

MOOSE: Model Based Optimal Input Design Toolbox

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Moose is a model based optimal input design toolbox developed for Matlab. The toolbox has been made to simplify implementation of the optimization problems found in input design. It provides an extra layer between the user and a convex optimization environment.

Features

- Design input spectrum, Φ_u .
- Easy to use text interface.
- Compatible with the Matlab Control System Toolbox.
- Applications oriented design.
- Classical input design, such as D-optimal.

The Math

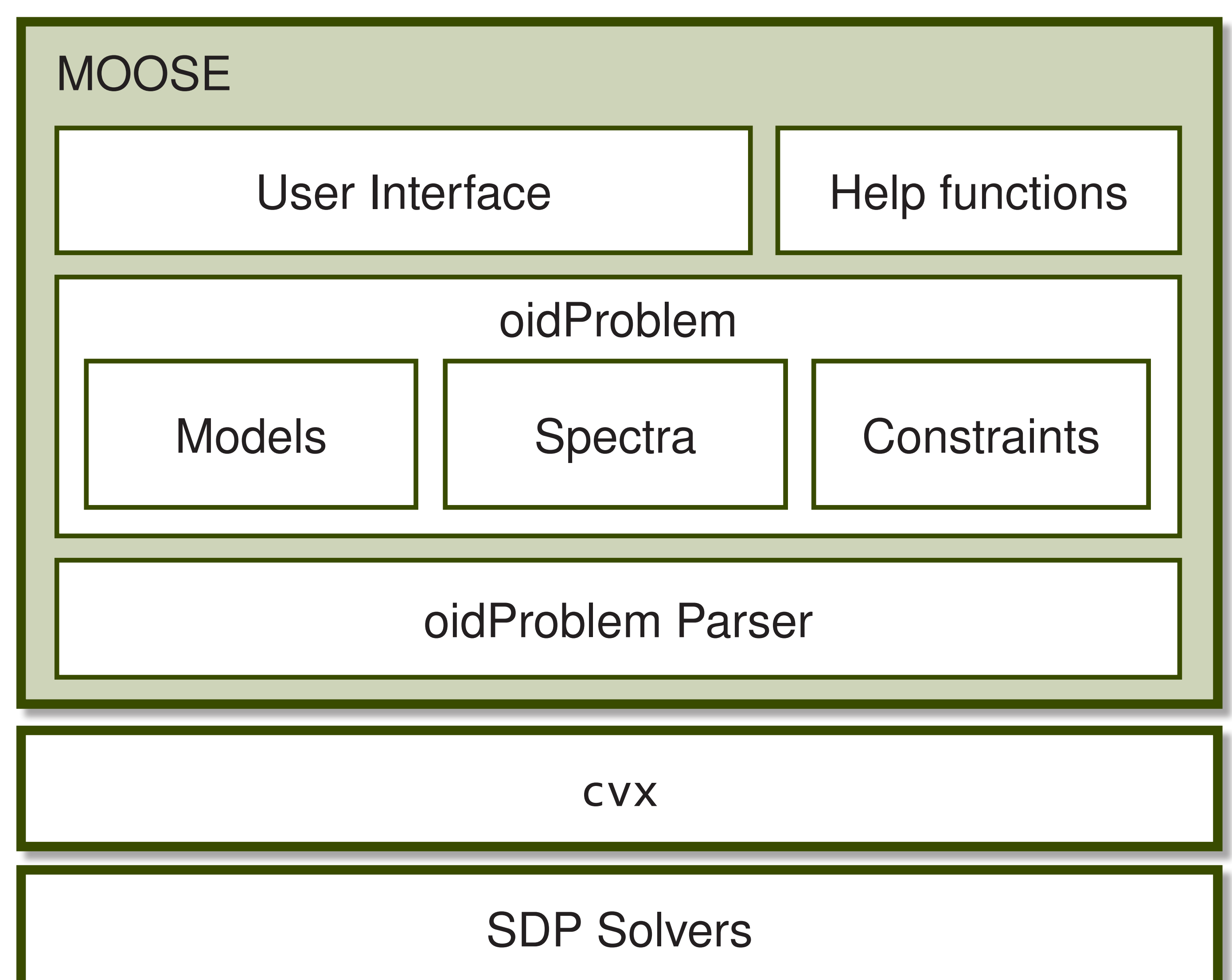
- Handles problems of the form

$$\begin{aligned} & \underset{\Phi_u}{\text{minimize}} && \text{objective} \\ & \text{subject to} && \mathcal{E}_{SI}(\alpha) \subseteq \Theta_{app}(\gamma) \\ & && \beta(\omega) \leq \Phi_u(\omega) \leq \delta(\omega), \quad \forall \omega. \end{aligned}$$

- Confidence ellipsoid inside application set.
- Relaxed to convex problem.

Implementation

- Matlab toolbox.
- Object oriented implementation.



MOOSE Example



- Minimize input variance.
- Satisfy application specifications.
- FIR input spectrum with 20 lags.

$$\begin{aligned} & \underset{\Phi_u(\omega)}{\text{minimize}} && E\{u^2\} \\ & \text{subject to} && \mathcal{E}_{SI}(0.95) \subseteq \Theta_{app}(100) \\ & && \Phi_u(\omega) \geq 0, \quad \forall \omega \end{aligned}$$

```
% Setup system and model
theta0 = [10 -9]';
G = tf([0;theta0],1,1,'variable','z^-1');
H = 1;
Re = 1;

% MOOSE declaration block
beginMoose
    objective minimize(inputPower)
    model G H Re
    identification constraints
        spectrum phiU = FIR(20)
        probability 0.95
        numSamples 100
    application constraints
        ellipsoid(@Vapp,100)
endMoose
optimalFilter = mooseProblem.spectralFactor;
```

www.ee.kth.se/moose

