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General Mathematics Colloquium

17 Oct 2018 | 16:00 - 16:45

Event

Speaker: Matthias Schlottbom (University of Twente)

Title:

A perfectly matched layer approach for radiative transfer in highly scattering regimes

Abstract:

We consider the numerical approximation of boundary conditions in radiative transfer problems by a perfectly matched layer approach. The main idea is to extend the computational domain by an absorbing layer and to use an appropriate reflection boundary condition at the boundary of the extended domain. A careful analysis shows that the consistency error introduced by this approach can be made arbitrarily small by increasing the size of the extension domain or the magnitude of the artificial absorption in the surrounding layer. A particular choice of the reflection boundary condition allows us to circumvent the half-space integrals that arise in the variational treatment of the original vacuum boundary conditions and which destroy the sparse coupling observed in numerical approximation schemes based on truncated spherical harmonics expansions. A combination of the perfectly matched layer approach with a mixed variational formulation and a PN-finite element approximation leads to discretization schemes with optimal sparsity pattern and provable quasi-optimal convergence properties. As demonstrated in numerical tests these methods are accurate and very efficient for radiative transfer in the scattering regime.

(this is joint work with Herbert Egger, TU Darmstadt)

Location: KdVI meeting room, Science Park 107, room F3.20

Science Park 107

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