THE UNIVERSITY OF HONG KONG

Institute of Mathematical Research
Department of Mathematics

Numerical Analysis Seminar

Dynamical Low Rank approximation of random time dependent problems

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Abstract

In this talk, we consider time dependent PDEs with random parameters and seek an approximate solution in a separable form that can be written at each time instant as a linear combination of a fixed number of linearly independent deterministic spatial modes multiplied by linearly independent stochastic modes (low rank approximation). Since the optimal deterministic and stochastic modes can significantly change over time, we consider a dynamical approach where those modes are computed on the fly as solutions of suitable evolution equations. We discuss the construction of the method, its well posedness and numerical discretization. In particular, we introduce a projector splitting time discretization scheme of the low rank equations for which we can prove (conditional) stability. Finally, if time permits, we present some preliminary results on the use of dynamical low rank approximations in the context of sequential data assimilation problems.

This is a joint work with Eva Vidlicková, Yoshihito Kazashi and Kody Law.

References:

[1] Y. Kazashi; F. Nobile; E. Vidlicková. Stability properties of a projector-splitting scheme for the dynamical low rank approximation of random parabolic equations, Numerische Mathematik, 2021, DOI : 10.1007/s00211-021-01241-4.

[2] Y. Kazashi; F. Nobile. Existence of dynamical low rank approximations for random semi-linear evolutionary equations on the maximal interval. Stochastics and Partial Differential Equations: Analysis and Computations, 2021, DOI : 10.1007/s40072-020-00177-4.

[3] E. Vidlickova; Dynamical low rank approximation for uncertainty quantification of time-dependent problems. PhD thesis, Ecole Polytechnique Federale de Lausanne, 2022.

Date:	November 24, 2022 (Thursday)
Time:	4:00 – 5:00pm
Venue:	ZOOM: https://hku.zoom.us/j/
	Meeting ID: 913 6532 3891
	Password: 310656

All are welcome