European Research Council

ERC-Starting Grant
High-Dimensional Sparse Optimal Control

Technische Universität München

Fakultät für Mathematik
Lehrstuhl für Angewandte
Numerische Analysis

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Two PostDoctoral positions at the Department of Mathematics of the Technical University of Munich

Dear Colleague,

we are advertising **2 PostDoctoral** positions for a term of up to 4 years at the Department of Mathematics of the Technical University of Munich within the ERC-Starting Grant project *High-Dimensional Sparse Optimal Control*.

Our research

We perform mathematical research oriented to applications in data analysis and time dependent phenomena (e.g., image processing, fracture simulation, remote satellite sensing for Earth observation, data analysis and modelling of pulsating stars, social dynamics and control of multiagent interactions), employing several related methods in variational calculus, nonlinear PDEs, optimization and optimal control, functional and harmonic analysis, numerical analysis. A short description of the scientific plan of the ERC-Starting Grant project *High-Dimensional Sparse Optimal Control* is reported below.

Environment

Our unit in Applied Numerical Analysis is a very active research group with a strong international profile (http://www-m15.ma.tum.de/). The Department of Mathematics of the Technical University of Munich is a young, stimulating, and dynamical environment, offering excellent working conditions. It is composed of 17 research units representing all the relevant fields of applied and numerical mathematics (http://www.ma.tum.de/Mathematik/Forschung), qualifying itself as one of the strongest centers of applied mathematics in Germany. The Technical University of Munich has been recently confirmed as a *University of Excellence* in Germany, and in the next years will be subjected to further relevant developments, in particular with a very new and competitive *tenure track career system* (http://www.exzellenz.tum.de/1/homepage/) .

We offer

To the successful candidates will be offered a research position up to 4 years with competitive salaries depending on qualification. The work is additionally supported with individual research funding (c.a. 10.000,00 EUR/year for each researcher). No teaching duties are requested. We provide both individual supervision and independent career promotion. The starting is at the earliest convenience (negotiable). **Application deadline: April 15, 2016**, or until filled. This advertisement will keep online until the position is filled.

We search

Interested candidates with a strong background in one or more of the following

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fields

- *inverse problems and parameter identification in PDE, learning theory, optimization and optimal control, nonlinear PDE* -

are invited to apply, by electronically submitting a motivation letter, curriculum, including publication list, a description of research interests, up to 3 letters of recommendation in pdf format. Outstanding candidates in related topics not listed above will also be considered.

Enquiries regarding the positions and the applications should be directed to Massimo Fornasier (massimo.fornasier@ma.tum.de).

Sincerely yours

Massimo Fornasier

Summary of the project *High-Dimensional Sparse Optimal Control*

We are addressing the analysis and numerical methods for the tractable simulation and the optimal control of dynamical systems which are modeling the behavior of a large number N of complex interacting agents described by a large amount of parameters (high-dimension). We are facing fundamental challenges:

- **Sparse optimal control in high-dimension and mean field optimal control**: while self-organization of such dynamical systems has been so far a mainstream, we will focus on their sparse optimal control in high-dimension. We will investigate L1-minimization to design sparse optimal controls. We will learn high-dimensional (sparse) controls by random projections to lower dimension spaces and their mean field limit.
- **Learning dynamics from observation of evolutions**: differently from purely physical problems, in the real-life the social forces, which are ruling the dynamics, are actually not known. Hence we will address the problem of automatic learning from collected data the fundamental functions governing the dynamics.