Renault has conducted car crash simulations for over twenty years and optimization for ten years. “We are currently in the process of changing our car crash model to be used on CURIE-supercomputer. The project, as such, is only getting started as we speak”, Marc Pariente, the Research Engineer at Renault SAS, explains.

The French PRACE project “FMOC – Fast Multi-physics Optimization of a Car” is headed by Pariente. Two companies and two universities are involved in the project: the car manufacturer Renault SAS, ESI Group, a leading provider of virtual prototyping, the Ecole Centrale de Lyon and the Ecole nationale supérieure des mines de Saint-Étienne.

“ESI Group brings their car crash simulation and modelling expertise to the project, while the universities, on the other hand, add their specialization in optimization and mathematical know-how. At Renault, we are experts in car design, applied mathematics, crash simulation and optimization. We are very interested in seeing what results this kind of cooperation can produce”, Pariente says.

**More accurate and larger models for safer cars**

All engineering at Renault is focused on improving car safety and the company has for some time been working on improving its numerical simulations. Renault has implemented several optimization phases in their standard car design process, in which a standard model of three million finite elements is used.

“We have done a lot of optimization studies at Renault, but this PRACE project will allow us to be much more precise. Accessing to a supercomputer like CURIE is a great opportunity for benefitting from its processing capacity to improve our optimization algorithms. The car crash model used in our PRACE project is ten times larger than the models used in this type of research before”, Pariente says.

The PRACE project’s aims are clear and practical.

“Our primary aim is to improve the crash simulations and achieve more precise results. Secondly, we want to improve our optimization methods and tools. The PRACE project allows Renault to use tools that we don’t currently have in-house. We also benefit from our project partners’ specialized knowledge. Working with PhD students from the applied mathematics departments from the two universities will improve the algorithms significantly.”

**Up to 200 parameters and 512 cores in a single simulation**

The project was allocated 42 million core hours on the thin nodes partition of the CURIE supercomputer. Compared to research conducted on car crash simulations elsewhere, the project is unique, as it combines optimization and topic modelling.

“It is one of the first times that we are conducting an optimization study on a car with more than two hundred parameters and with such a big model of up to 20 millions finite elements. To date our studies have been done with fewer than a hundred parameters on up to 3 millions finite elements!”

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**Designing Safer Cars with Accurate Crash Test Simulations**

A project conducted by Renault, ESI Group and two French universities, aims to achieve more accurate crash test results with better optimization. Supercomputers will allow the team to study twice as many parameters compared to previous tests, in a much shorter timeframe than before.
Xcelerit Unleashes the Power of Many-Core Hardware

PRACE chose an Irish software company, Xcelerit, specializing in cross-platform acceleration tool as the winner of the “Most Innovative Industrial HPC Solution in Europe” prize. The company’s products enable engineers and scientists with no knowledge of parallel computing to access the raw power of hardware accelerators in their applications. Xcelerit’s products broaden the use of HPC within European industry.

Large car model with big data technology
The researchers are building a large car model (more than 20 million finite elements) that includes many physical phenomena that have not commonly been taken into consideration before:
- Iron sheet cracking
- Welding point cracking
- Failure of screw body
- Wheel rim deformation
- Windshield cracking
- Crash and stamping coupling

The researchers will use big data technology to extract more information from the simulations and improve the accuracy of the statistical models.

MORE INFORMATION:
- http://www.prace-ri.eu/PRACE-6thRegular-Call

Road safety is one of the cornerstones of Renault’s corporate culture and draws on fifty years of research and development. Crash test in 2012 on New Renault Clio.