TEMPLE UNIVERSITY
Department of Mathematics

Applied Mathematics and Scientific Computing Seminar

Room 617 Wachman Hall

Monday, 27 January 2020, 4:00 p.m.

Density Interpolation Methods

by Carlos Pérez Arancibia
Pontificia Universidad Católica de Chile

Abstract.

In this talk, I will present present recent developments on a class of effective and simple-to-implement methods for the numerical evaluation of boundary integral operators and layer potentials associated to classical PDEs, that address longstanding efficiency, accuracy, and practical implementation issues that have hindered the applicability of boundary integral equation methods in science and engineering. These methods rely on the use of Green's third identity and local Taylor-like interpolations of density functions in terms of homogeneous solutions of the underlaying PDE. The proposed technique effectively regularizes the singularities present in boundary integral operators and layer potentials, recasting them in terms of integrands that are bounded or even more regular depending on the order of the density interpolation. The resulting boundary integrals can then be easily, accurately, and inexpensively evaluated by means of standard quadrature rules. A variety of numerical examples demonstrate the effectiveness of these techniques in the context of Nyström and boundary element methods for the Laplace, Helmholtz, and Maxwell equations.