

MAP-i - Doctoral Programme in Computer Science

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- 2 Applications and research outcome



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Research areas – Semi-Infinite Programming

We are dealing with optimization problems where a finite number of variables are optimized subject to an infinite number of constraints.

Semi-Infinite Programming

$$\begin{aligned} & \min_{u \in R^n} f(u) \\ \text{s.t. } & g_i(u, v) \leq 0, \quad i = 1, \dots, m \\ & u_{lb} \leq u \leq u_{ub} \\ & \forall v \in \mathcal{R} \subset R^p. \end{aligned}$$



Research areas – Multi-Local Optimization

We are addressing an optimization problem where all the local (and therefore global) optima are requested.

Multi-Local Optimization

$$\max_{v \in \mathcal{R} \subset \mathbb{R}^p} \bar{g}(v)$$

Multi-local optimization is connected with some numerical methods for semi-infinite programming.



Research areas – Global Optimization

We seek for the global maximum of an optimization problem.

Global Optimization

$$\begin{aligned} \min_{x \in R} \quad & f(x) \\ \text{s.t.} \quad & \ell \leq x \leq u \\ & Ax \leq b \end{aligned}$$

Where $f(x)$ is consider a “black box” objective function (no derivatives and possible noisy).



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Semi-Infinite Programming

Application areas

We have used SIP in problems related with:

- * Pollution control;
- * Robot trajectory planning;

Software outcome

We have produced the only publicly available software for SIP

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MATLAB is planning to use SIPAMPL in their “new” solver numerical tests.

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- * SIPAMPL – an extension of AMPL to semi-infinite programming problems (with some limitations)

- * SIPS – solver for semi-infinite programming with interface to AMPL (also available in the MATLAB toolbox) (<http://neis.ncees.nrl.gov/news/solvers/sipmaps/AMPL.html>)

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Multi-Local Optimization

Application areas

We are mostly interested in the use of multi-local optimization in a reduction type methods for SIP.

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MLOPSOA - Software for multi-local optimization with interface to AMPL, based on the particle swarm paradigm.



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Global Optimization

Application areas

We are dealing with an Astrophysics application (On the Milipeia platform). We are aware of PSwarm use on a Economical problem (with linear constraints) and a Mechanical problem (structural design).

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PSwarm - Software for global optimization with interface to AMPL. Developed in C (serial and parallel versions) and MATLAB. Also available in the [NEOS server](#)

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