HAMILTON-JACOBI EQUATIONS : APPROXIMATIONS,
NUMERICAL ANALYSIS AND APPLICATIONS

CIME Courses-Cetraro
August 29-September 3 2011

COURSES

The final version of the texts of the lectures will be published in the Springer
Lecture Notes in Mathematics, CIME Subseries. A preliminar version (slides on
line) during the course will be helpful to the understanding.

On September 3 (saturday morning) we plan informal discussions.

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<th>Times</th>
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<tr>
<td>9.00</td>
<td>Barles 1</td>
<td>Ishii 3</td>
<td>Litvinov 4</td>
<td>Achdou 2</td>
<td>Souganidis 4</td>
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<td>10.00</td>
<td>Barles 2</td>
<td>Ishii 4</td>
<td>Litvinov 5</td>
<td>Achdou 3</td>
<td>Souganidis 5</td>
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<td>11.15 Coffee Break</td>
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<td>11.45</td>
<td>Litvinov 1</td>
<td>Achdou 1</td>
<td>Souganidis 3</td>
<td>Barles 5</td>
<td>Ishii 5</td>
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<td>12.45</td>
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<td>13.00 Lunch</td>
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<td>16.45-17.45</td>
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<td>18.00-19.00</td>
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<td>Litvinov 3</td>
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<td>19.00-20.00</td>
<td>Souganidis 1</td>
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<td>Round Table</td>
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Yves Achdou, UFR Mathématiques, Université Paris 7, Case 7012, 175 rue du Chevaleret, 75013 Paris, France and UMR 7598, Laboratoire Jacques-Louis Lions, F-75005, Paris, France. achdou@math.jussieu.fr

1.1. CIME course program. Models of mean field type for the limit of Nash equilibria for stochastic game problems see [3] when the number of players tends to \( +\infty \) have recently been studied by J-M. Lasry and P-L. Lions, see [5, 7, 8]. The main assumptions are that all the \( N \) players are identical and that each player chooses his optimal strategy in view of a global (partial) information on the game. At the limit a system of two coupled equations is obtained: a forward in time Hamilton-Jacobi-Bellman for a value function and a backward in time Kolmogorov equation for a probability measure. Uniqueness is obtained under some reasonable assumptions. Infinite horizon games will also be considered.

The following points will be discussed:

- some notions on the asymptotic behavior of the Nash equilibria when \( N \to \infty \), (a brief and incomplete review of the theory of Lasry and Lions)
- existence for the previously mentioned system of PDEs in the finite horizon case
- uniqueness
- numerical methods for approximating the above mentioned system and numerical analysis, see [1, 2, 4, 5].

REFERENCES

First-order Hamilton-Jacobi Equations and Applications. Guy Barles.

Guy Barles, Laboratoire de Mathématiques et Physique Théorique CNRS UMR 6083 (Tours), Fédération Denis Poisson, Université François Rabelais Tours, Parc de Grandmont 37200 TOURS, France.

2.1. CIME course program. The topic will be mainly devoted to first order Hamilton-Jacobi Equation: notion of viscosity solutions, main properties, comparison theorems, stability, Lipschitz regularity of solutions and further regularity, lower bounds on the gradient, applications to dislocation equations.

REFERENCES


Hitoshi Ishii, Department of Mathematics, Waseda University, Nishi-Waseda, Shinjuku, Tokyo, 169-8050 Japan, hitoshi.ishii@waseda.jp

3.1. CIME course program. Basic properties of viscosity solutions, some aspects of weak KAM theory, as well as comparison theorems, regularity results and asymptotic analysis for first-order and second-order nonlinear partial differential equations.

A reference to this course could be

References


Grigory L. Litvinov, Independent University of Moscow and the Russian-French Laboratory “J.-V. Poncelet” Bol’shoi Vlasievskii per., 11 Moscow 119002, Russia. islci@dol.ru.

4.1. CIME course program. The Maslov dequantization and tropical mathematics. Idempotent mathematics and the idempotent correspondence principle.


References

5. Homogenization and Approximation for Hamilton-Jacobi equations.
Panagiotis E. Souganidis.

Panagiotis E. Souganidis, Department of Mathematics, The University of Chicago, 5734 S. University Avenue, Chicago, IL 60637

5.1. CIME course program. First- and second-order Hamilton-Jacobi equations, Homogenization of fully nonlinear equations in random media, Approximations of viscosity solutions and rates of convergence.

References