1057-35-47 **Robert S. Callihan*** (robert.callihan@afit.edu), 2950 Hobson Way, Wright-Patterson AFB, OH 45433, and **Aihua Wood**. *Maxwell's Equations for Electromagnetic Scattering of an Overfilled Cavity with Mixed Boundary Conditions.* Preliminary report.

We consider the time-domain scattering problem of a two-dimensional overfilled cavity embedded in the infinite ground plane with Robin or mixed boundary conditions. An artificial boundary condition is introduced on a semicircle enclosing the cavity that couples the fields from the infinite exterior domain to those fields inside to include the cavity portion. This establishes a Dirichlet-to-Neumann (DtN) operator on the artificial boundary. The problem is first discretized in time using the Newmark time-marching scheme. At each time step, we derive the variational formulation of the semidiscrete problem, and establish existence and uniqueness using properties of the DtN operator. In addition, the problem is fully discretized in both time and space to perform finite element error and stability analysis. This sets the foundation for finite element numerical techniques, which further establish the efficiency and validity of the method. The problem hinges on solving the exterior problem above the infinite half-plane. This involves the time domain form of the wave equation, $-\Delta E_z^s + \dfrac{\partial^2 E_z^s}{\partial t^2} = 0$, where E_z^s represents the z-component of the scattered electric field that satisfies a mixed boundary condition at the surface. (Received December 17, 2009)