

Title:

From Scientific Computing to Domain Decomposition Methods: Robust Solvers for Complex PDEs

Speaker:

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Premio José Fernando Escobar de la Sociedad Colombiana de Matemáticas por contribuciones en investigación 2019.

Premio TWAS Colombia de la Academia Colombiana de Ciencias Exactas, Físicas y Naturales 2016.

Mención meritoria Odelar Linares Award, Brazil, 2008.

Mención de Honor por rendimiento académico 2001, University of Cartagena.

Joven talento para la investigación de la comisión regional para la ciencia y tecnología de la costa Caribe, 1999-2000.

Abstract: In the first part of the talk, we introduce the fundamentals of scientific computing by presenting key concepts and ideas, illustrated through a contextual detour that connects theory with real-world examples. In the second part, we discuss recent work on domain decomposition preconditioners for second-order elliptic PDEs, focusing on two main challenges: high-contrast coefficients and irregular domains. Our approach, based on local spectral information and a two-level additive

Schwarz framework, shows strong robustness in numerical experiments, with applications to subsurface flow in porous media. The talk is based on several collaborative projects led or co-authored by the speaker, which are well known in the domain decomposition community. These contributions led to the speaker's recognition as a 2024 Top Scholar by ScholarGPS, ranking in the top 0.5% of scholars worldwide (#35 in Multiscale Modeling and #706 in Finite Element Method), which reflects a consistent and influential body of work in computational mathematics.