

HPC Simulation for an Endourethral Sphincter against Urinary Incontinence

Organizations

RELIEF is a SME whose main objective is to develop and manufacture devices for handling urinary incontinence.

M3E is an SME with extensive experience in complex numerical simulation.

The Centre for Mechanics of Biological Materials is a research center with broad multi-disciplinary competence in in silico medicine activities.

CINECA is the largest Italian supercomputing centre with an HPC environment equipped with cutting-edge technology.



End User



Application Expert



HPC Expert



HPC Provider

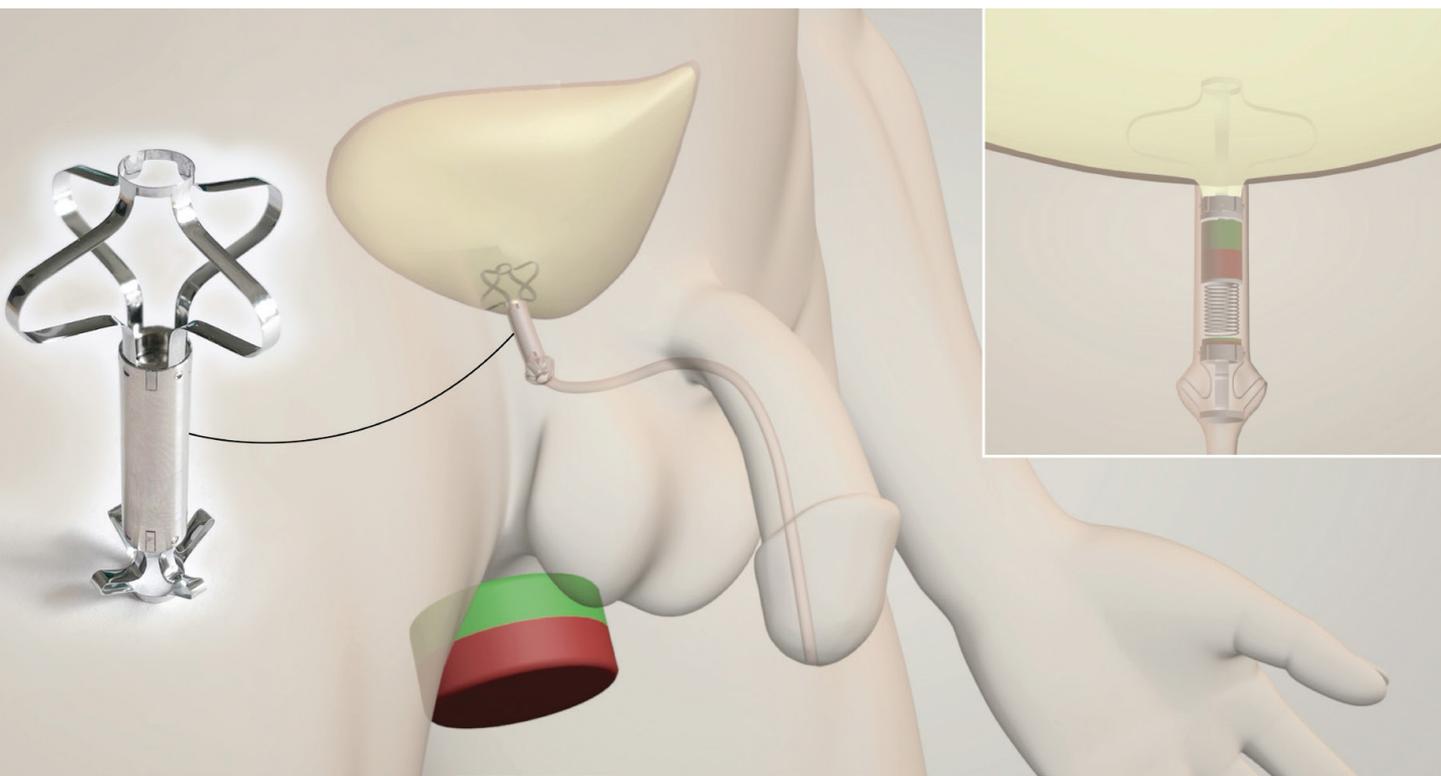


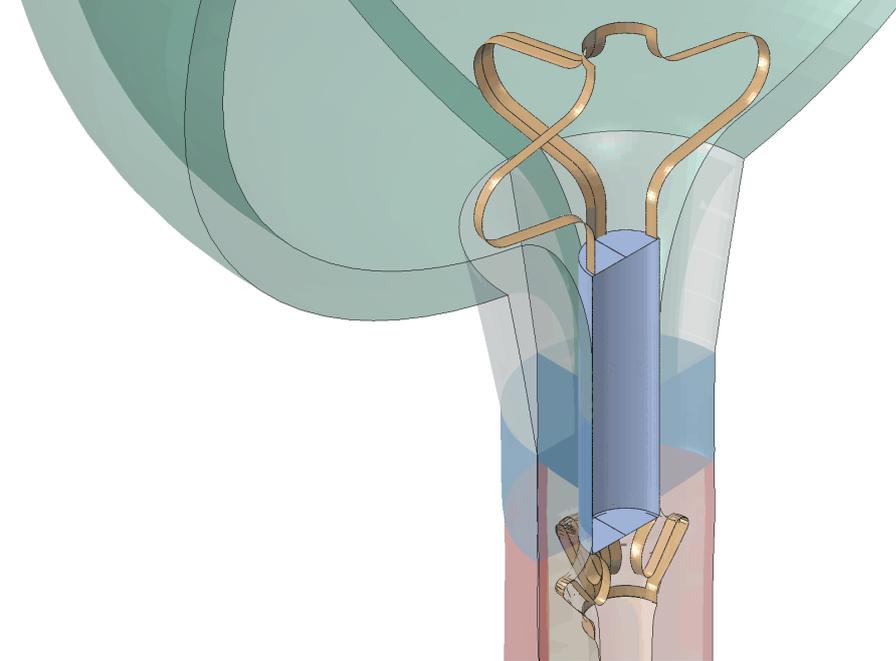
CINECA is part of the Italian NCC.



The Challenge

RELIEF has developed an innovative Artificial Urinary Sphincter (AUS), for the treatment of incontinence. In-vivo / in-vitro tests and a first-human pilot study demonstrated the feasibility, acceptability, and easy use of the AUS, but also the need for optimization of the final product design. Furthermore, a decision-support system (DSS) is needed to allow medical doctors to choose the optimal size of the device for each individual patient.





Industry Sector
Healthcare

Technology used:
HPC,
FEM Simulations

The Solution

Finite element analyses were used to optimise the AUS shape design and also to define the key information required to select the device for individual patients. Thus, the side-effects of implantation will be limited and medical doctors can easily choose the right size for a patient, whose long-term satisfaction could be considerably improved. HPC-based simulations mean that the highly complex models, needed to deliver results with sufficient accuracy, are available within RELIEF's business workflow.

The Impact

"In silico" investigation using numerical simulation gives RELIEF a disruptive boost in the development of the product via:

- Savings in design costs. A reduction of costs by €400 per device is expected. This sums up to more than €40,000 yearly.
- Savings in experiment costs. Numerical simulations, powered by HPC systems, can reduce in-vivo experiments costs by up to 43%.
- Faster time-to-market. This solution reduces the number of prototypes to be designed, manufactured, and tested.
- A competitive advantage. RELIEF has built a DSS that allows medical doctors to easily decide the right AUS size for each patient, providing a more advanced service offer for its product.

This solution will also have a social impact considering:

- Reduction of in vivo tests. Digital models reduce the need for animals or cadavers for validation and optimisation purposes.
- Improvement of long-term patient satisfaction. Personalised selection of the AUS size promotes correct use and reduces undesired effects.

Benefits

- Drastic reduction of animal or cadaver tests for experimental validation and optimisation.
- €40,000 yearly reduction of production cost.
- 43% reduction in experimental cost.
- 6 to 12 months reduction in time-to-market.