**Katedra matematiky a didaktiky matematiky** (KMD, FP TUL)
**Ústav nových technologií a aplikované informatiky** (NTI, FM TUL)
**Oddělení nanotechnologií a informatiky** (INT, CxI TUL)

Srdečně zveme spolupracovníky v rámci TUL i zájemce z řad odborné veřejnosti na

# přednášky prof. Dr. Christiana Grossmanna

(TU Dresden, Institute of Numerical Mathematics) pořádané v rámci odborného semináře KO-MIX

## Finite Elements and Penalties Applied to Linear Quadratic Optimal Control

### Pondělí 14. 10. 2013 od 14:30, Didaktický kabinet KMD

(budova H areálu TUL, Voroněžská 1329/13, Liberec, 4. patro, č. dv. H/5027)

**Abstract:** In this talk the numerical treatment of optimal control problems with a quadratic goal functional and elliptic state equations are studied. There are discussed cases of distributed as well as boundary controls. The state equations are discretized mainly by conforming finite elements, but furthermore aspects of discontinuous Galerkin methods are included.

Occurring constraints upon controls as well as states are treated by a class of barrier-penalty methods. In this context a quite broad class of barrier-penalty methods are considered. Taking advantage of the elliptic state equations the necessary and sufficient optimality condition can be expressed by a coupled system of nonlinear equations in appropriate function spaces and in finite dimensional spaces in case of the continuous problems and its discretization, respectively. The used barrier-penalty terms can be interpreted as certain approximate projections. This allows to reduce the optimality system such that obtained remaining system does not explicitly contain the controls, but the more regular states and adjoints only. This techniques brings more stability to the numerical treatment than a pure barrier-penalty approach.

Finally, some connections between Nitsche mortaring for discontinuous finite elements and Lagrange duality are presented.

## Optimal Control with Partial Differential Equations: Existence and Properties of Optimal Controls

### Úterý 15. 10. 2013, 12:30 - 14:00 hodin, posluchárna A11

(budova A areálu TUL, Hálkova 6, Liberec, 2. patro, č. dv. A/108)

**Abstract:** Optimal control problems are considered with state equation in classical formulation, i.e. by partial differential equations and its appropriate weak formulation. The main focus of the lecture is directed to the construction of the weak formulation in Sobolev spaces of the governing state equations. Essential properties of the solution of the state equation as existence, uniqueness, but also regularity are derived for given controls. The controls can be distributed throughout the underlying domain (mainly two dimensional) or on its boundary. As method of choice the state equations are discretized by conforming finite elements, but furthermore certain aspects of discontinuous Galerkin methods are discussed.

## Numerical Treatment of Optimal Control Problems with Partial Differential Equations

### Čtvrtek 17. 10. 2013, 8:50 - 10:20 hodin, posluchárna H32

(budova H areálu TUL, Voroněžská 1329/13, Liberec, 3. patro)

**Abstract:** For the numerical treatment of optimal control problems iterative methods are discussed. The weak formulation of the state equations are discretized by conforming finite elements. Various methods to cope with constraints upon controls as well as states are discussed, e.g. active set strategies certain barrier-penalty methods. In particular the rate of convergence of discretization and penalty techniques are studied. The optimality conditions with penalties can be reduced to the condensed optimality systems that does not contain the controls explicitly. We discuss the advantage of this approach over a direct penalty application. Finally, some primal dual finite element methods are presented and its relation to augmented Lagrangian methods investigated.

Za organizátory srdečně zve

RNDr. Václav Finěk, Ph.D.