



## MATH-IMS Joint Applied Mathematics Colloquium Series The Chinese University of Hong Kong

*This MATH-IMS Joint Colloquium Series is organized by Center for Mathematical Artificial Intelligence (CMAI), under Department of Mathematics and Institute of Mathematical Sciences (IMS) at The Chinese University of Hong Kong. The colloquium series focuses on mathematics and applications of artificial intelligence, big data and related topics.*

**Date:** Mar 26, 2021 (Friday)

**Time:** 16:00-17:00 (Hong Kong Time)

**Zoom Link:** <https://cuhk.zoom.us/j/92775210812>

### Regularization by architecture: Learning with few data and applications to CT

*Speaker: Professor Peter Maass, University of Bremen*

**Abstract:** We start with a basic introduction on deep learning approaches to inverse problems. We then focus on the learned ISTA concept and describe it as a method for learning a data dependent optimized Tikhonov functional. The main part of the talk is on learning with few data. In particular we investigate deep prior networks for solving inverse problems. Using the LISTA architecture in a deep prior network allows to proof equivalences to classical regularization schemes. On the experimental side we focus on low dose CT reconstructions. We present a standardized data set and perform a numerical comparison of different deep learning concepts. The comparison is in terms of accuracy but also in terms of the amount of test data needed for training. We close the talk with an overview of our plan for future research (DL for parametric PDEs, magnetic particle imaging). This is a joint work with Johannes Leuschner, Maximilian Schmidt, Sören Dittmer and Daniel Otero Baguer.

**Bio:** Professor Peter Maass got the diploma in mathematics at University of Heidelberg in 1985, then got the PhD degree at the Department of Mathematics, TU Berlin. From 1990-1991, Professor Maass was an assistant professor at Tufts University, Boston. He then moved to Saarbrücken University from 1991-1993, and became Professor (C4) for numerical mathematics in Potsdam. Since 1999, he has been Professor and director of the Center for Technomathematics at University of Bremen. Professor Maass's research interests lie in inverse problems, machine learning, image and signal processing in life sciences, computational engineering, systems theory and parameter identification and has made significant contributions in these fields.