Potential operators for differential forms on Lipschitz domains

M. Costabel

Potential operators are right inverses of the exterior derivative on the space of differential forms satisfying the appropriate integrability conditions. They are generalizations of the operators that determine a scalar potential for a conservative vector field or a vector potential of a divergence free magnetic field. Such operators R_k satisfying the algebraic homotopy relation

$$d_{k-1}R_k + R_{k+1}d_k = id_k$$

where d_k and id_k are the exterior derivative and the identity on k-forms, were recently constructed for bounded and unbounded Lipschitz domains.

For bounded Lipschitz domains, one can use line integrals as in Poincaré's lemma, regularized with respect to the origin of the line integral. It can be shown that these regularized Poincaré operators and their adjoints, the Bogovskiĭ operators, are classical pseudodifferential operators of order -1. They have applications in vector analysis, computational electromagnetics and in fluid dynamics. On unbounded Lipschitz epigraphs, potential operators can be constructed as convolutions with a function supported in any given cone.

This talk is based on joint work with A. McIntosh and R. Taggart.

References

[1] M. Costabel, A. McIntosh, *On Bogovskiĭ and regularized Poincaré integral operators for de Rham complexes on Lipschitz domains*, Math. Z. **265** (2010) 297-?320.

[2] M. Costabel, A. McIntosh, R. J. Taggart, *Potential maps and Hardy spaces on special Lipschitz domains* (2010).