1154-35-1213 **Oana Marin**, **Marieme Ngom*** (mngom@anl.gov) and **Barry Smith**. *Optimal distribution of dielectrics via boundary integral constrained optimization.*

We show a method for determining the optimal distribution of a collection of dielectrics with the objective that the power of the scattered waves achieves its maximum in a target region. The physical problem is modeled using the Helmholtz equation recast in the boundary integral formulation. The change of simulation framework is justified by an increase in accuracy due to a more rigorous treatment of the dielectric interfaces as well as the free-space boundary conditions via the Sommerfeld condition. Well-conditioning of the discretized linear system is guaranteed by using the Combined Field Integral Equation (CFIE) which incorporates both single and double layer formulations in the half-space plane. This new approach requires the derivation of continuous adjoint operators associated with the half-space Helmholtz kernels for single and double layer formulations. The derivatives are verified against finite differences evaluations of the gradient of the objective function. The optimization itself is performed using the Limited Memory Variable Metric (LMVM) algorithm as well as steepest descent methods, and two types of objective functions are considered. (Received September 13, 2019)