ID de Contribution: **1**　　Type: **Non spécifié**

Physics-informed polynomial chaos expansion

lundi 4 décembre 2023 17:00 (45 minutes)

Surrogate modeling of costly mathematical models representing physical systems is challenging since it is necessary to fulfill physical constraints in the whole design domain together with specific boundary conditions of investigated systems. Moreover, it is typically not possible to create a large experimental design covering whole input space due to computational burden of original models. Therefore there has been recently a considerable interest in developing surrogate models capable of satisfying physical constraints –spawning an entirely new field of physics-informed machine learning. In this lecture, a recently introduced methodology for the construction of physics-informed polynomial chaos expansion (PC2) that combines the conventional experimental design with additional constraints from the physics of the model will be presented. Physical constraints in PC2 can be represented by a set of differential equations and specified boundary conditions allowing surrogate model to be constructed more accurately with fewer physics-based model evaluations. Although the main purpose of the PC2 lies in combining data and physical constraints, it is also possible to construct surrogate model only from differential equations and boundary conditions alone without requiring evaluations of the original model. It is well known that a significant advantage of surrogate models in form of polynomial chaos expansions are their possibilities in uncertainty quantification including statistical and sensitivity analysis. Efficient uncertainty quantification by PC2 can be performed through analytical post-processing of a reduced basis filtering out the influence of all deterministic space-time variables. Various examples of PDEs with random parameters will be presented to show the efficiency and versatility of PC2 and its benefit for uncertainty quantification.

Orateur: NOVAK, Lukas (Brno University of Technology)