Non-intrusive polynomial chaos method applied to problems in computational fluid dynamics and a comparison with POD

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1. Introduction

- **Angle of attack** for an airfoil.
- Focus on computing the **lift coefficient** as an output of interest.
- Uncertainty quantification using **non-intrusive PCE**.
- Parameters are **velocity magnitude and angle of attack**.
- Data generated randomly using **Latin Hypercube** sampling approach.
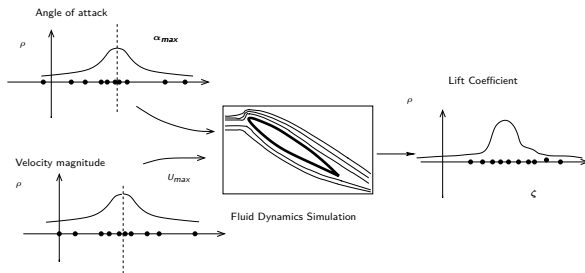
2. The Full Order Model

- The **Finite Volume** numerical discretization is used for the Navier-Stokes equations.
- **OpenFOAM** is used as the high order solver.

3. The Reduced Order Model

- **POD-Galerkin** ROM for Finite Volume
- The in-house developed **ITHACA-FV** open source library has been used to build and solve the reduced order model.
- **Supremizer** approach for stabilizing the pressure
- Results : Lift coefficient reconstructed using both **POD** and **PCE**