

Prof. Fabio Nobile

SEMINAR OF NUMERICAL ANALYSIS / MECHANICS

Jointly organized by Prof. Fabio Nobile (CSQI) and Dr. Penelope Leyland (IAG)

➤ **TUESDAY 17 JANUARY 2017 - ROOM CO 01 1 – 15:15**

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“Risk measures in the context of robust and reliability based optimization”

Abstract:

Many industrial optimization processes must take account of the stochastic nature of the system and processes to be designed or re-designed and have to consider the random variability of some of the parameters that describe them. Thus it is necessary to characterize the system that is being studied from various points of view related to the treatment of uncertainty. This talk is related to the use of various risk measures in the context of robust and reliability based optimization. We start from the definition of risk measure and its formal setting and then we show how different risk functional definitions can lead to different approaches to the problem of optimization under uncertainty. In particular, the application of value-at-risk (VaR) and conditional value-at-risk (CVaR) is here illustrated. These risk measures originated in the area of financial engineering, but they are very well and naturally suited to reliability-based design optimization problems and they represent a viable alternative to more traditional robust design approaches. We will then discuss the implementation of an efficient risk-measure based optimization algorithm based on the introduction of the Weighted Empirical Cumulative Distribution Function (WECDF) and on the use of methods for changing the probability measure. Finally we will discuss the problems related to the error in the estimation of the risk function and we will illustrate the 'bootstrap' computational statistics technique to get an estimate of the standard error on VaR and CVaR. Finally, we will report some application examples of this approach to robust and reliability based optimization, with particular reference to the robust design optimization of a natural laminar flow wing for a supersonic business jet.

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