ÉCOLE POLYTECHNIQUE
FÉDÉRALE DE LAUSANNE

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# *SEMINAR OF NUMERICAL ANALYSIS*

➢ **THURSDAY 22 OCTOBER 2015 - ROOM MA B1 11 - 16h15**

**Dr. David AMSALLEM** (Stanford University, USA) will present a seminar entitled:

## "Accelerating the robust optimization of aeronautical systems with adjoints and reduced-order models"

Abstract:

Robust optimization based on nonlinear PDE constraints leads to some of the most computationally intensive numerical optimization problems. Indeed, each evaluation of the objective and constraints requires a large number expensive of PDE solutions associated with multiple operating conditions. Furthermore, the optimization of aeronautical systems is usually characterized by a large number of design variables. Hence, a direct sensitivity analysis would require the solution of as many linear systems as there are design variables. Adjoint-based optimization alleviates this burden by only requiring the solution of a small number of linear systems. However, the dimension of this systems still scales with the discretization of the PDE.
To alleviate this computational burden, an approach based on projection-based reduced-order models (ROMs) is proposed here. Two distinct ROMs are proposed: the first ROM reduces the complexity associated with solving the nonlinear PDE and the second ROM reduces the complexity associated with solving the linear adjoint system.
A trust region model management framework is used in addition to avoid training the ROMs in the entire design space while a greedy approach is used to train the ROM in the space of operating conditions.

Lausanne, 8 October 2015/AM/cr

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