ORAL DEFENCE ANNOUNCEMENT

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Well-Conditioned Collocation Schemes and New Triangular Spectral-Element Methods

Date : 29 Apr 2014, Tuesday
Time : 2.00 pm – 3.30 pm
Venue : MAS Executive Classroom 2 (MAS-03-07)
Supervisor : Assoc. Prof. Wang Li-Lian

Abstract:

In the first portion of this thesis, a well-conditioned collocation method for solving general $p$th-order linear differential equations with a variety of boundary conditions is constructed, based on Birkhoff interpolation. The collocation scheme resulting from the interpolation basis functions uses only interior collocation points and its coefficient matrix has condition number independent of the number of points. Problems with different differentiation orders, computational domains and dimensionalities are considered, noting corresponding implementation issues.

In the latter portion of this thesis, the triangular spectral-element method using a recent rectangle-triangle mapping is further developed. This mapping induces a logarithmic singularity, allowing a fast, stable and accurate numerical algorithm for its removal; thus, triangular elements are efficiently handled, as quadrilateral elements. Optimal estimates of approximation by the modal basis on a triangle are obtained. Implementations on one triangle and on an unstructured triangulation of a polygon demonstrate that the methods are efficient and accurate.