# Legendre-tau Chebyshev Spectral Method for Maxwell's Equations with Interfaces and its Theoretical Analysis

*Dong Liang*

Department of Mathematics and Statistics
York University
Toronto, ON, M3J 1P3, Canada
(Email: dliang@yorku.ca)

Computational electromagnetics plays an important role in many applications in modern society, such as internet and satellite communication systems, radar systems, medical imaging systems, telecommunication chips, and so on. The propagation and scattering of electromagnetic waves are governed by Maxwell's equations. The problems of inhomogeneous media are universal in practical engineering.

In this study, we develop and analyze multidomain Legendre-tau Chebyshev spectral method for solving Maxwell's equations with material interfaces. The computational domain is decomposed into some non-overlapping sub-domains naturally along material interfaces, while the interface conditions are treated in a way like the natural boundary conditions based on the constructed weak formulation. The electric and magnetic fields are approximated by using Legendre-tau Chebyshev polynomial spaces of different degrees, which can be solved separately in computation. The important feature is that the scheme makes the numerical solution retain the original physical properties. We further analyze theoretically the multidomain Legendre-tau Chebyshev spectral scheme for the Maxwell's equations with interfaces. We prove its energy conservation in the discrete form and its optimal error estimates. Numerical experiments confirm that the spectral accuracy is achieved being not affected by the discontinuity of solutions. Compared with some related methods, the computational cost times of the schemes are shorter. This is a joint work with C. Niu and H. Ma.