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Qiang Du is the Fu Foundation Professor of Applied Mathematics at Columbia University and a co-chair of the Center of Computing Systems for Data-Driven Science. He also serves as the Editor-in-Chief (EIC) of the SIAM Journal on Applied Mathematics and the founding co-EIC of Communications of the American Mathematical Society. Prof. Du received his B.S. from the University of Science and Technology of China and his Ph.D. from Carnegie Mellon University. Some recent recognition for his work includes a SIAM Outstanding Paper Prize (2016), being a Gordon Bell Prize finalist (2016), the USACM T.J.R. Hughes Medal (2021), and the ICBS Frontier of Science Award (2024). He was also an invited speaker at the ICM 2018 and has been selected to give an invited lecture at the ICIAM 2027.

Title: Recent development of nonlocal models on bounded domains

Abstract: Recent applications and theoretical developments of integral models using nonlocal operators have shown promise as effective alternatives to local models, particularly for problems involving singularities and anomalies. For complex systems, nonlocal interactions can be viewed as a generic outcome of dimension reduction and reduced-order modeling, with formulations that can be derived from physical principles or learned from data. Nonlocal models also serve as mathematical tools to analyze large-scale discrete models. In this talk, we give an overview of recent progress on the mathematical study of nonlocal models with a finite interaction range defined on bounded domains. We discuss various options for rigorously formulating nonlocal interactions both in the interior and on the boundary. We also present recent advances in the mathematical and numerical analysis of these problems and their applications.