Colloquium

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10:00 a.m., HH-3017

Algebraic multigrid in theory and practice

Abstract:
Computational simulation is an important tool in many fields of science and engineering, providing crucial insight into a wide range of real-world problems. At the core of many simulations lies the solution of large linear systems of equations that can, in principle, be solved using simple techniques, such as Gaussian elimination. The high computational cost of Gaussian elimination, however, often makes high-fidelity simulations intractable. For example, the modeling of convective flows in the Earth's mantle is limited to simulations with a few hundred thousands of degrees of freedom using this approach. In this talk, I will discuss both the theory and practice of algebraic multigrid methods, which can be used to overcome this barrier in many cases. I will show both theoretical analysis, leading to a rigorous framework for motivating the choice of components within a multigrid algorithm, and practical results, enabling efficient simulations of mantle convection with up to 100 million degrees of freedom.