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The NEOS Server

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`http://www.mcs.anl.gov/home/more/`

NEOS (Network-Enabled-Optimization-System) Server

The NEOS Server uses the computational and algorithmic resources of OTC (Optimization Technology Center) collaborators to solve optimization problems automatically with minimal input from the user.

Ingredients

- Optimization software
- Software tools
- Automatic differentiation

Typical Environment for Nonlinear Optimization

$$\min\{f(x) : x_l \le x \le x_u,\ c_l \le c(x) \le c_u\}$$

Tasks

- Develop code to evaluate the objective function $f : \mathbb{R}^n \mapsto \mathbb{R}$ and constraint $c : \mathbb{R}^n \mapsto \mathbb{R}^m$
- Decide on the software
- Retrieve the software
- Hand-code the gradients, Hessians, sparsity patterns.
- Compile, debug, compile, debug, …run
- Interpret the results
- Repeat the process

The NEOS Way

- Develop code to evaluate the objective function $f : \mathbb{R}^n \mapsto \mathbb{R}$ and constraint $c : \mathbb{R}^n \mapsto \mathbb{R}^m$
- Submit problem to the **NEOS** Server
- Interpret the results
- Repeat the process

Advantages

Easy to use
No need to choose or retrieve software
No need to compute derivatives or sparsity patterns

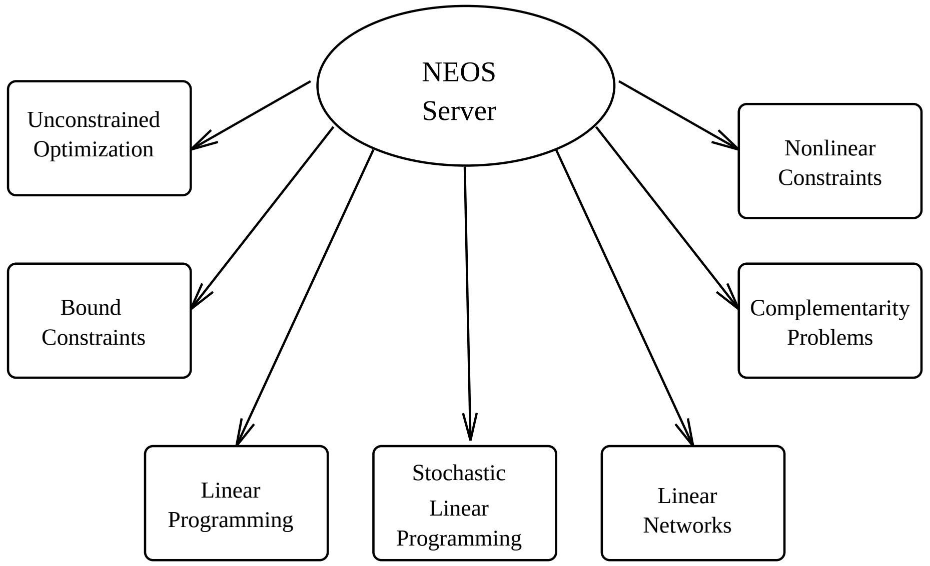
NEOS

- NEOS Server
- NEOS Guide
  - Optimization Software Guide
  - Optimization Tree
  - Case Studies
  - Test Problems

Outline

- What optimization problems can we solve?
- How are optimization problems submitted?
- How are optimization problems solved automatically?
- How do we add optimization solvers to the NEOS Server?

