1064-65-180 **Nicholls David*** (nicholls@math.uic.edu), Dept of Math, Stat, & CS (MC 249), University of Illinois at Chicago, 851 South Morgan Street, Chicago, IL 60607, and **Reitich Fernando**.

High-Order Integral Equations Methods for High-Frequency Scattering by Diffraction Gratings.

In this talk we present a new high-order Integral Equation algorithm for the simulation of high-frequency scattering returns by diffraction gratings. For shallow gratings (those for which Geometric Optics indicates that there will be no multiple reflections) the method amounts to a phase-extraction technique resulting in a slowly-varying amplitude as unknown which requires only a small number of degrees of freedom to resolve. For deeper gratings we follow the work of Bruno, Reitich, and collaborators (e.g., Phil. Trans. Roy. Soc. London A 362, 2004) who utilize Geometric Optics corrections to iteratively update the rapidly varying amplitude which consists of many slowly-varying components. Our current contribution shows that the iterative update scheme can be eliminated and replaced with a simultaneous solution procedure. While our central ideas can be extended to the full vector electromagnetic time-harmonic Maxwell equations, we focus upon the case of two-dimensional linear acoustics for simplicity. (Received September 08, 2010)