

Ecole Doctorale des Sciences Fondamentales

Title of the thesis: Resolution of non-linear systems using Least-squares type methods.

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Summary :

Least-squares methods have been introduced in the 70's to solve equations and systems through iterative processes. For the equation $-E(u)=f$ – the idea is to minimize with respect to u the functional $N(E(u)-f)$ where N is a norm (see [1]).

Recently, this kind of method has been introduced to solve controllability problems for linear non stationary PDEs. Recall that in control theory, the aim is to drive the solution to a given state through an additional function, the control. Actually, the variational framework proposed by least-squares approach is really convenient to reformulate control problems.

We refer to [2,3,4,5] for some realizations in the linear context.

The main of the thesis is to study the potential of least-squares method to solve direct and control problems for non linear system. We have in mind notably the stationary and non stationary Navier-Stokes system and also obstacle problem [6].

This thesis requires some skills in functional analysis (PDE Theory, Calculus of Variations), numerical analysis and also in computing.

More information can be found at <http://math.univ-bpclermont.fr/~munch/>

Interested people are encouraged to contact Arnaud Munch.

References

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[2] A. Munch, A variational approach to approximate controls for system with essential spectrum: application to the membranal arch, ECCT 2013,

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[6] F. Ammar-Khodja, S. Micu, A. Munch, Exact boundary controllability of a string submitted to a unilateral constraint. *Annales de l'IHP série C*, 2010.