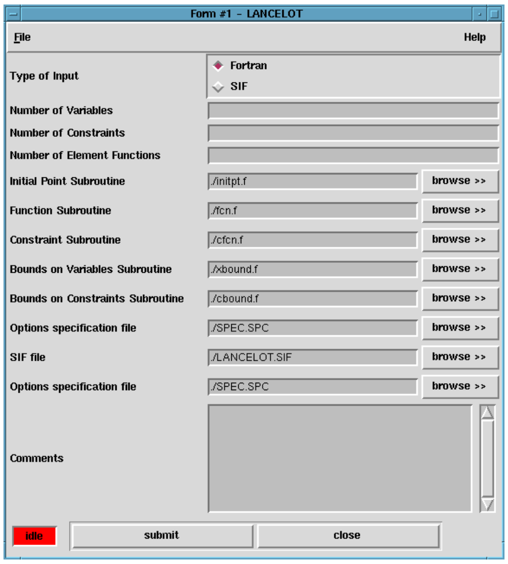
NEOS Server Solvers



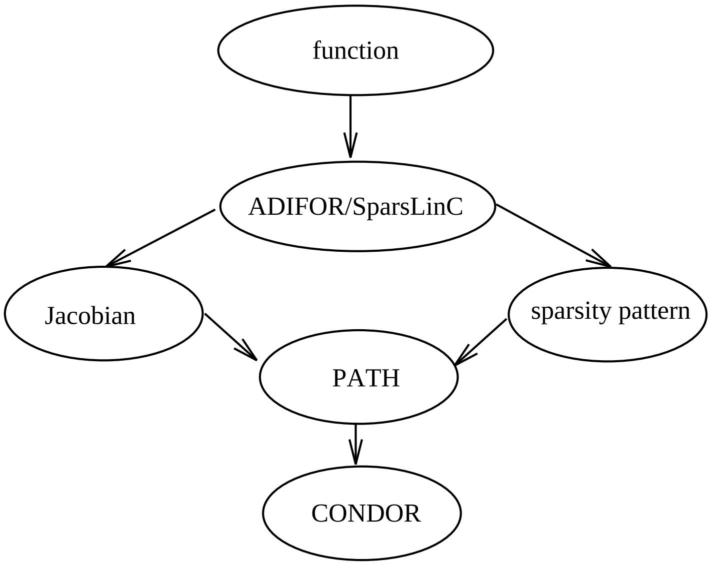
NEOS Server Submissions

- NEOS Submission tool
  - Socket-based; results returned via `neos-submit`.
  - NEOS Server submission tool entry in `http://www.mcs.anl.gov/home/otc/Server/`
- Web Browser
  - Web-based; results returned via browser or email.
  - `http://www.mcs.anl.gov/home/otc/Server/`
- Email
  - Email-based; results returned via email.
  - `neos@mcs.anl.gov`

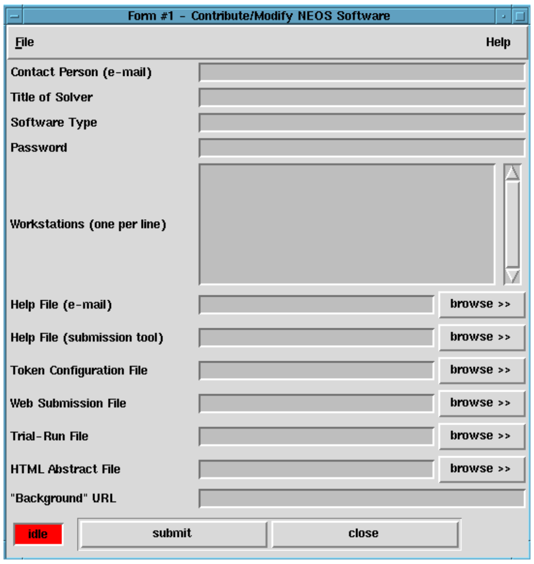
NEOS Submission Tool – LANCELOT



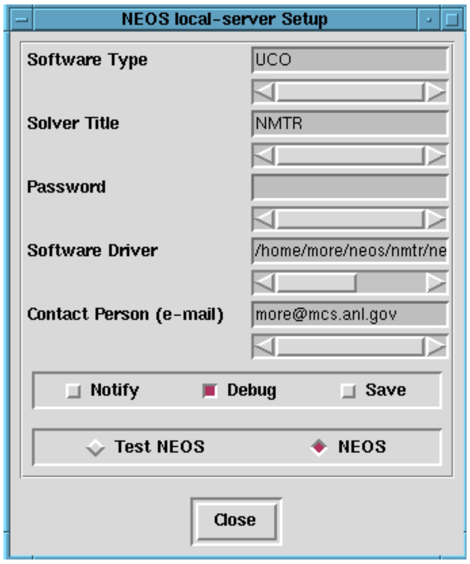
Handling Complementarity Problems: PATH



Registration of Software: NEOS Submission tool



Registration of Software: NEOS Communications tool



Miscellaneous Issues

- Monitoring traffic – The NEOS Monitor
  - Job number, date, user name.
  - Type of job, solver, and interface
  - Host and domain for the submission
- Checking user input
  - Initial point
  - Functions at initial point
  - Continuity and differentiability

Uses of the NEOS Server

- Solving large optimization problems
- Education and information on optimization technology
- Classroom exercises
- Testing optimization software
- Comparing optimization software
- Prototype problem solving environment

Future Directions for the NEOS Server

- Handling C-programs (ADOL-C and ADIC)
- Distributed computing (remote procedure calls)
- Global optimization
- Problem-solving environment

Additional Information

NEOS Server
`http://www.mcs.anl.gov/home/otc/Server/`

NEOS Guide
`http://www.mcs.anl.gov/home/otc/Guide/`

Optimization Technology Center
`http://www.mcs.anl.gov/home/otc/`