

## Invitation to lecture series „Simulation Sciences“

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Wednesday, December 7th, 2016, SWZ room 324 (C9), TU Clausthal, 3:30 pm

**Univ.-Prof. Dipl.-Ing. Dr. Barbara Kaltenbacher**  
**Institute of Mathematics, Alpen-Adria University of**  
**Klagenfurt**

will talk about

### **Integration based profile likelihood calculation for PDE constrained parameter estimation problems**

(Joint work with Romana Boiger, Alpen-Adria-Universität Klagenfurt as well as Jan Hasenauer and Sabrina Hroß, Helmholtz Zentrum München.)

#### Content of the lecture:

Partial differential equation (PDE) models are widely used in engineering and natural sciences to describe spatio-temporal processes. The parameters of the considered processes are often unknown and have to be estimated from experimental data. Due to partial observations and measurement noise, these parameter estimates are subject to uncertainty. This uncertainty can be assessed using profile likelihoods, a reliable but computationally intensive approach. In this talk, we present the integration based approach for the profile likelihood calculation developed by Chen and Jennrich, 2002, and adapt it to inverse problems with PDE constraints. While existing methods for profile likelihood calculation in parameter estimation problems with PDE constraints rely on repeated optimization, the proposed approach exploits a dynamical system evolving along the likelihood profile. We derive the dynamical system for the unreduced estimation problem, prove convergence and study the properties of the integration based approach for the PDE case. To evaluate the proposed method, we compare it with state-of-the-art algorithms for a simple reaction-diffusion model for a cellular patterning process. We observe a good accuracy of the method as well as a significant speed up as compared to established methods. While our computational experiments have been done for an application example in systems biology, we emphasize that due to generality of this methodology, integration based profile calculation appears to facilitate rigorous uncertainty analysis for parameter estimation problems with PDE constraints also in many other fields.

Guests are welcome.

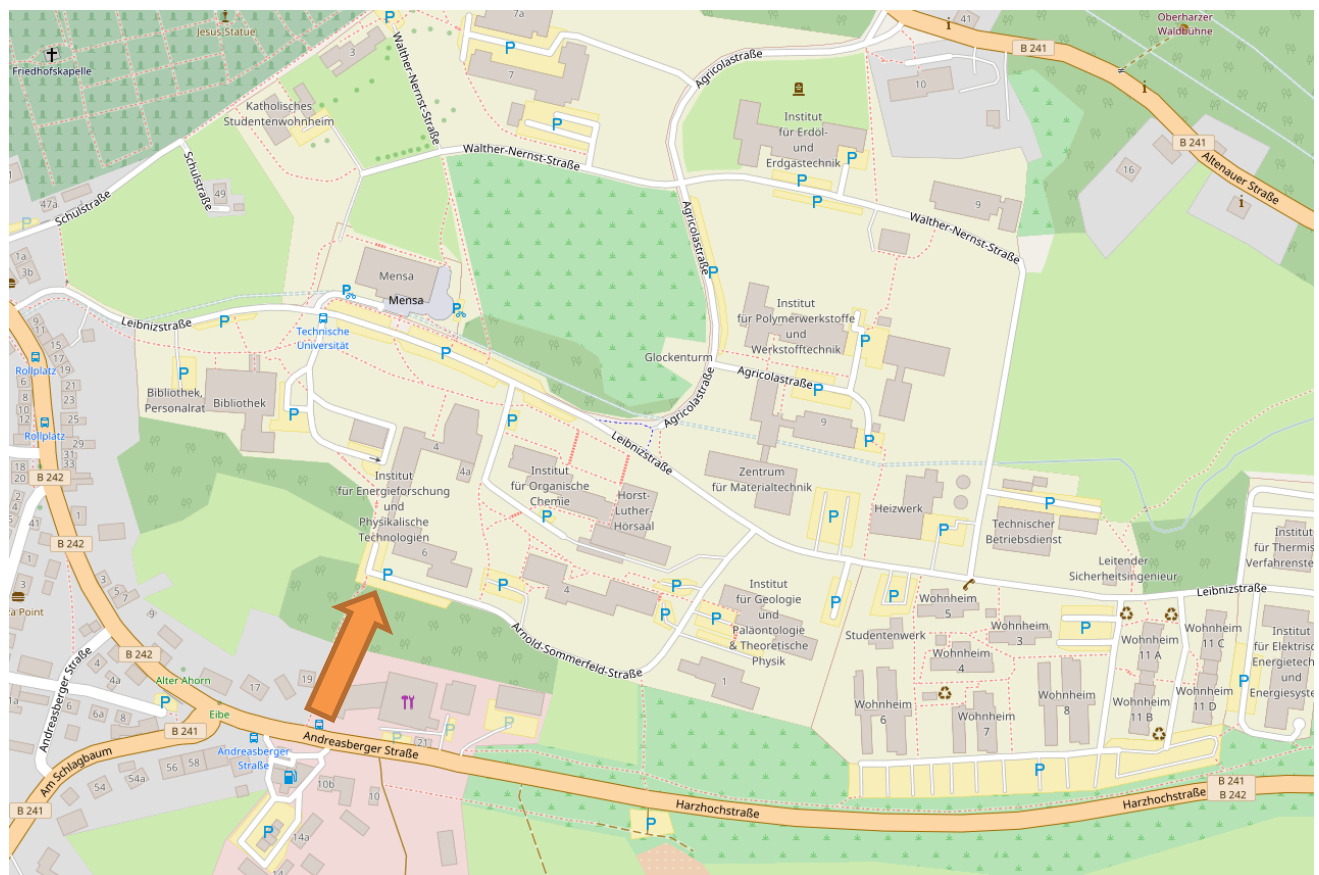
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The SWZ is a common interdisciplinary research facility in simulation science of

The lecture will be held in this building:

**Simulation Science Center Clausthal-Göttingen  
Building C9, Room 324  
Arnold-Sommerfeld-Straße 6  
38678 Clausthal-Zellerfeld**



**Navigation:**  
[tu-c.de/c9](https://tu-c.de/c9)

