **Carsten Scherer** from the University of Stuttgart. Prof. Scherer received the Ph.D. degree in mathematics from the University of Würzburg, Germany in 1991. Until February 2010 he was a full professor within the Delft Center for Systems and Control at Delft University of Technology, The Netherlands. Since March 2010 he holds the SimTech Chair for Mathematical Systems Theory in the Department of Mathematics at the University of Stuttgart, Germany. His main research activities cover various topics in applying optimization techniques for developing new advanced controller design algorithms and their application to mechatronics and aerospace systems. Dr. Scherer acted as the chair of the IFAC technical committee on Robust Control (2002-2008), and he has served as an associate editor for *IEEE Transactions on Automatic Control* (1997-1999, 2018-), *Automatica* (2000-2006) and *Systems & Control Letters*; he is currently active on the editorial board of the *European Journal of Control*. Since 2013 he is an IEEE fellow "for contributions to optimization-based robust controller synthesis".

The workshop will be supplemented by a lecture of Dr. **Maxim Kristalny** from RAFAEL-ADA on related aspects of autopilot design.

Leonid Mirkin, Technion-IIT
Workshop organizer

Modern Gain-Scheduling Control by Convex Optimization

Carsten Scherer

Mathematical Systems Theory, Department of Mathematics, University of Stuttgart

Monday, 21 May 2018

8:30	Registration	
9:00	Opening (Moshe Idan / Leonid Mirkin)	
9:05	Introduction to convex optimization in systems and control	
	- Basics of linear matrix inequalities	9:05-9:50
	- Analyzing stability and performance properties of linear systems	10:00-10:45
10:45	Coffee break	
11:10	Controller synthesis by linear matrix inequalities	
	- State-feedback and estimator design	11:10-11:55
	- Output feedback controller synthesis	12:05-12:50
12:50	Velger Prize ceremony	
13:00	Lunch break	
14:00	LPV design: Theory and examples	
	- Practical aspects of autopilot design, by Maxim Kristalny	14:00-14:45
	- The polytopic approach to gain-scheduling design	14:55-15:40
15:40	Coffee break	
16:05	Recent developments	
	- Systems analysis with integral quadratic constraints	16:05-16:50
	- The power of a general gain-scheduling paradigm	17:00-17:45
17:45	Closing	

Abstract: Convex optimization and semi-definite programming have become very popular tools for analyzing dynamical systems and synthesizing controllers. In this workshop we focus our attention on Linear Parameter Varying (LPV) systems that are described by linear differential equations whose describing matrices depend—possibly in a non-linear fashion—on time-varying parameters. The goal of the related synthesis problem is to design a controller of the very same structure such that the overall controlled system satisfies certain desired specifications on stability and performance for the entire set of permissible parameter trajectories. The implementation of LPV controllers takes on-line measurements of the time-varying parameters into account in order to improve the performance over robust controllers, compensators without any adaptation capabilities. Since the time-varying parameters often admit the interpretation of describing the location of the system's operation point, LPV control methods are viewed as a viable alternative to classical gain-scheduling designs for controlling nonlinear systems.

The workshop is intended to develop the relevant background in semidefinite programming for analyzing the stability and performance properties of linear systems and LPV systems by linear matrix inequalities. We highlight the key ideas that are involved in convexifying problems of controller and estimator synthesis. We discuss how such techniques seamlessly generalize to robustness analysis and gain-scheduling synthesis for LPV systems. The last parts of the workshop are devoted to recent extension of the gain-scheduling paradigm, by covering aspects of the theory of integral quadratic constraints and distributed controller synthesis.

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שייערך במלון "דניאל", הרצליה

יום ב', 21 למאי, 2018

טופס הרשמה:

שם: _____
כתובת: _____
דוא"ל: _____
מקום עבודה: _____
טלפון: _____ פקס: _____

דמי השתתפות (כוללים ארוחת צהרים, כיבוד וזכות הורדת חומר ההרצאות):

רישום מוקדם עד 13.5.18 ₪ 480

רישום החל מ-14.5.18 ₪ 530

סטודנט (בזמן מלא) ₪ 250

מצורפת המחאה ע"ס _____ ₪ לפקודת איב"א (איגוד ישראלי לבקרה אוטומטית)

לחיוב תקציב מוסדי בטכניון שמספרו _____

רישום במקום (באמצעות המחאה לפקודת איב"א, או מזומן בלבד)

תאריך _____ חתימה _____

את הטופס יש לשלוח לכתובת:

מירה ארן, מזכירת איב"א

הפקולטה להנדסת חשמל

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או לפקס: 04-8295745 (לידי מירה)

או למייל: mira@ee.technion.ac.il

לידיעתך, קו 29, מתחנת הרכבת בהרצליה למלון דניאל, יוצא כל 10 דקות (זמן נסיעה כ-15 דקות)

תודתנו נתונה למפעלים ולמוסדות

הבאים אשר תמיכתם באיב"א

מאפשרת לקיים ימי עיון מסוג זה:

אלביט מערכות – יבשה ותקשוב בע"מ

קריה למחקר גרעיני – נגב

רפאל – מערכות לחימה מתקדמות בע"מ