University of Pisa

"Stochastic sensitivity analysis applied to URANS simulations of high-pressure injectors"

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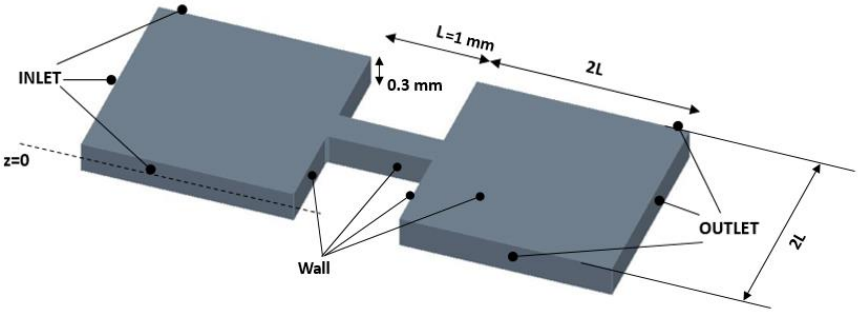
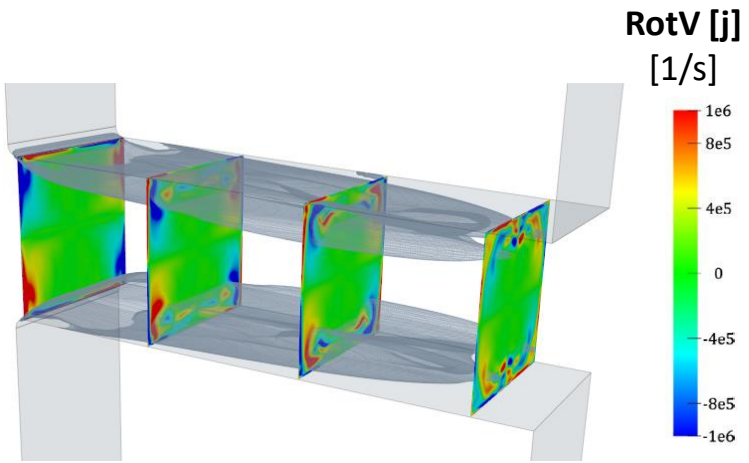
Stochastic sensitivity analysis applied to URANS simulations of high-pressure injectors

- Turbulence and cavitation modeling makes numerical simulations of high-pressure injectors very challenging
- **Industry requirements: low computational costs preserving good result quality**
- Idea: **Optimization of URANS equation** setup available in commercial codes through UQ methodologies:
  - **Generalized Polynomial Chaos (gPC)**
  - **Stochastic Collocation (SC)**
- UQ applied to a cavitation model closed by 4 free-parameters



Computational Geometry



Iso-surfaces α=0.1 vs. Mean streamwise vorticity

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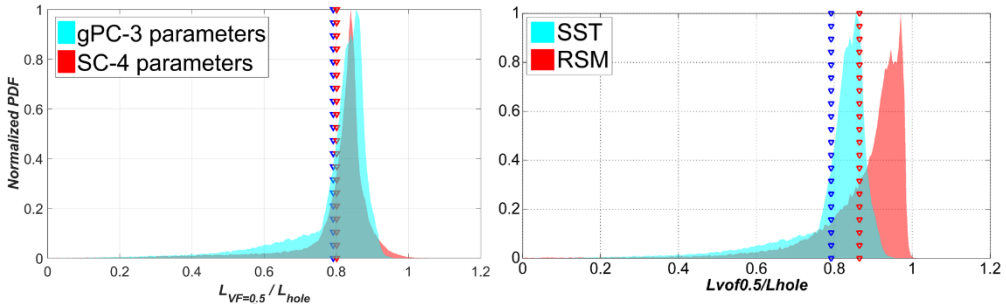
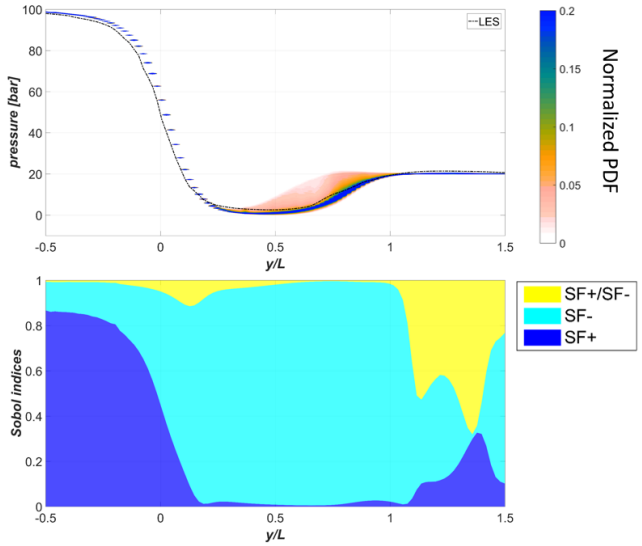
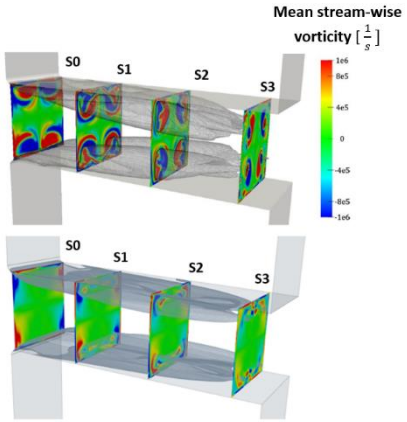
- I step: 2D screening to highlight the most important parameters



- II step: Analysis on 3D geometry



- III step: **Optimization**



- The optimized setup can predict with good precision the macroscopic quantities that are involved in injector design
- **The optimized setup has been validated** successfully in a different test-case