数学与系统科学研究院

计算数学所网络学术报告

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报告题目：

Fast Algorithms for Maxwell's Equations for 3D Photonic Crystal

邀请人： 张硕 副研究员

报告时间：2020 年 12 月 17 日（周四）

上午 **9:00-10:00**

报告工具：腾讯会议（ID：363 453 631）

会议链接：

https://meeting.tencent.com/s/0LQDP4mHMTEF

Abstract：

In this work we propose the Fast Algorithms for Maxwell's Equations (FAME) package for solving Maxwell's equations for modeling three-dimensional photonic crystals. FAME combines the null-space free method with fast Fourier transform (FFT)-based matrix-vector multiplications to solve the generalized eigenvalue problems (GEPs) arising from Yee's discretization. A GEP is transformed into a null-space free standard eigenvalue problem with a Hermitian positive-definite coefficient matrix. The computation times for FFT-based matrix-vector multiplications with 7 million matrix dimensions are only 0.33 and 3.6×10^{-3} seconds using MATLAB and a single NVIDIA Tesla P100 GPU respectively. Such multiplications significantly reduce the computational costs of the conjugate gradient (CG) method for solving linear systems. We successfully use FAME on a single P100 GPU to solve a set of GEPs with more than 19 million dimensions in 127 to 191 seconds per problem. These results demonstrate the potential of our proposed package to enable large-scale numerical simulations for novel physical discoveries and engineering applications of photonic crystals.

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