Friedrich-Alexander-Universität
Department Data Science | DDS

Chair
DYNAMICS, CONTROL
AND NUMERICS
FAU

Alexander von Humboldt
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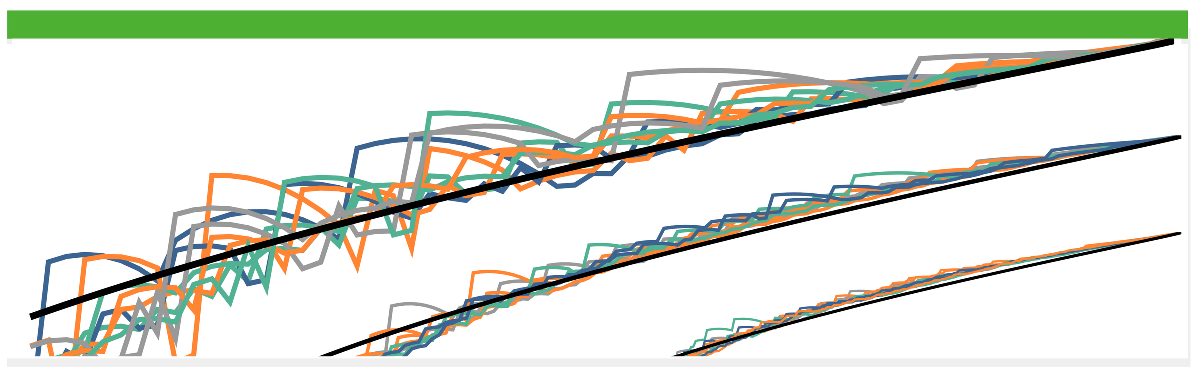
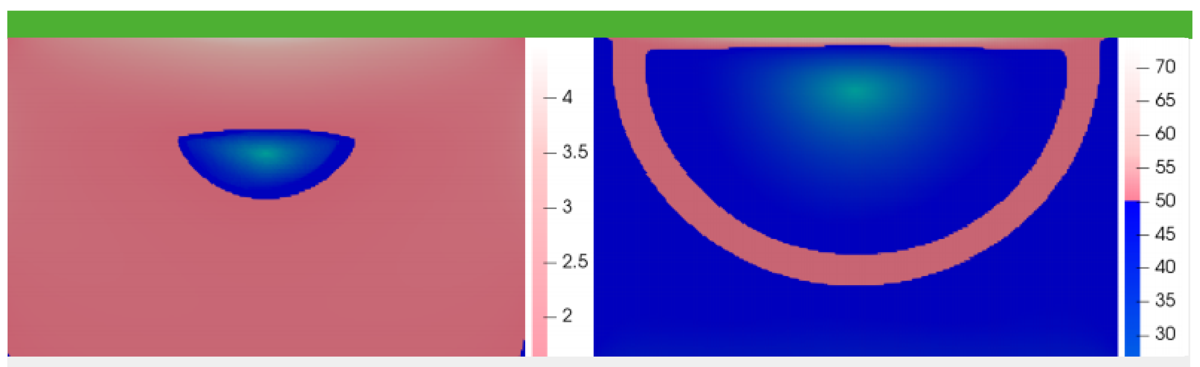
Chair for Dynamics, Control and Numerics - Alexander von Humboldt Professorship



Stochastic simulation and optimization for dynamical systems

We propose a new stochastic simulation method for the efficient simulation and optimal control of large-scale linear dynamical systems. An example shows a 3x speedup when compared to conventional methods.

