AIChE Webinar Series

Computing & Systems Technology Division (CAST) Welcomes

Dr. John Siirola

Principal R&D Member of Technical Staff
Sandia National Laboratories

Sandia National Laboratories

Structured Optimization Modeling with Pyomo and Coopr

Abstract:

Computational tools for modeling mathematical programs are widely used within both academia and industry. Available commercial and open-source modeling packages support generic modeling by separating modeling constructs from instance data through concepts like sets, parameters, and parameterized constraints. However, limiting models to "flat" algebraic representation forces the modeler to explicitly convert or relax high-level constructs, which can obscure much of the structure in the model. In this presentation, I will provide an overview of Pyomo, an open-source library for modeling general algebraic optimization problems in Python. I will go on to show how high-level non-algebraic modeling constructs can be coupled with automated model transformations to improve model clarity and abstraction. This coupling provides a more flexible workflow where the modeler can explicitly apply transformations that link the structured model to a particular solver, thereby separating the core model from subsequent reformulation decisions. I will draw examples from various Coopr project areas including disjunctive, bilevel, dynamic, and stochastic programming.

Biography:

Dr. John D. Siirola is a Principal R&D Member of Technical Staff in the Analytics Department at Sandia National Laboratories. His main areas of expertise are systems design, operations research, optimization modeling, and optimization algorithms. John's research focuses on the intersection of computational tools with systems design and analysis; in particular, developing approaches for modeling highly structured systems, optimization algorithms that can exploit the expressed structure, and the application of these techniques to national security problems. Much of John's research is disseminated through open-source software projects. He leads the Acro project (optimization algorithms) and co-leads the Coopr project (optimization modeling). He is a core contributor to the Water Security Toolkit (modeling and analysis tools for drinking water distribution systems) and Dakota (optimization and uncertainty quantification), and contributes to numerous tools, including Utilib, PyUtilib, gcovr, and cxxtest. John has a B.S. from Purdue University (2000) and Ph.D. from Carnegie Mellon University (2005), both in Chemical Engineering. He is a senior member of the AIChE, member of INFORMS, and member of the COIN-OR Foundation. John currently serves on the COIN-OR Technical Leadership Council. He was also selected to co-chair the 2014 Foundations of Computer Aided Process Design (FOCAPD) conference.

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