ADVANCED OPTIMIZATION FOR ENERGY PROCESSES

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OPTIMIZATION
Theory
Algorithms
Software

Energy Systems

Biomedical Computing

Computational Chemistry
• One-third of U.S. CO2 emissions come from power plants and other point sources

• Available carbon capture and sequestration technologies would increase electricity costs
  – Pulverized coal plants
    » Currently: 75% increase
    » Goal: < 35% increase
  – Integrated gasification combined cycle plants
    » Currently: 35% increase
    » Goal: < 10%

• Risk quantification required
CARBON CAPTURE AND SEQUESTRATION TECHNOLOGIES

• Capture
  – Pre/Post/Oxy-fuel Combustion
  – Absorption, adsorption, membranes, cryogenic distillation, …

• Sequestration
  – Ocean
  – Mineral
  – Geologic
    – Oil/gas reservoirs
    – Saline formations
    – Coal seams
    – …

MAJOR GOALS

• Develop algorithms and software to facilitate optimization of energy processes
  – BARON: Global optimization of algebraic NLPs/MINLPs
  – Optimization without an algebraic model
    » Simulation-based optimization
    » Derive surrogate algebraic models from simulations; optimize surrogates with algebraic methods
PROJECTS AND STUDENTS

• Optimization of CO2 capture technologies
  – Alison Cozad

• Design of drilling fluids for high P/T
  – Apurva Samudra

• Risk assessment for CO2 sequestration
  – Yan Zhang