

אגוד ישראל לבקרה אוטומטית - איב"א

ISRAEL ASSOCIATION for AUTOMATIC CONTROL

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הזמנה ליום עיון בנושא:

Simple Adaptive Control and New Results in Stability Analysis

שייערך במלון "דניאל", הרצליה

יום ב', 27 למרץ, 2017

Simple adaptive control (SAC) techniques have been conceived for large-scale systems. Before appropriate mathematical tools of analysis had been developed, SAC was considered to be just a modest version of the standard model reference adaptive control (MRAC). Further developments showed that SAC techniques can readily be applied to such applications as robots, airplanes, missiles, satellites, fine motion control, etc. Various drawbacks related to classical MRAC have been addressed and eliminated and conditions needed for robust stability have been significantly mitigated. Recent developments in nonlinear systems stability analysis tools lead to clear proofs of SAC stability in realistic environments. Realistic examples from various domains of flight control, guidance and aerospace are used to show that indeed SAC is the stable direct MRAC methodology. A non-minimum-phase and unstable UAV will be used as a detailed case-study to show the simplicity of SAC as an add-on to classical control design which improves performance. Application to real hardware will be demonstrated.

Although Lyapunov stability theory is the customary basis of any modern stability analysis, its direct application requires fitting a positive definite function to the system whose derivative "along all trajectories of the system" is negative definite, whereas in most non-trivial problems the derivative is at most negative semi-definite. Because early extensions of Lyapunov stability theory were only covering autonomous systems, various alternatives were sought for non-autonomous systems. An alternative provided by the Barbalat Lemma imposes conditions of uniform continuity of functions and even continuity of derivatives that again could limit its applicability. Besides, even when applicable, it only ends with partial results. Although extensions of LaSalle's Invariance Principle to non-autonomous systems have been available since at least 1976, they have remained surprisingly unknown for large circles of the nonlinear control community. Moreover, even if assumed known, misinterpretations of its larger mathematical scope (that covers much more than mere asymptotic stability) may have misled users with respect to its usefulness. The review of LaSalle's Invariance Principle along with a new extended Invariance Principle, together with a presentation of various alternatives to stability analysis, will help show the extreme efficiency of the new theorems of stability for nonlinear systems stability analysis.

Organizers: Itzhak Barkana (Barkana Consulting, Israel), Haim Weiss (Rafael, Israel), Ilan Rusnak (Rafael, Israel)

Simple Adaptive Control and New Results in Stability Analysis

March 27, 2017

Program

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|-------|---|--|
| 08:30 | Registration | |
| 09:00 | Opening | Moshe Idan |
| 09:10 | Session 1: - The need for adaptation - The role of passivity in adaptive control | <i>I. Barkana</i> <i>I. Barkana</i> |
| 10:25 | Coffee break | |
| 10:50 | Session 2: - Review of adaptive control architectures | <i>I. Barkana</i> |
| 12:05 | Session 3: - Architectures of control loops - Simple Adaptive Control for Engineers | <i>I. Rusnak</i> <i>H. Weiss</i> |
| 13:20 | Lunch Break | |
| 14:45 | Session 4: - Simple Adaptive Control for Engineers (cont.) - New stability results and their implication for SAC | <i>H. Weiss</i> <i>I. Barkana</i> |
| 16:00 | Coffee Break | |
| 16:20 | Session 5: - New stability results and their implication for SAC (cont.) - Applications of the SAC algorithm | <i>I. Barkana</i> <i>I. Rusnak and I. Barkana</i> |
| 17:35 | Concluding Remarks | |
| 17:45 | End | |

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שייערך במלון "דניאל", הרצליה

יום ב', 27 למרץ, 2017

טופס הרשמה :

שם: _____

כתובת: _____

דוא"ל: _____

מקום עבודה: _____

טלפון: _____ פקס: _____

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

רישום מוקדם עד 19.3.17 ש"ח 450

רישום החל מ- 20.3.17 ש"ח 500

סטודנט (בזמן מלא) ש"ח 250

מצורפת המחאה ע"ס _____ ש"ח

לחיוב תקציב מוסדי שמספרו _____

רישום במקום (באמצעות המחאה או מזומן בלבד)

תאריך _____ חתימה _____

את הטופס יש לשלוח לכתובת:

מירה ארן, מזכירת איב"א

הפקולטה להנדסת חשמל

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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