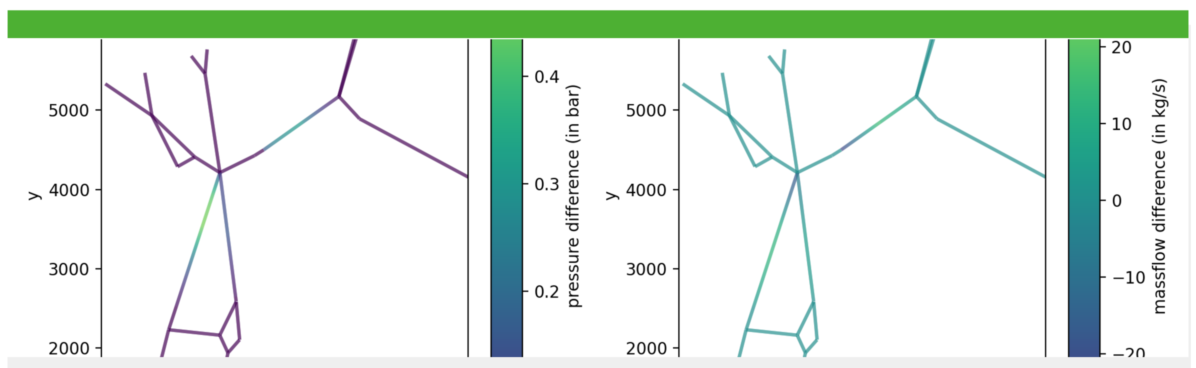
Daniël Veldman, Enrique Zuazua



Semismooth Newton Method for Viscoplastic Flow

The numerical simulation of viscoplastic flow remains a challenging task due to the non-smooth nature of the problem. In this work, we develop a semismooth Newton method for the system employing a recently introduced regularisation that brings new advantages.

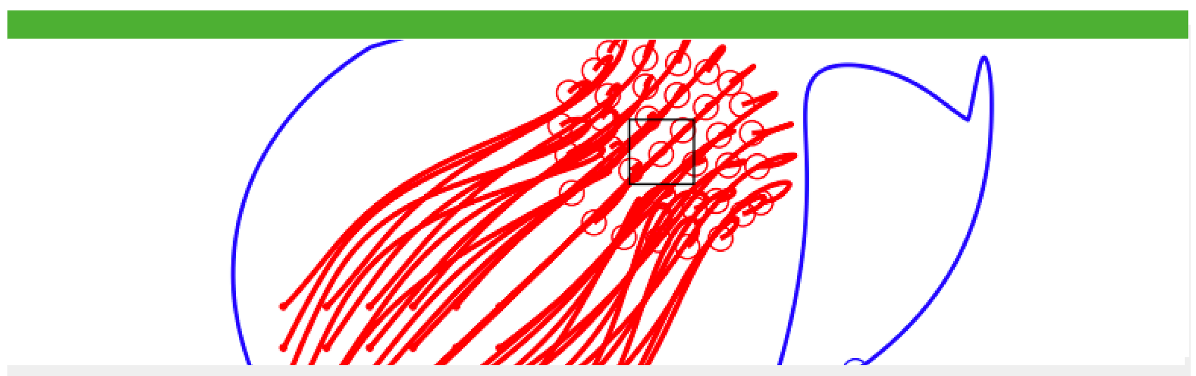
Alexei Gazca



Observer-based Data Assimilation in Time-dependent Flows in Gas Networks

For the operation of gas networks, it is important to have an observer system for the corresponding network system of hyperbolic balance laws. The original system and the observer system are coupled either with data from pointwise measurement or by distributed coupling.

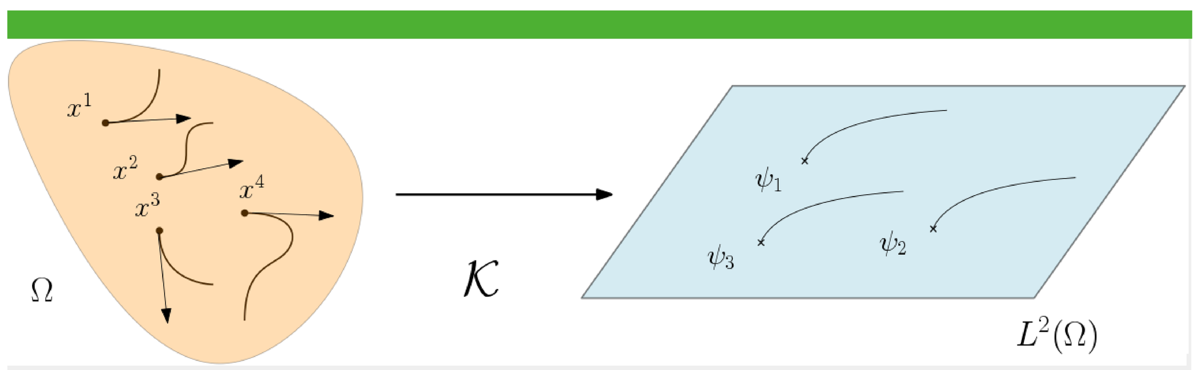
Martin Gugat, Jan Giesselmann, Teresa Kunkel, Sven Weiland



Model predictive control with random batch methods for a guiding problem

The optimal control problem for many individuals commonly requires a heavy computation, nearly unaffordable. We adopt the random batch methods and model predictive control to derive an approximative scheme to guide sheep by controlling dogs.

