

# Proposition de TFE 2016-2017

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## Simulation of geophysical wave propagation using domain decomposition techniques

In terms of computational methods, solving time-harmonic wave problems is known to be challenging, especially in the high frequency regime when dealing with inhomogeneous media. Simulating the propagation of geophysical waves in the ground (for seismic simulations or for prospection) is one very complex particular case of tremendous societal and industrial importance.

The brute-force application of finite element type techniques in this case leads to the solution of very large, complex and possibly indefinite linear systems. Direct sparse solvers do not scale well for such problems, and Krylov subspace iterative solvers can exhibit slow convergence, or even diverge. Domain decomposition methods provide an alternative, iterating between subproblems of smaller sizes, amenable to sparse direct solvers.

In this master's thesis you will

- learn the fundamentals of this challenging problem
- use a finite element solver based on the open source code GetDP/Gmsh to handle the elastodynamics equation
- implement, validate and test a parallel overlapping domain decomposition method to handle large scale simulations

