Modellierung Numerik Kolloquium Differentialgleichungen

Ankündigung

Im Rahmen des Kolloquium der AG ModNumDiff spricht

Wolfgang L. Wendland (U Stuttgart)
aus Anlaß seines 50-jährigen Promotionsjubiläums an der TU Berlin

am Dienstag, den 10. November 2015 um 16:15 Uhr
im Raum MA 313 des Instituts für Mathematik der TU Berlin über

On the Gauss minimal energy problem with Riesz potentials

Abstrakt:

This is a lecture on joint work with H. Harbrecht (U. Basel, Switzerland), G. Of (TU. Graz, Austria) and N. Zorii (Nat. Academy Sci. Kiev, Ukraine).

In $\mathbb{R}^n$, $n \geqslant 2$, *we study the constructive and numerical solution of minimizing the energy relative to the Riesz kernel* $|\mathbf{x}-\mathbf{y}|^{\alpha-n}$, *where* $1 < \alpha < n$, *for the Gauss variational problem, which is considered for finitely many compact, mutually disjoint, oriented, boundaryless* $(n-1)$*–dimensional Lipschitz manifolds* Γ_ℓ, $\ell \in L$, *each* Γ_ℓ *being charged with Borel measures with the sign* $\alpha_\ell = \pm 1$ *prescribed.*

For Newton potentials, i.e. the special case $\alpha = 2$, *this problem goes back to C.F. Gauss who used it as the model for electrostatic fields. Nowadays it is of interest for the storage of charges as produced by solar electricity modules. The more general Riesz kernels have also applications for finding best packings and numerical integration formulae on manifolds, stable molecules, crystallography and aircraft radar testing.*

We show that the Gauss variational problem over an affine cone of Borel measures can alternatively be formulated as a minimum problem over an affine cone of surface distributions belonging to the Sobolev–Slobodetski space $H^{-\varepsilon/2}(\Gamma)$, *where* $\varepsilon := \alpha - 1$ *and* $\Gamma := \bigcup_{\ell \in L} \Gamma_\ell$. *This allows the application of simple layer boundary integral operators on* Γ. *A corresponding numerical method is based on the Galerkin–Bubnov discretization with piecewise constant boundary elements and an active set strategy. For* $n = 3$ *and* $\alpha = 2$, *multipole approximation and in the case* $1 < \alpha < 3 = n$ *wavelet matrix compression is applied to sparsify the system matrix.*

The analysis is recently extended to hypersingular Riesz potentials with $-1 < \alpha < 1$ *by the use of Hadamard's partie finie boundary integral operators and corresponding pseudodifferential operators of order* $(1-\alpha)$ *on* Γ.

References

[1] G. Of, W.L. Wendland and N. Zorii: On the numerical solution of minimal energy problems. *Complex Variables and Elliptic Equations* ***55*** (2010) 991–1012.

[2] H. Harbrecht, W.L. Wendland and N. Zorii: On Riesz minimal energy problems. *JMAA* ***393*** (2012) 397–412.

[3] H. Harbrecht, W.L. Wendland and N. Zorii: Riesz minimal energy problem on $C^{k-1,1}$–manifolds. *Math. Nachr.* ***287*** (2014) 48-69.

Vor dem Vortrag ist zu Kaffee, Tee und Gebäck geladen —
ab 15:45 im Raum MA 315.

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