



**The Hong Kong Polytechnic University
Department of Applied Mathematics**

Colloquium

**The quasi reversibility method with fractional derivatives
as a regularizer for backwards diffusion**

By

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Abstract

The backwards heat equation is one of the classical inverse problems, related to a wide range of applications and exponentially ill-posed. One of the first and maybe most intuitive approaches to its stable numerical solution was that of quasireversibility, whereby the parabolic operator is replaced by a differential operator for which the backwards problem in time is well posed.

After a short overview of approaches in this vein, we will dwell on a new one that relies on replacement of the first time derivative in the PDE by a fractional differential operator, which, due to the asymptotic properties of the Mittag-Leffler function as compared to the exponential function, leads to an only moderately ill-posed problem. Thus the order α of (fractional) differentiation acts as a regularization parameter and convergence takes place in the limit as α tends to one. We study the regularizing properties of this approach and a regularization parameter choice by the discrepancy principle. Additionally, a substantial numerical improvement can be achieved by exploiting the linearity of the problem by breaking the inversion into distinct frequency bands and using a different fractional order for each.

This is joint work with William Rundell.

Date : 25 November, 2020 (Wednesday)

Time : 15:00-16:00 (Hong Kong Standard Time GMT +8)

Venue : Online Talk via Zoom(Meeting ID: 945 2320 0858)

Speaker: Prof. Barbara Kaltenbacher , Alpen-Adria-Universitaet Klagenfurt

Host: Dr. Zhou Zhi, The Hong Kong Polytechnic University

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