UE An introduction to shape and topology optimization

Niveau d'étude
Bac +5

ECTS
3 crédits

Crédits ECTS Echange
3.0

Composante
UFR IM2AG (informatique, mathématiques et mathématiques appliquées)

Période de l'année
Automne (sept. à dec./janv.)

- **Langue(s) d'enseignement:** Anglais
- **Méthodes d'enseignement:** En présence
- **Forme d'enseignement :** Cours magistral
- **Ouvert aux étudiants en échange:** Oui
- **Crédits ECTS Echange:** 3.0
- **Code d'export Apogée:** GBX8AM28

Présentation

Description

In a very broad acceptation, shape and topology optimization is about finding the best domain (which may represent, depending on applications, a mechanical structure, a fluid channel,…) with respect to a given performance criterion (e.g. robustness, weight, etc.), under some constraints (e.g. of a geometric nature). Fostered by its impressive technological and industrial achievements, this discipline has aroused a growing enthusiasm among mathematicians, physicists and engineers since the seventies. Nowadays, problems pertaining to fields so diverse as mechanical engineering, fluid mechanics or biology, to name a few, are currently tackled with optimal design techniques, and constantly raise new, challenging issues.
The purpose of this course is to discuss the main aspects related to the numerical resolution and the practical implementation of shape and topology optimization problems, and to present state-of-the-art elements of response. It focuses as well on the needed theoretical ingredients as on the related numerical considerations. More specifically, the following issues will be addressed:

- How to define a `good' notion of derivative for a ``cost'' function depending on the domain;
- How to calculate the shape derivative of a function which depends on the domain
via the solution of a Partial Differential Equation posed on it;

 - How to devise efficient first-order algorithms (e.g. steepest-descent algorithms) based on the notion of shape derivative;
 - How to numerically represent shapes so that it is at the same time convenient to perform Finite Element computations on them, and to deal with their evolution in the course of the optimization process.

Heures d'enseignement

CM	CM	18h

Pré-requis recommandés

Only a basic knowledge of functional analysis and scientific computing will be assumed: differential calculus, Finite Element method, etc.

Période : Semestre 9

Infos pratiques

Contacts

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Lieu(x) ville

- Grenoble

Campus

- Grenoble - Domaine universitaire