סמינר מדעי היסוד

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ד״ר עדי דיטקובסקי
אוניברסיטת תל-אביב

NEAR-FIELD INFINITY-SIMULATING BOUNDARY CONDITIONS FOR THE HEAT EQUATION

תקציר

Many applications, such as wave mechanics and heat transport, are defined in infinite domains. Since, in practice, it is impractical to numerically compute infinite problem over the whole domain, these problems are often approximated in a finite domain, D. The boundary conditions are constructed such that the solution of the finite problem is unique and coincides with (or approximates closely) the restriction to D of the solution to the infinite domain problem. These boundary conditions are called Infinity simulating boundary. In the context of waves dynamics these boundary conditions are often called absorbing boundary conditions.

Unlike wave propagation problems, where local boundary conditions or perfectly match layers (PML) can be successfully applied, in heat transfer problems only global (in time) can be used, typically by computing the exact boundary condition using the Neumann to Dirichlet formula, or similar formulations. However, since the kernel is singular, these boundary conditions, are highly expensive to compute and inaccurate.

We suggest to compute the exact boundary condition at the outer boundary of a thin layer which encases the original domain, using values from the inner part of this layer. The kernel now is not singular, which makes this approach much more accurate and computationally efficient. This differential problem, the heat equation with this non standard boundary condition was proved to be stable.

Joint work with Alex Suhov.

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