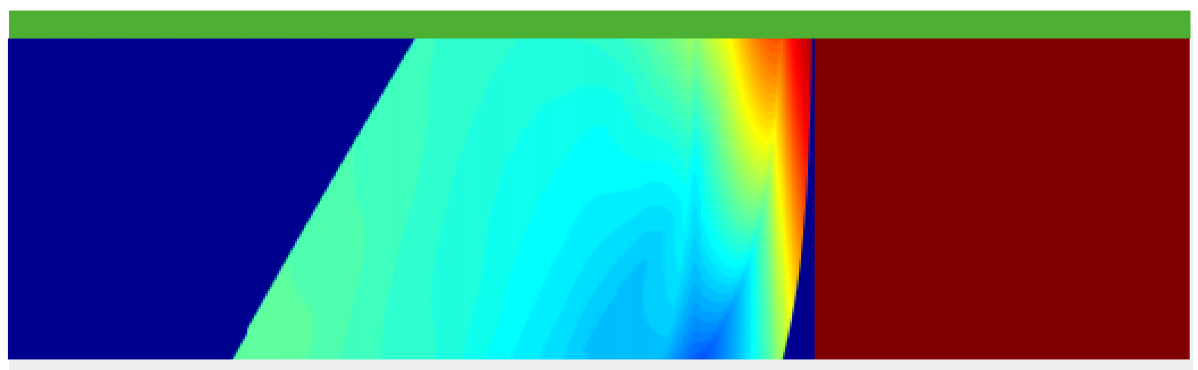
Dongnam Ko, Enrique Zuazua



System Identification by Koopman Operators: Quantitative Analysis

We give estimates on the convergence and cost of a data-driven system identification method based on the Koopman operator in finite element spaces. In 1D, we produce numerical examples showing that interpolation is more cost-effective.

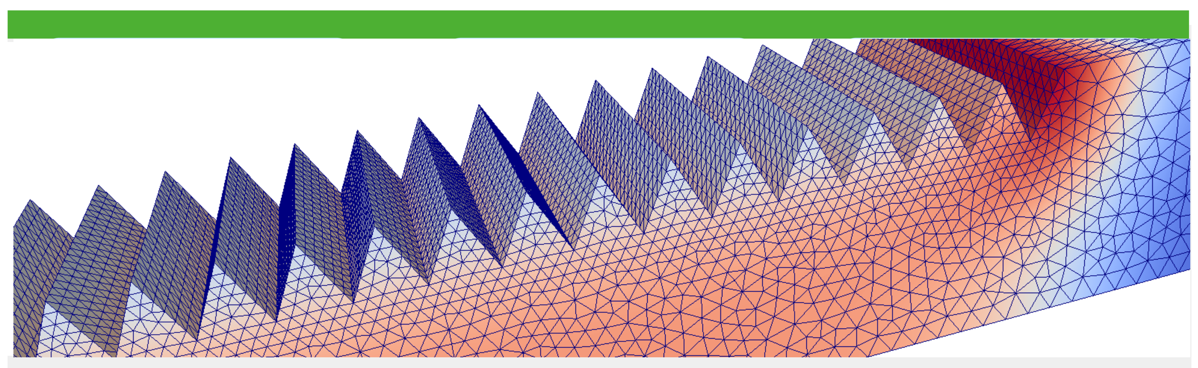
Christophe Zhang, Enrique Zuazua



The Singular limit of Nonlocal conservation Laws to Local Conservation Laws

We aim to close the gap between local and nonlocal modeling of phenomena governed by conservation laws. We prove convergence of solutions of a singularly perturbed problem to a solution of the original problem.

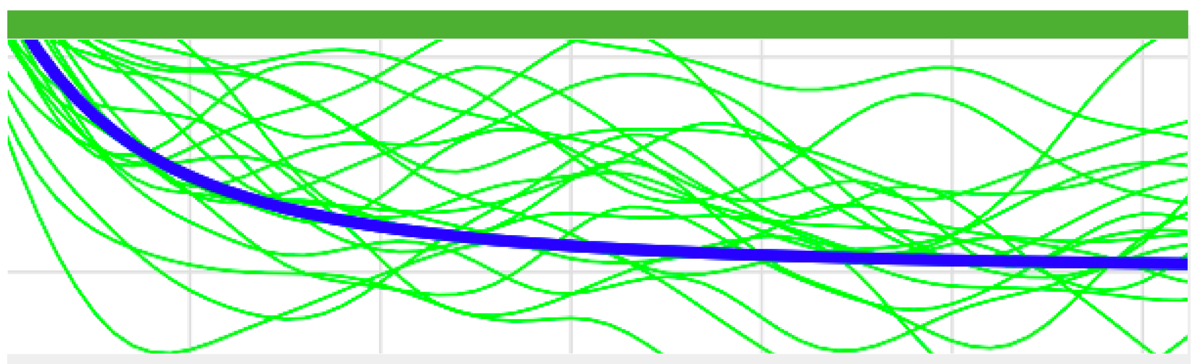
Giuseppe Maria Coclite, Jean-Michel Coron, Nicola de Nitti, Alexander Keimer, Lukas Pflug



