Lorenz T. Biegler

Lorenz T. (Larry) Biegler is currently the Bayer Professor of Chemical Engineering at Carnegie Mellon University, which he joined after receiving his PhD from the University of Wisconsin in 1981. His research interests lie in computer aided process engineering (CAPE) and include flowsheet optimization, optimization of systems of differential and algebraic equations, reactor network synthesis and algorithms for constrained, nonlinear process control. Prof. Biegler has been a visiting scholar at Northwestern University, a scientist-in-residence at Argonne National Lab, a Distinguished Faculty Visitor at the University of Alberta, a Gambrinus Fellow at the University of Dortmund, a Fulbright Fellow at the University of Heidelberg and a Distinguished Jubilee Lecturer at IIT-Bombay. He has authored or co-authored over 250 archival publications, authored or edited nine books and given numerous invited presentations at national and international conferences.

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NSOS – Nonlinear Systems Optimization and Statistics

Algoritmi R&D Centre
University of Minho

Recent Advances in Barrier Methods in Nonlinear Programming & Simultaneous Nonlinear Programming Strategies for Dynamic Optimization

Lorenz T. Biegler

October 10, 2008
15h00-16h00 & 16h30-17h30
ANF, EE II
Campus de Gualtar
4710-057 Braga

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&

Simultaneous Nonlinear Programming Strategies for Dynamic Optimization

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Part I: Recent Advances in Barrier Methods in Nonlinear Programming

We present a primal-dual interior point algorithm with a filter line search method for nonlinear programming. Local and global convergence properties of this method were analyzed in previous work. Here we provide a comprehensive description of the method including strategies for second order corrections, filter restoration phase, scaling and inertia correction of the KKT matrix. This method has been implemented in the IPOPT code, which can be downloaded from http://www.coin-or.org. Moreover, the resulting algorithm can easily be adapted to exploit particular NLP structures and computing architectures. This will be demonstrated on a variety of applications that demonstrate favorable performance of IPOPT.

Part II: Simultaneous Nonlinear Programming Strategies for Dynamic Optimization

With the need to develop better designs and operating policies for dynamic nonlinear systems, it because important to consider efficient systematic strategies for the optimization of these systems. In particular, simultaneous approaches to dynamic optimization because of their efficiency and ability to handle complex dynamic features. This approach discretizes both the state and control profiles and solves a large-scale nonlinear program that results from the discretized system. Simultaneous optimization can be applied to optimize systems that are unstable, path constrained and high dimensional. Moreover, they are supported by two important elements:
- theoretical aspects of this approach have an equivalence to classical approaches such as Pontryagin's maximum principle
- efficient solution of large-scale nonlinear programs can be applied to these problems.

In addition to discussing these issues, a number of examples drawn from real-time optimization and data assimilation of water networks and chemical processes will be presented that demonstrate the benefits of this approach.