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**THE HONG KONG UNIVERSITY OF SCIENCE & TECHNOLOGY**

**Department of Mathematics**

# SEMINAR ON SCIENTIFIC COMPUTATION

# Space-time Spectral Methods

**by**


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**Abstract**

Most common spectral methods for time dependent PDEs use low-order finite difference approximations of the time derivative and spectral approximations of the spatial derivatives. This is not ideal since the temporal discretization error overwhelms the spatial discretization error. Space-time spectral methods apply spectral discretization in both space and time, resulting in full spectral convergence in space and time, provided that the solution is smooth. Unfortunately, time stepping is no longer possible - the unknowns over all times must be solved at the same time. In the first half of this talk, we survey progress in the analysis of these methods over the past decade, including convergence and condition number estimates for canonical linear PDEs (heat, wave, beam, Stokes), extension to PDEs defined on irregular domains, and to delay PDEs. In the second half, we report some recent work on the method applied to 1D hyperbolic conservation laws where shocks typically appear.


**Date : 30 November 2026 (Monday)**
**Time : 4:00p.m.-5:00p.m.**
**Venue : Room 2303 (Lifts 17/18)**

*All are Welcome!*