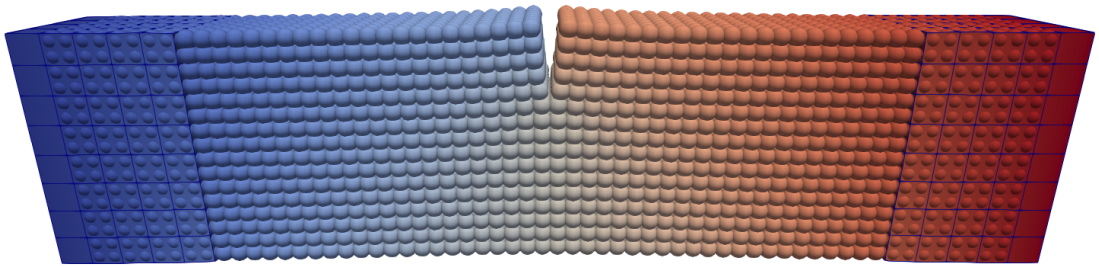
Università degli Studi di Pavia
Computational Mechanics & Advanced Materials Group - DICAr

3D@UniPV
Virtual Modeling and Additive Manufacturing for Advanced Materials

SEMINAR

Nonlocal Models in Computational Science and Engineering: Challenges and Applications

Nonlocal continuum theories can capture strong nonlocal effects due to long-range forces at the mesoscale or microscale. For problems where these effects cannot be neglected, nonlocal models are more accurate than classical Partial Differential Equations (PDEs) that only consider interactions due to contact. However, the improved accuracy of nonlocal models comes at the price of a computational cost that is significantly higher than that of PDEs.
In this talk I will present nonlocal models and the Nonlocal Vector Calculus, a theory that allows us to treat nonlocal diffusion problems in almost the same way as PDEs. Furthermore, I will present current open challenges related to the numerical solution of nonlocal problems and show how we are currently addressing them.
In the first part of my talk I will present local-nonlocal coupling methods, whose goal is to combine the computational efficiency of PDEs with the accuracy of nonlocal models. Our approach formulates the coupling as a control problem where the states are the solutions of the nonlocal and local equations, the objective is to minimize their mismatch on the overlap of the nonlocal and local domains, and the controls are virtual volume constraints and boundary conditions. I will present consistency and convergence studies and, using three-dimensional geometries, I will also show that our approach can be successfully applied to challenging, realistic, problems.
In the second part of the talk I will introduce a new concept of nonlocal neighborhood that helps improving the performance of FE methods and show how our approach allows for fast assembling in two-dimensional computations.



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July 25th, 11:00 (sharp)
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