Parabolic Problems Arising in Real-World Applications

There are many real-world applications of models of parabolic type with inherently nonsmooth data for which classical methods fail to apply. We show how the framework of maximal parabolic regularity can allow us to overcome these challenges.

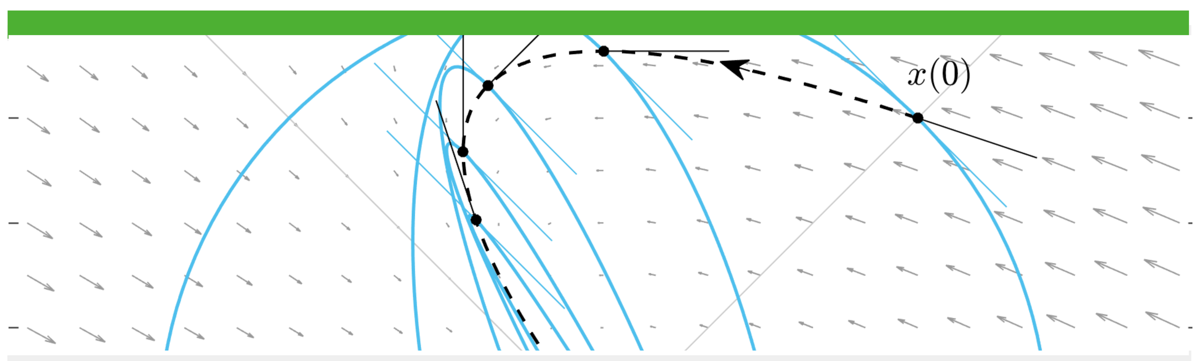
Hannes Meinlschmidt, Joachim Rehber



Nodal control and the Turnpike phenomenon

The aim is to prove turnpike results for optimal nodal control problems in gas networks. Probabilistic constraints are included since they allow to take into account the uncertainty of e.g. the customer demand.

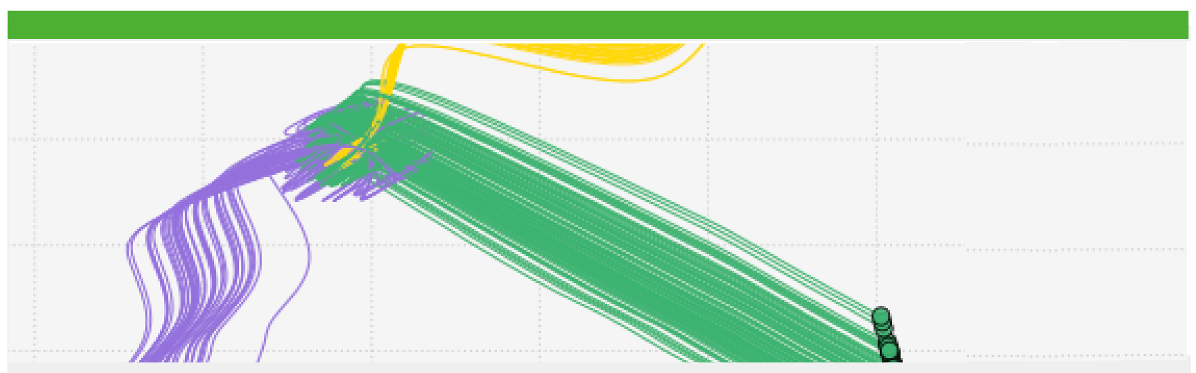
Martin Gugat, Rüdiger Schultz, Michael Schuster



Sharp Estimates in Defective Evolution Equations: From ODEs to Kinetic Equations with Uncertainties

With the goal of quantifying model sensitivity with respect to uncertainty for linear kinetic PDEs, we construct Lyapunov functionals that capture the sharp long-time behavior of solutions for the sensitivity equations.

