Workshop on

Filippov-ODEs with State-dependent Switches

Theory and Hands-On Practical with IFDIFF

Switched ODEs

- **Discontinuous right-hand-side** or state-jumps
- Frequently occur when **switching between submodels**
- Challenge: Correct treatment requires profound knowledge of both theory and numerical methods (or using IFDIFF)

Switched 1-predator 2-prey model with Filippov sliding mode manifold computed by IFDIFF

Course Contents

- Brief introduction to ODEs with state-dependent (implicit) switches and **Filippov sliding mode**
- **Hands-On practical** with IFDIFF:
   - Model switches and state jumps
   - Computing sensitivities
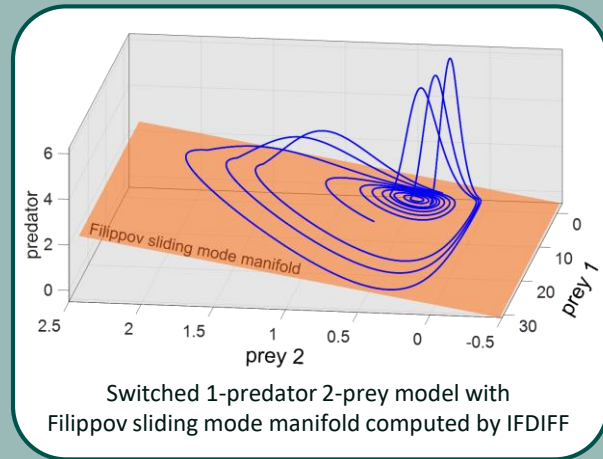   - Sliding on Filippov manifolds

Addressed Audience

- **Students** and researchers
- **Modelers** from **industry**
- Everyone interested in Filippov systems

HGS MathComp fellows can receive 1 ECTS point.

Organizers: Lev Gromov, Marvin Hertweck, Pilar Keller, Michael Strik
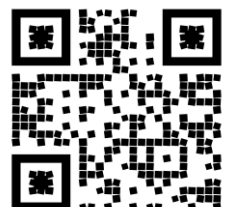Project Leader PErFDiff: Andreas Sommer

View Project on GitHub
https://andreassommer.github.io/ifdiff

Register here!
https://t1p.de/ifdiff2025

Friday, July 18, 2025 • 9-16h (s.t.)
Mathematikon • CIP-Pool 1 • 3rd Floor
Im Neuenheimer Feld 205 • 69120 Heidelberg

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Course program

09:00 – 11:00 Introduction to Switched ODEs

- A canonical example
- A glimpse on the theory of switched ODEs: Switching functions
- Sensitivities: Derivatives w.r.t. to initial value and parameters
- Filippov sliding mode

[In between: breaks with coffee and cookies]

11:00 – 12:00 Hands-On Practical: Part 1
- Short recap: Solving ODE in Matlab
- Applying IFDIFF to existing Matlab code

12:00 – 13:00 Lunch break (with finger food and beverages)

13:00 – 16:00 Hands-On Practical: Part 2

- Solving switched ODE problems with IFDIFF
- Formulating switched ODE systems and state-jumps
- Guided examples
- Sensitivity computation and usage in parameter estimation
- Diagnosing and avoiding common mistakes

[Coffee and cookies always available]