

Numerical methods for the multi-dimensional fractional Laplacian and their applications

Yanzhi Zhang, Missouri University of Science and Technology

Recently, the fractional Laplacian has received great attention in modeling complex phenomena that involve long-range interactions. However, the nonlocality of the fractional Laplacian introduces considerable challenges in its analysis and simulations. In this talk, we present numerical methods to discretize the multi-dimensional fractional Laplacian in hypersingular integral form. Compared to other existing methods, our method is more accurate and simpler to implement, and moreover it closely resembles the central difference scheme for the classical Laplace operator. Finally, we apply these methods to numerically study problems involving the fractional Laplacian.