

COMMUNICATION SKILLS
Master of Science in Computational Mechanics/Numerical Methods
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Review on *Hybrid optimization methods* by Jordi Pons

In this seminar, the author presented the state of the art of the optimization methods that combine genetic algorithms with gradient-based methods.

First of all, the author made a general introduction on the definition of the concepts to use in the optimization field. This introduction was very general in order to allow any people with not background in the field. This presentation included the definition of objective function, condition on minimum, design parametrization, constraints ... Each of the terms was defined in a short but concise way understandable for anyone with a general mathematical background.

After that, some different types of optimization were presented and classified over different criteria:

- Problem to handle in the optimization process:
 - Shape optimization
 - Topological optimization
- Constraints nature:
 - Unconstrained problems
 - Constrained with equality constraints
 - Constrained with inequality constraints
 - Single or multi-objective
- Algorithm used to solve the problem
 - Deterministic (e.g. Gradient based methods)
 - Heuristic (e.g. Evolutionary algorithm)
 - Hybrid

As the seminar was focused on the hybrid methods, the deterministic and heuristic methods were detailed explained with their pros and cons. Special emphasis was done to the explanation of all the parameters of the genetic algorithms as well as the effects on their tuning. In summary, deterministic methods have faster convergence to local minimum and heuristic methods have the capacity of escaping from the local minimum to find the global optimal point.

Then, the author explained common methods of implementation of the hybrid algorithms methods. In particular, it explained the combination of the hybrid formulation with the Nash game theory.

Finally, the implementation in the CIMNE developed software was explained with some illustrative examples and the benefit from an industrial point of view.

In conclusion, this was a very complete seminar in the sense that all parts of the topic were addressed: from the introduction of the necessary concepts to understand the subject through an explanation of the key ideas to finally, the application of the method with its benefits.