Fredholm Theory for the Dirichlet Problem for Δ^3 in Infinitesimally Flat AR Domains

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Elliptic boundary value problems naturally arise in modeling various physical phenomena, such as electrostatics, elasticity, steady-state incompressible fluid flow, and electromagnetism. The layer potential method serves as a powerful tool for addressing these problems by reducing them to a boundary integral equation involving a singular integral operator associated with the domain and a coefficient tensor corresponding to the underlying PDE. When this singular integral operator is compact, the boundary integral equation can be treated using Fredholm Theory. While significant progress has been made in studying second-order elliptic systems through this approach, higher-order elliptic systems remain less understood. In this talk, I will present a *distinguished* coefficient tensor for the polyharmonic operator Δ^3 in all dimensions, and illustrate how the associated singular integral operator is compact on L^p Lebesgue-type spaces, for all integrability exponents $p \in (1, \infty)$, thus opening the door for the employment of Fredholm Theory for the solvability of the Dirichlet Problem for Δ^3 in infinitesimally flat AR domains. This is an ongoing work with Dorina Mitrea (Baylor University), Irina Mitrea (Temple University), and Marius Mitrea (Baylor University).

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