FEM/DGM Coupling

MSc 1 Projet Report

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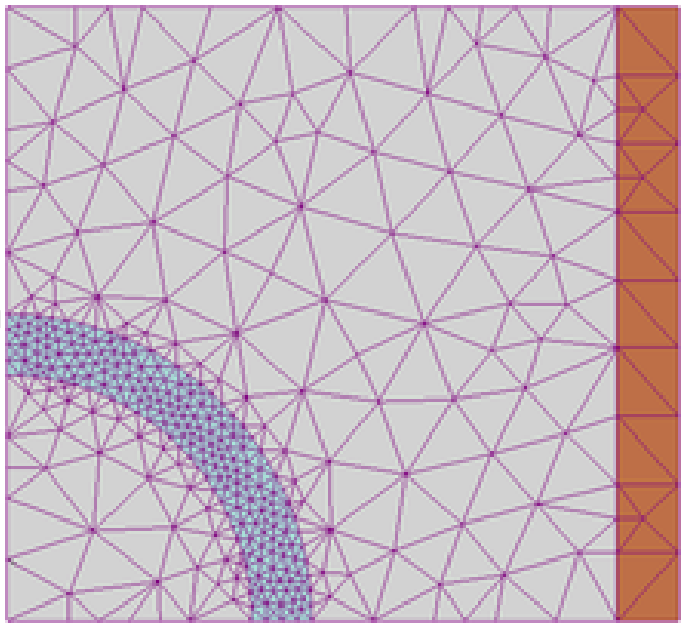
Initial state

- Numerous numerical methods, each with specificities
- Proven efficiency of methods relying on adaptative meshes
- A powerful adaptative method yet to be found



Wave-based DGM & FEM

Wave-based Discontinuous Galerkin Method

- Use of a plane-waves basis to improve accuracy
- Number of unknowns only dependent on the number of plane waves in the test-field
- Excellent approximation event for huge elements with big details

Finite Elements Method

- Number of unknowns dependent on the order of the chosen polynomials
- Excellent approximation for small elements with tiny details
- Robust and used for years

How to mix ?

Problem to solve : Write the interface operator !

- Write boundary conditions for FEM using characterics-based formulation from DGM
- Choose wisely the polynomial basis to preserve order while applying boundary conditions
- Solve the meshing discontinuity problem (between TR6 and TR3 meshes)
- Snap all that together and pray !

What's done, what's left ?

Done

- Test of different polynomial basis for FEM
- FEM computation using characterics-based boundary conditions
- Simple 1D-DGM computation

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Still to do

- Coupling of FEM and DGM
- Evaluation of method accuracy for simple problems
- Reflexion around 2D generalization of the method

References

- **A discontinuous Galerkin Method with Plane Waves for Sound Absorbing Materials**, *Int. J. Numer. Engng*, G. Gabard, O. Dazel
- **A comparison of wave-based discontinuous Galerkin, ultra-week and least-square method for wave problems**, *Int. J. Numer. Engng*, G. Gabard, P. Gamallo, T. Huttunen
- **Analyse Numrique : une approche mathmatique**, M. Schatzman