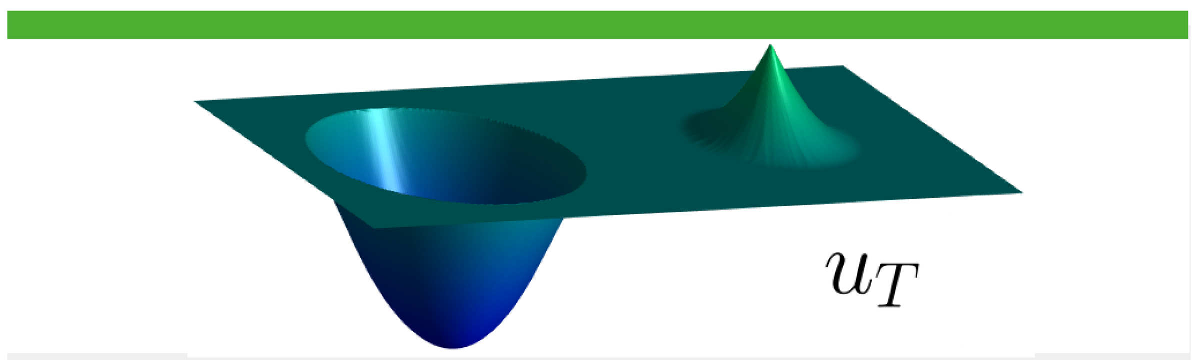
Tobias Wöhrer, Anton Arnold, Shi Jin



Machine learning via control of Neural ODEs

A workhorse behind the recent successes of DL are residual neural networks. Due to the dynamical nature of these networks, an associated ODE formulation allows us to understand learning via high-dimensional simultaneous control, and the stabilizing impact of the depth via the turnpike property in optimal control.

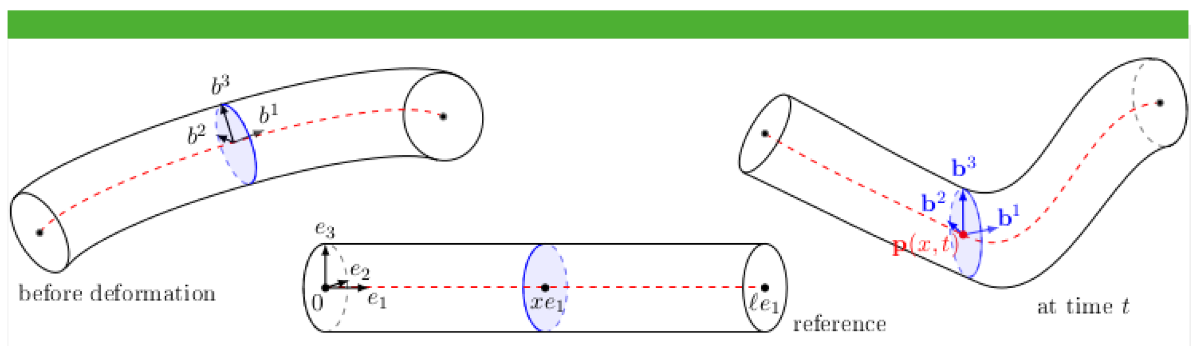
Borjan Geshkovski, Enrique Zuazua



Inverse design for Conservation Laws and Hamilton-Jacobi equations

For Scalar Conservation Laws and Hamilton-Jacobi equations, backward uniqueness is eventually lost due to shock formation, making the dynamics time-irreversible. We present a method to construct all the possible initial conditions which are compatible with a given observation.

