数学与系统科学研究院

计算数学所学术报告

报告人： **Dr. Wu Yumao**

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报告题目：

A novel frequency independent approach for high frequency scattered electromagnetic fields on electrically large quadratic surfaces and some numerical methods for nano-periodic structures

邀请人： 陈志明 研究员

报告时间：**2013** 年 **2** 月 **19** 日（周二）

上午 **10:00~11:00**

报告地点： 科技综合楼三层 **311**

计算数学所报告厅

Abstract:

Due to the highly oscillatory nature of the electromagnetic fields in the high frequency regime, reduction of the computational workload of the scattered fields on electrically large objects remains as a changeling problem. In this talk, I will present the surface integral equation method for analyzing the scattered electromagnetic fields on electrically large quadratic surfaces. We propose the numerical steepest descent path method, by deforming the integration path of the physical optics (PO) integrand into the numerical steepest descent path on the complex plane. Then, high frequency critical-point contributions that contain the stationary phase point, boundary resonance points, and vertex points, are comprehensively studied by the proposed numerical steepest descent path method. Numerical results on the parabolic and saddle quadratic engineering models illustrate that the proposed method is frequency independent in computational cost and error controllable in accuracy. For an arbitrary curved surface discretized by a number of quadratic triangles, the geometry errors shall be much smaller than those generated by the same number of flat triangular patches. This natural extension gives an important application for the proposed method used on the real-world objects.

Then, I will present some numerical methods for nano-periodic photonic structures, including photonic crystals and diffraction gratings. Dirichlet-to- Neumann maps (DtN) method is used to calculate the scattered spectrums of the two and three dimensional photonic structures. Our proposed method is efficient since it never calculates the wave field in the interiors of the unit cells and approximates the DtN map operators by small matrices. For analyzing diffraction gratings, a new method is developed based on dividing one period of the grating into homogeneous sub-domains and computing the Neumann-to-Dirichlet maps for these sub-domains by boundary integral equations. The method avoids the quasi-periodic Green's functions that are expensive to evaluate.

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