Ecole Doctorale Carnot-Pasteur

Proposition de sujet de thèse

Intitulé français du sujet de thèse proposé :

Méthodes spectrales multi-domaines pour des EDPs dispersives

Intitulé en anglais :

Multi-domain spectral methods for dispersive PDEs

Unité de recherche :

IMB

Nom, prénom et courriel du directeur (et co-directeur) de thèse :

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Domaine scientifique principal de la thèse :

Mathématiques

Domaine scientifique secondaire de la thèse :

Physique

Description du projet scientifique

Nonlinear dispersive PDEs are important in applications and mathematically challenging since they can have solutions with zones of rapid modulated oscillations and even blow-up, i.e., a loss of regularity. To numerically study such phenomena, spectral methods are a convenient tool because of their excellent approximation properties for smooth functions and because of the only minimal introduction of numerical viscosity.

The thesis will focus on the efficient implementation of such techniques for dispersive PDEs. An important technical problem in this context is the fact that computational domains are finite. This raises the question which boundary conditions to impose at the computational boundary. The goal is to explore multi-domain approaches with an exterior compactified domain as known from astrophysics. The results are to be compared with approximate non-reflecting boundary conditions and perfectly matched layer approaches. For the study of blow-up, adaptive mesh refinement is to be implemented via these techniques.

Connaissances et compétences requises :

Basic programming knowledge (Matlab, C++ or Fortran).