

## Lattice DFT, quadrature and interpolation

Dr Huiyuan Li  
Institute of Software,  
Chinese Academy of Sciences,  
Beijing, China



**Date :** 12 October 2009 (Monday)  
**Time :** 4.30 pm – 5.30 pm  
**Venue:** SPMS-Executive Classroom 1, MAS-03-06  
School of Physical and Mathematical Sciences

In this talk, a discrete Fourier transform (DFT) associated with lattice tiling is first developed, which leads naturally to trigonometric quadrature and trigonometric interpolation based on the equally spaced points. All three quantities - discrete Fourier transform, quadrature and interpolation are important tools in numerous applications and form an integrated part of the discrete Fourier analysis. We then apply the result to the fundamental domains of several concrete lattices in the plane, providing explicit formulas and detailed analysis. By restricting two functions that are invariant under certain reflection groups, the results can be transformed to results on a triangle that makes up the fundamental domain, which define analogues of cosine and sine functions on the triangle. In particular, a Lagrange interpolation on the triangle is shown to satisfy an explicit compact formula and the Lebesgue constant of the interpolation is shown to be in the order of  $\mathcal{O}(\log n)^{\text{nd}}$ . We finally define generalized Chebyshev polynomials from those generalized cosine and sine functions respectively and develop the discrete analysis of these algebraic polynomials. We will also touch on the study of common zeros of the generalized Chebyshev polynomials and Gaussian quadrature, a topic that does not seem to have been studied systematically before.

### Speaker Biography

Dr. Li received his PhD in Computational Mathematics from Shanghai University in 2002. He is now an Associate Professor at the Institute of Software, Chinese Academy of Sciences. His research interests include spectral methods, Fourier analysis and high performance computing.

Host: Prof. Wang Li-Lian, Division of Mathematical Sciences, School of Physical and Mathematical Sciences

Queries to: Ms Denise Lim, [deniselimrj@ntu.edu.sg](mailto:deniselimrj@ntu.edu.sg)

### SCHOOL OF PHYSICAL AND MATHEMATICAL SCIENCES

NANYANG TECHNOLOGICAL UNIVERSITY  
SPMS-MAS-03-01, 21 NANYANG LINK, SINGAPORE 637371  
FAX: +65 6515 8213 TEL: +65 6513 7423