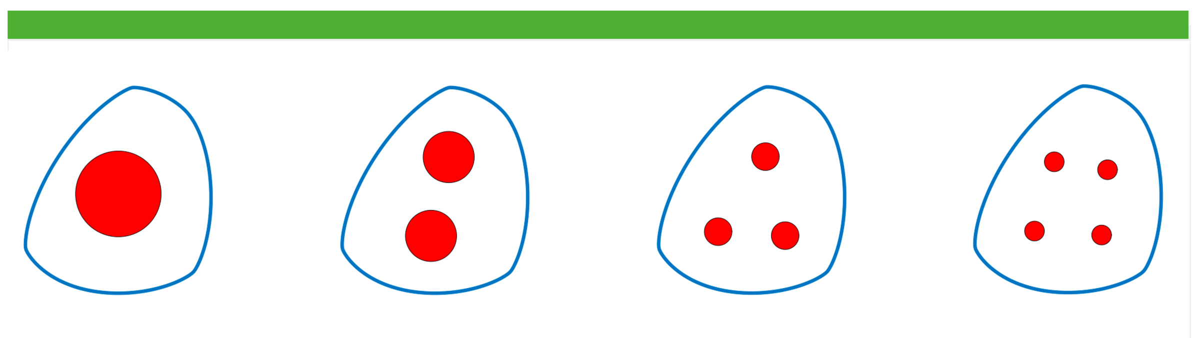
Carlos Esteve, Enrique Zuazua



Control and Stabilization of Geometrically Exact Beams

To model highly flexible structures, we use geometrically nonlinear beam models on networks, and then tackle problems of stabilization and control of nodal profiles -- a 'weaker' notion of controllability allowing us to deal with loops.

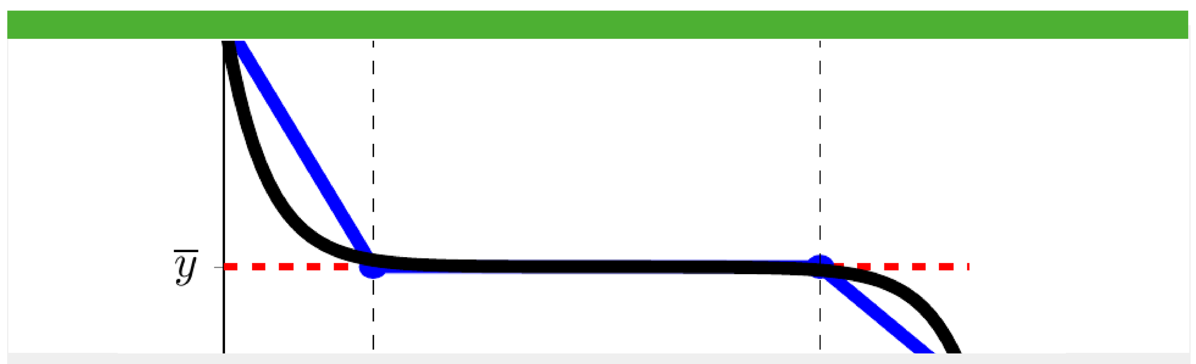
Charlotte Rodríguez, Günter Leugering, Yue Wang



Optimal shape design of sensors via a geometric approach

The optimal shape and placement of sensors frequently arises in industrial applications such as urban planning and temperature and pressure control in gas networks. We consider a simple and natural geometric criterion of performance, based on distance functions.

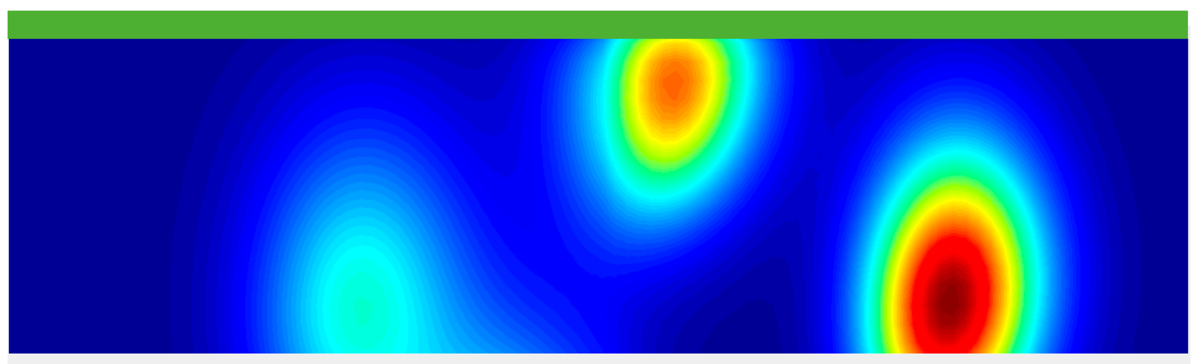
Ilias Ftouhi, Enrique Zuazua



Long Time Control

We demonstrate the need for long times in control dynamics, for a constrained diffusion model. The validity of the turnpike property is shown for a prototypical optimal control problem.

Dario Pighin, Enrique Zuazua



Sparse Initial Source Identification for a Diffusion – Advection Equation

The identification of moving pollution sources in fluids that can be described by diffusion-advection systems and can be mathematically modeled by initial source identification problems of diffusion-advection systems, where the initial source is assumed to be sparse.

Umberto Biccari, Yongcun Song, Yuan Xiaoming, Enrique Zuazua