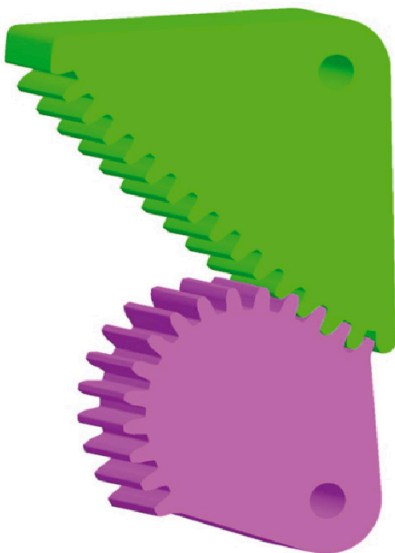# HPC-based design of non-circular gears

Fortissimo Experiment Facts:
- Industry Sector: **Mechanical Engineering**
- Country: **Italy**
- Software Used: **Noesis Optimus, Maple, Matlab**

THE COMPANIES

STAM is an Italian engineering and manufacturing firm. Since 2011, it has pioneered the development of Non-Circular Gears, which are used in many sectors such as automation & robotics, defence & security, aerospace, transport, and energy. Noesis solutions is a Belgian system integrator and independent software vendor.

THE CHALLENGE

Non-Circular Gears generate a prescribed motion with great precision, regardless of external factors. This is a highly desirable feature in advanced transmissions. Designing these gears is a complex process that requires a significant amount of expertise and expensive, computationally intensive iterations. In-house computing systems are not powerful enough to perform these calculations.

A cloud-based engineering workflow would significantly shorten the time required to design and deliver an NCG. A key element of this is cost-effective access to the necessary computing power.

THE SOLUTION

The partners developed an HPC-based engineering workflow for NCG design. The workflow, CloudGear, allows STAM to optimise the design of an NCG in less than 3 minutes, providing fast feedback concerning potential modifications and improvements. Previously, just the computation phase of the workflow would take 25 minutes, not including set-up and results delivery. Due to the near-real-time delivery of results, STAM is able to significant speed up its internal design process.

Using Noesis' Optimus software, the design process was automated and the most computationally expensive part of the process sent to an HPC system. CloudGear will also be offered by Arctur through the Fortissimo Marketplace.

BUSINESS IMPACT

Customers of the CloudGear workflow will be able to design better NCG-based solutions at lower costs. This in turn benefits users of their machinery, plants, prototypes and other products. Five potential customers for CloudGear have already been identified.

STAM sells a custom NCG solution for approximately €15,000 each. The CloudGear approach will allow them to sell 8 new solutions in the first year, 10 in the second, and 12 in the third. The reduction in development time and lower manufacturing costs give STAM a significant advantage.

Noesis will benefit through an increase in sales of the Optimus software directly related to the sales of the CloudGear solution, as CloudGear is built on the Optimus platform. The Optimus optimization tool is extremely flexible and can easily capture the simulation needs of end-users in a number of different industries.
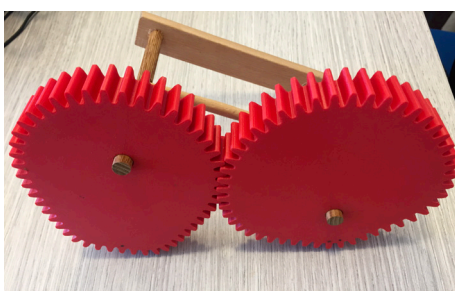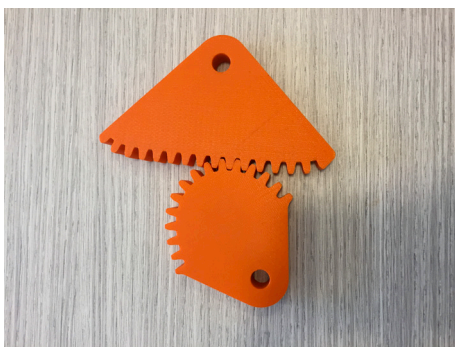
BENEFITS

- Increase in turnover, rising to 20% after 7 years, for STAM, due to sales of NCGbased solutions and software.

- NCGs can be designed faster, and with more advanced features that would not be possible to simulate without HPC.

- Noesis expects a 3% increase in total sales, worth a total of €1.6 M over five years.

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 more than 100 partners including Manufacturing Companies, Application Developers, Domain Experts, IT Solution Providers and HPC Cloud Service Providers from 14 countries. These partners are engaged in over 90 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 Horizon 2020 and is part of the I4MS Initiative.