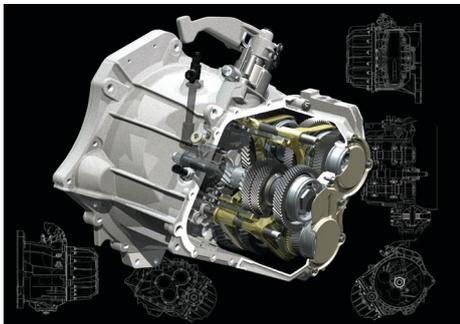
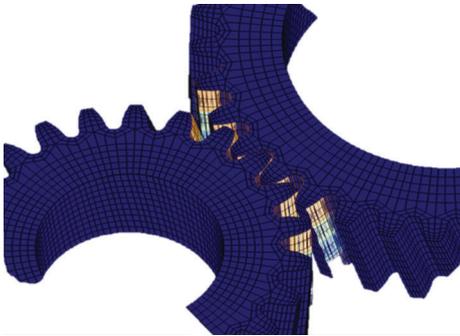


## High Performance Gear Analyzer

### Fortissimo Experiment Facts:

- Segment: Automotive
- Application Domain: Finite Elements
- Application: MSC Marc



### The Company

VE&D is an SME which has been working in the field of automotive engineering for over 50 years, providing design services to its industrial partners. In particular, it has been involved in designing gearboxes for large companies such as Piaggio. The gearbox market in Europe had revenues of ~ €3 billion in 2010. The market is forecast to reach ~ €3.7 billion in 2017. Italy has a large number of gear manufacturers, many of them are SMEs, operating in the areas of gear production, gear design and gearbox manufacture. Generally, these SMEs lack the skills and resources to develop complex simulation models. They also lack the resources to buy expensive software licences to perform large-scale computations and to hire highly skilled people having experience in stress analysis and gears. The objective of this experiment was to develop an HPC-Cloud-based High Performance Gear Analyzer (HPGA) using advanced software and high-performance computing resources which would allow SMEs such as VE&D to benefit from the most advanced methods for gear analysis and design.

### The Challenge

A typical SME gear designer, is generally an expert in gears and traditional design tools, based on standards, simple tables, databases implemented in spread-sheets and specialist commercial and CAD software. Such designers generally have only a basic knowledge of software for structural analysis and only limited awareness of specialized applications. The challenge of this experiment was to provide a new technology for supporting the design of reliable and efficient gears, using cloud-based advanced simulation, without the need for significant investments in computational resources, expensive software licences and time consuming and expensive training. The goal is to develop HPGA as an advanced analysis methodology which will provide new innovation opportunities and services for European gear manufacturers.

### The Solution

The development of HPGA draws on more than ten years of research in the field of mechanical transmissions. The research group of UNIMORE, the ISV partner in this experiment, developed several computational tools for gear analysis and optimization. During this development, it became clear that HPC Cloud technologies would be needed to make HPGA available for design engineers with an appropriate time to solution. The HPGA software appears as a simple interface, where the end-user finds all standard gear datasheets. In addition, some popup menus are devoted to specific operations such as the creation of gear geometry and checking for data coherence, the performance of analyses and optimizations and the presentation of results in a standard way acceptable to potential end-users. Behind such a simple interface, innovative and advanced analysis is implemented using Cloud-based HPC and state-of-the-art software.

### The Benefits

The current yearly costs for VE&D to simulate gears in-house are approximately €160K: €10K for software licences; €88K for staff costs, computer hardware costs of between €20K to €40K and other costs (administration, personnel and security) of €32K. The yearly costs for VE&D to simulate gears using HPGA via Cloud-based HPC are approximately €143K: €10K for the use of HPGA (licence and computing costs included); €25K for computer

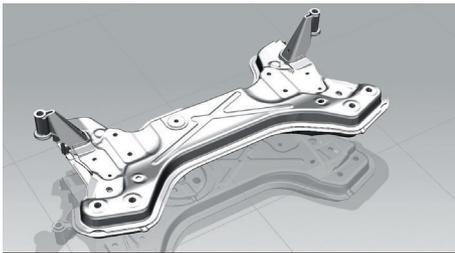
### Fortissimo Experiment Partners:

- VE&D (End-user)
- CINECA (HPC Expert and HPC provider)
- UNIMORE (Application Expert and ISV)

### More Information:

[www.fortissimo-project.eu](http://www.fortissimo-project.eu)

E-Mail: [info@fortissimo-project.eu](mailto:info@fortissimo-project.eu)



€10K for the use of HPGA (licence and computing costs included); €25K for computer hardware, €79K for staff costs and other costs of €28K. VE&D will see an annual saving of €17K as a result of using HPGA via cloud-based HPC. Given that there are a significant number of SMEs, which design gears, this represents a substantial saving across this sector.

A further benefit is that HPGA enables tooth contact analysis, which is more refined than that currently performed by VE&D. The market is going to increasingly require this kind of analysis. Having this capability is expected to increase VE&D's market share.

For the ISV UNIMORE the benefits of HPGA will be twofold. Firstly, there will be a direct increase of contracts related to the design of mechanical transmissions, starting from the actual turnover of about €20K per annum in 2017 rising to €100k per annum after 5 years. Secondly, the reputation of UNIMORE will rise leading to a subsequent increase in collaborative research projects. CINECA expects to see a rise in revenue from cycle sales through the use of HPGA. UNIMORE, VE&D and CINECA will make the HPGA tool, developed in this experiment, available via the Fortissimo marketplace.

### The Fortissimo Project

Fortissimo is a collaborative project that enables European SMEs to be more competitive globally through the use of simulation services running on a High Performance Computing cloud infrastructure. The project is coordinated by the University of Edinburgh and involves 123 partners including Manufacturing Companies, Application Developers, Domain Experts, IT Solution Providers and HPC Cloud Service Providers from 14 countries. These partners are engaged in 53 experiments (case studies) where business relevant simulations of industrial processes are implemented and evaluated. The project is funded by the European Commission within the 7th Framework Programme and is part of the I4MS Initiative.

**I4MS** Fortissimo is part of I4MS ICT Innovation for Manufacturing SMEs: [www.i4ms.eu](http://www.i4ms.eu)



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