

ECHAHID HAMMA LAKHDAR UNIVERSITY - EL-OUED

Under the Supervision of the **DGRSDT** and in collaboration with the **CRTI**

International Pluridisciplinary PhD Meeting (IPPM'20)

1st Edition, February 23-26, 2020

Theme : Modern Technology and Fineness Life

Multigrid methods for Nonlinear Elliptical Variational Inequalities

NESBA Nour El Houda, BEGGAS Mohammed

Faculty of Exact Sciences, Echahid Hamma Lakhdar University of El Oued, Operator theory, EDP and applications laboratory

1-Summary

This work concerns the study of a class of variational inequalities, in the sense that the second member depends on the solution, applying the methods multigrids in two domain .

Find $u \in K_g$ solution of

$$\begin{cases} \Delta u \geq f(u) & \text{in } \Omega \\ u \leq \psi; \quad \psi \geq 0 \\ u = g; \quad \text{on } \partial\Omega \end{cases}$$

where $f \in L^\infty(\Omega)$ and

$$K_g = \{v \in H^1(\Omega) : v = g \text{ on } \partial\Omega, v \leq \psi \text{ in } \Omega\}$$

Multigrid methods consist in successively using grids (or meshes) of different sizes, so as to obtain a detailed solution in the high frequencies, while ensuring rapid relaxation of the basic frequencies. Multigrid methods have been studied for linear elliptical problems. For our part, we are interested in the finite difference approximation, in using multigrid algorithms, for variational inequalities nonlinear, as the second member depends on the solution.

2-Keywords

Variational inequality, Quasi-variational elliptic inequality, Methods multigrids, finite differences, finite element, Approximations.

3-Thesis plan

- Bibliographic research.
- Mathematical study of continuous problem.
- Comprehensive study on multi-grid methods.

- The finite element approximation by introducing algorithms to multi-grids, for a nonlinear elliptical variational inequality, where the second member depend of the solution.
- Numerical simulation.

4-Abstract Graphic

In this work we will study the multi-grid method for a nonlinear elliptical variational inequality, where the second member depend of the solution.

5-Bibliographic references

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