

Parametric Programming & Control

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The last decades have seen the rapid increase in the use of optimization-based techniques for improved design, control and operation of various types of engineering systems. A prime difficulty in applying these types of techniques to real systems and processes arises from the unavoidable presence of variations in the problem parameters such as fluctuations in uncertain inputs and measurements, or variations in inherent system properties and characteristics. These variations readily translate to deviations from the prescribed optimal point, thus, either failing to exploit fully the benefits of the optimization based solution or requiring the repetitive solution of the problem for different values of the problem parameters.

Parametric programming is a technique that determines computationally inexpensively the exact mapping of the optimal solution profile in the space of the system parameters. In this way the repetition of the problem solution is avoided, while the optimal solution can readily adapt to the system variability. In our group we have developed algorithms for multi-parametric (mixed integer) linear, quadratic, non-linear and dynamic optimization problems that are commonly encountered in (i) optimization under uncertainty, where the uncertainties are the problem parameters, (ii) multi-level and multi-objective optimization where the different levels/objectives play the role of the parameters and (iii) model-based on-line control and optimization where the process states correspond to the parameters.

In this presentation, we will first give an overview of the mathematical foundations of multi-parametric programming for different classes of mathematical models. We will then discuss its application to model-based optimal control, with emphasis on how to design off-line affordable advanced multi-parametric controllers for industrial, automotive and biomedical systems.

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- Born 12 August 1961, Thessaloniki, Greece
- Diploma – Chemical Engineering – Aristotle University of Thessaloniki, Greece, 1984
- PhD – Chemical Engineering – Carnegie Mellon University, Pittsburgh, 1988
- Senior Engineer, Shell Chemicals, Amsterdam, the Netherlands (1988-1990)
- Served in the Greek Army (January 1990-August 1991)
- Joined Imperial College in 1991, Lecturer 1991-1996, Reader 1996-1999
- Professor of Chemical Engineering, Imperial College London - since 1999
- Director, Centre for Process Systems Engineering, Imperial College London – since 2002
- Authored/Co-authored over 200 research publications (in the area of optimisation, control and process systems engineering applications)
- Co-Editor, Book Series in Process Systems Engineering, Wiley-VCH
- Editorial Board, Journal of Global Optimization, Kluwer
- Editorial Board, Computational Management Science, Springer
- Co-Founder and Senior Consultant, PSE Ltd
- Founder and Director, PAROS Ltd (recently listed in AIM - LSE)
- 22 PhD students graduated so far (and over 30 MSc students)
- Current research group – 7 PhD students, 2 Post-Docs, 3 MSc students
- Involved in over 50 research and industrial contracts (1991-2006) as Coordinator and/or PI, with total funding of over £12 M
- Research interests include (i) theory, algorithms and computational tools for continuous and integer parametric programming, (ii) advanced model based control and its biomedical and industrial applications and (iii) energy and the environment - sustainable process development
- Invited Member, Computer Aided Process Engineering (CAPE) Working Party, European Federation of Chemical Engineers
- Member of the Advisory Scientific Committee, European Enterprise Institute (EPP-ED Association)
- Married to Dr. Maria Zarari; two children, Eleni (8 years old) and Yiannis (7 years old)