Semiclassical approach to the solution of the Helmholtz equation

The Helmholtz equation describes the periodic solutions of the wave equation (possibly in a heterogeneous medium, in a bounded medium, with boundary conditions ...). In general, there is no explicit solution to such an equation, and an approximate solution of the equation must be computed numerically.

All the existing methods (finite elements, finite differences…) have in common that they are more and more expensive when the frequency of the waves increases.

The goal of this work is to discover new methods to solve this equation, better adapted to the regime of numerical high frequencies. These methods are inspired by theoretical considerations of semi-classical analysis and wavelet theory. One of the objectives of the internship is to study these methods in the case where the coefficients of the equation present discontinuities.

Prerequisites (essential): analysis (Fourier transform, Sobolev spaces, distributions…) as well as basic knowledge in numerical analysis (finite element methods…).

Prerequisites (optional): harmonic analysis (semi-classical analysis, wavelets…), spectral theory or skills in numerical implementations would have advantages, but are not mandatory.

This internship is remunerated, and may be followed by a PhD thesis at Inria of the Université Côte d'Azur on a similar subject.

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