Department of Mathematics,
University of California San Diego

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Computational Geometric Mechanics Research Seminar

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UCSD

Wave Simulations in Infinite Spacetime

Abstract:

The development of accurate and efficient numerical solutions to the wave equation is a fundamental area of scientific research with applications in several fields, including music, computer graphics, architecture and telecommunications. A key challenge in wave simulation research concerns the proper handling of wave propagation on an unbounded domain. This challenge is known as the infinite domain problem. In this talk, I present a novel geometric framework for solving this problem based on the classical Kelvin transformation. I express the wave equation as a Laplace problem in Minkowski spacetime and show that the problem is conformally invariant under Kelvin transformations using the Minkowski metric while the boundedness of the spacetime is not. These two properties of the Kelvin transformation in Minkowski spacetime ensure that harmonic functions which span infinite spacetime can be simulated using finite computational resources with no loss of accuracy.

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