DAMUT Colloquium

Thank you for agreeing to present at the Department of Applied Mathematics, University of Twente (DAMUT) colloquium. This document is sent to all speakers in order to help them in preparing. If you have any questions then please get in contact with us.

Colloquium webpage: `https://www.utwente.nl/ewi/damut/damutcolloquium/`

Practical aspects

Unless you have been informed otherwise, your presentation will be in room 1501 of the Ravelijn building and we ask for talks to last 45 minutes (from 12:45 until 13:30). Following this there is 5 minutes available for questions and discussions until the end of the colloquium at 13:35. Before the colloquium starts, the audience is provided with a lunch, which they will eat during the presentation.

Audience

The DAMUT colloquium is held once a month, with the audience being of approximately 40 researchers of masters level onwards from a variety of fields in Applied Mathematics (see below for research groups). This means that while the audience is interested in applications, they especially want to see the underlying mathematics, with the hope of being to transfer the techniques to their own work. One important thing to bare in mind is that the mathematics should be in a form that they can follow. Whilst the audience's basic knowledge is very good, there is always the difficulty that something considered well known or obvious in one field, may be completely new for someone from a different field.

Research Groups

Mathematics at the University of Twente has inspiration by application in its DNA. On the one hand mathematical insights help to advance adjacent fields. On the other hand, questions in these fields stimulate the development of mathematics. The research is clustered into two research lines, namely *Operations Research and Stochastics* (ORS) and *Systems, Analysis and Computational Science* (SACS).

The research line Operations Research and Stochastics combines the chairs of Discrete Mathematics and Mathematical Programming (Uetz), and Stochastic Operations Research (Boucherie). Research topics include:

Mathematical optimisation: Aims at the development of new techniques that are relevant for the efficient solution of optimisation problems, ranging from combinatorial to nonlinear optimisation. This includes approximation algorithms, probabilistic and smoothed analysis of algorithms, as well as new methods for the design and analysis of mechanisms in distributed information settings. New models and techniques find their way into practice in optimising smart energy grids, health processes, and traffic models.

Stochastics & probability: Targets new methods for systems that are exposed to randomness. Our research advances theory and application of queueing systems, polling models, Petri nets, random graphs, Markov chains, rare event simulation as well as mathematical statistics. New stochastic and statistic methods are developed in modelling and optimising health processes, communication systems, large and complex networks, or in dynamic learning and pricing problems.

The research line Systems, Analysis and Computational Science combines the chairs Applied Analysis (v Gils), Hybrid Systems (Zwart), Mathematics of Computational Science (vd Vegt) and Multiscale Modelling & Simulation (Geurts). Research topics include:

Numerical methods: Aims at the development and analysis of computational methods, tailored to the mathematical structure of the governing mechanisms found in key areas of science and engineering. Prominent examples are in (multiphase) fluid mechanics, nonlinear waves, neuroscience and electromagnetism.

Mathematical modelling: Powerful mathematical methods are developed for systematic modelling of problems in multidisciplinary applications. Expertise in variational analysis is adopted for medical imaging. Immersed boundary methods and interface reconstruction and tracking strategies are used in the analysis of aneurysms as well as boiling processes. Abstract delay equations and bifurcation methods are developed for neuroscience.

Systems and control: High tech systems are becoming increasingly complex, but also require tighter specifications. Simple classical linear controllers can often no longer provide this. This requires better models, often involving a spatial structure described by PDE's or decentralised models with interconnections modeled by graph theory. Estimation also needs to be improved to handle intrinsic nonlinearities as well as increasing in the number of sensors. Finally, control theory needs to be able to handle constraints and decentralised structures, while still meeting challenging specifications.