



**Tuesday, March 25, 2014.**

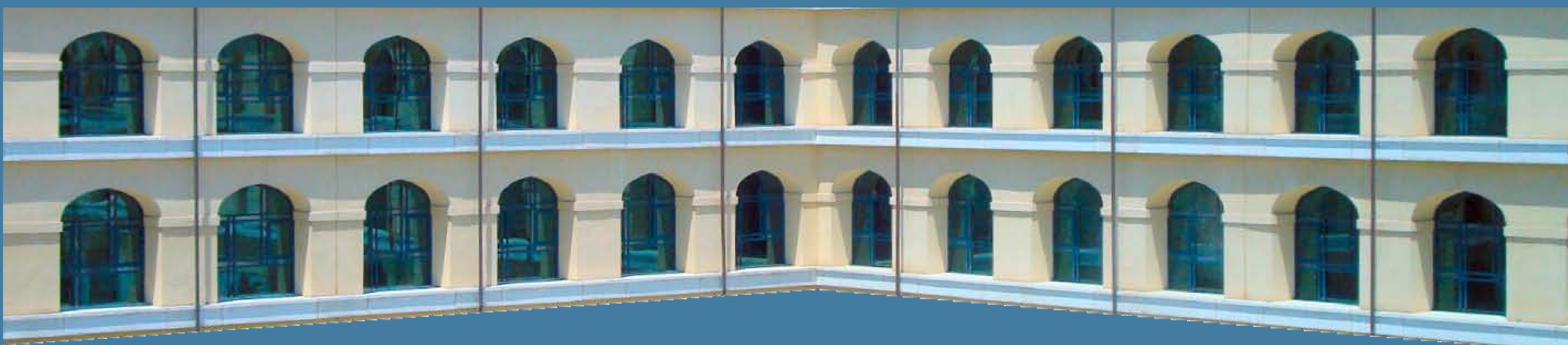
**Hanno Gottschalk (Universität Wuppertal, Germany)**

## **Probabilistic failure mechanisms in fatigue life and optimal reliability via shape control**

### **Abstract:**

Mechanical components fail under cyclic loading due to fatigue of the materials. This process is highly stochastic as the time to the formation of mesoscopic cracks is subject to a statistical scatter of one order of magnitude in lab experiments. In this talk, the probabilistic crack formation is modeled by spatio-temporal point processes with intensity depending locally on the mechanical load situation. This allows to compute failure probabilities at a given number of load cycles. A survey is given about experimental calibration and validation of these models, numerical implementation and their applications to gas turbine design.

In mechanical design, reliability is one of the main design objectives. The mathematical quest thus is to find a shape for the component such that the failure probability is minimized. This optimization task can be understood as an optimal control problem with the elasticity PDE as the state equation and the boundary of the shape as control parameter. A proof for the existence of optimal shapes within certain regularity classes of the boundary is given using strong solutions and uniform Schauder estimates.



**Univ. Carlos III de Madrid**



**Default Data**

**Time** 11:00 to 12:00  
**Location** Room 2.2.D08  
Building Sabatini (2nd Floor)

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