Programme des Leçons Jacques-Louis Lions 2022
données par Karen E. Willcox
du 25 au 28 octobre 2022

La septième édition des Leçons Jacques-Louis Lions aura lieu du 25 au 28 octobre 2022.

Données par Karen E. Willcox (Université du Texas à Austin), les Leçons Jacques-Louis Lions 2022 consisteront en :

– un **mini-cours**

Learning physics-based models from data:
Perspectives from projection-based model reduction

3 séances, **mardi 25, mercredi 26 et jeudi 27 octobre 2022 de 11h30 à 13h,**

– et **un colloquium**

Mathematical and computational foundations
for enabling predictive digital twins at scale

vendredi 28 octobre 2022 de 14h à 15h.

Tous les exposés seront donnés en présence dans la **salle du séminaire du Laboratoire Jacques-Louis Lions**

Sorbonne Université, Campus Jussieu, 4 place Jussieu, Paris 5ème,
barre 15-16, 3ème étage, salle 09 (15-16-3-09).

Ils seront retransmis en temps réel par Zoom.

Résumé du mini-cours

Learning physics-based models from data:
Perspectives from projection-based model reduction

Operator Inference is a method for learning predictive reduced-order models from data. The method targets the derivation of a reduced-order model of an expensive high-fidelity simulator that solves known governing equations. Rather than learn a generic approximation with weak enforcement of the physics, we learn low-dimensional operators of a dynamical system whose structure is defined by the physical problem being modeled. These reduced operators are determined by solving a linear least squares problem, making Operator Inference scalable to high-dimensional problems. The method is entirely non-intrusive, meaning that it requires simulation snapshot data but does not require access to or modification of the high-fidelity source code. This mini-course will cover the basic Operator Inference approach, the conditions under which Operator Inference recovers the traditional intrusive projection-based reduced-order model, variable transformations to handle nonlinear terms, and the importance of regularization in achieving numerical robustness. The mini-course will also present extensions of the approach, including the use of piecewise-linear and quadratic manifold approximation spaces for problems where the complexity of the physics does not admit a global low-rank structure, and a Bayesian Operator Inference formulation to provide uncertainty quantification. Throughout, examples will be drawn from large-scale engineering problems in aerodynamics, rocket combustion, additive manufacturing and materials phase-field modeling.

Résumé du colloquium

Mathematical and computational foundations for enabling predictive digital twins at scales

Digital twins represent the next frontier in the impact of computational science on grand challenges across science, technology and society. A digital twin is a computational model or set of coupled models that evolves over time to persistently represent the structure, behavior, and context of a unique physical system, process or biological entity. A digital twin is characterized by a dynamic two-way flow of information between the computational models and the physical system. A digital twin provides an integrated framework for calibration, data assimilation, planning, and optimal control. This talk will highlight the important roles of reduced-order modeling and uncertainty quantification in achieving robust, reliable digital twins at scale. The methodology will be illustrated for applications in aircraft structural digital twins and cancer patient digital twins.

Adresse de la page web des Leçons Jacques-Louis Lions 2022 (Karen E. Willcox)

https://www.ljll.math.upmc.fr/lecons-jacques-louis-lions-2022-karen-e-willcox