

## Segula Technologies innovates with a new more accurate fluid-structure interaction model for predicting potential nuclear risks

*Segula Technologies and Carnot SMILES have teamed up to help predict critical velocity thresholds that can cause instability in the steam generator tubes of nuclear power plants.*

### Supporting Innovation

Segula Technologies is an engineering group with a global presence, helping to boost competitiveness in all major industrial sectors: automotive, aerospace, energy, rail, naval, pharmaceuticals and petrochemicals. Among their many areas of expertise, Segula engineers help meet the technological challenges inherent in nuclear power plant safety and reliability. For example, modelling the behaviour of steam generator tubes is a critical link in the process of sizing nuclear facilities. Consequently, Segula Technologies has developed expertise and software for understanding and modelling the underlying physical phenomena. To enhance nuclear power plant safety, Carnot SMILES is endorsing Segula Technologies' innovative strategy, offering new complementary models that provide a better understanding and more accurate predictions of the underlying physical phenomena that trigger instability in steam generators.



### The client needs

One of the key technological challenges in the nuclear industry concerns the dynamic stability of the steam generator tubes that drive the turbines that actually produce the electricity. These tubes are prone to strong vibrations due to the forces induced by the fluids flowing inside the steam generator. These vibrations need to be controlled to avoid any instability that could compromise the mechanical integrity of the heat exchangers. As a means to this end, it was necessary to analyse stability thresholds – which depend on crossflow – together with algebraic models that determine the instability threshold. The aim of the project was to help gain a better understanding of how fluids behave when they interact with the tubes, using innovative mathematical methods to simulate and predict critical flow velocity thresholds.

### Partnership

Carnot SMILES is a public research institute specialised in mathematical modelling, numerical simulation, optimisation and data science. One of its research labs, Laboratoire Jacques-Louis Lions, contributed expertise in the numerical analysis of physical models. This, combined with the operational strength of Carnot's research engineers, helped accelerate Segula Technologies' innovation processes. The partnership objective was to come up with a new mathematical model that would pinpoint dynamic instability thresholds in steam generator tubes based on flow velocity – considered to be irreducible – by modelling the effects of fluid-structure coupling, thus predicting the generation of critical vibration phenomena. Carnot SMILES teams provided knowledge transfer that helped enhance Segula Technologies' ability to compete in the technological, fiercely competitive nuclear sector.