

Post-doctoral position in computational mechanics

Required Education / Niveau requis : PhD in computational mechanics / applied mathematics

From / Date de début : right away

Duration / Durée : 2 years

Salary : 3136 euros gross per month

Context / Contexte

Domain decomposition methods are well established approaches for solving large scale problems on parallel computers. In the field of solid mechanics, non-overlapping approaches such as FETI (Finite Element Tearing and Interconnecting) and BDD (Balancing Domain Decomposition) are recognized as the methods of choice. Given the current trend of increasing computational power by increasing the number of cores, the adaptation and tuning of these approaches is essential in order to maintain their parallel efficiency while employing large numbers of cores.

Description / Description

In domain decomposition methods, the domain associated with the partial differential equation is decomposed into a possibly large number of subdomains. Local problems are then defined on each subdomain and are solved at each iteration step in order to approximate the inverse of the system's matrix (stiffness matrix in mechanics for instance). It must be noticed that, in order to obtain an efficient and scalable parallel algorithm, a coarse problem has to be introduced and solved at each iteration step. Given the evolution of parallel computers to higher core counts, the number of subdomains grows (say several thousands and beyond) so that sizes of the local (subdomain) stiffness matrices are reduced. On the one hand, this notably accelerates the local treatments (mainly factorization of the stiffness matrices). On the other hand, this increases the dimension of the null space and solving the coarse problem will then turn out to constitute a major computational cost. The goal of the post-doctoral internship is to deal with this new challenge by studying novel techniques to solve and approximate the subdomain and the coarse grid problems, and to devise asynchronous scheduling and suitable load balancing strategies. The goal of the project is to help engineers as well as scientists to benefit from the performance of parallel computers with very large number of cores.

Industrial partnership / Partenariat industriel

The post-doctoral position takes part in a wider industrial partnership through the nationally funded project PAMSIM (PARallélisme Massif en Simulation numérique pour la Mécanique *aka* Massive Parallelism for the Numerical Simulation in Solid Mechanics). In addition to CERFACS, the consortium includes the R&D division of EDF, the LMT laboratory of ENS Cachan and several participating start-ups.

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