



DEPARTMENT OF APPLIED MATHEMATICS

應 用 數 學 系

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

Colloquium

**Skew-symmetric differentiation matrices and
spectral methods on the real line**

by

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Abstract

A most welcome feature of orthogonal bases employed in spectral methods is that their differentiation matrix is skew symmetric, since this makes energy conservation automatic in conservative time-evolving problems. A familiar example is given by Hermite functions, which are dense in $L(-\infty, \infty)$ and give raise to a skew-symmetric, tridiagonal differentiation matrix.

In this talk, describing joint work with Marcus Webb (KU Leuven), we present full characterisation of all orthogonal systems acting on $L(-\infty, \infty)$, dense either there or in a Paley—Wiener space, and that have a differentiation matrix which is skew-symmetric, tridiagonal and irreducible. We also present a constructive algorithm for their generation — essentially, given any symmetric Borel measure on $(-\infty, \infty)$ or in $(-a, a)$ for some $a > 0$, there exists a unique (up to rescaling) basis of this kind and it can be generated constructively. We conclude with a number of examples, related to Konoplev, Carlitz and Freud measures.

Date : 15 June, 2018 (Friday)

Time : 3:00p.m. – 4:00p.m.

Venue : TU801, The Hong Kong Polytechnic University

***** ALL ARE WELCOME *****