Safety and Uncertainty Assessment: The Info-Gap Approach

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Systems are designed to achieve goal-oriented functional performance. However, the need for reliability must temper the aspiration for high functionality. To achieve this balance we must model and manage our severely deficient information about, and understanding of, the processes we confront.

The central question in this talk is:

Given **severe uncertainty** in data, models, loads, materials, etc.,
How should we evaluate the **reliability** of a physical system or of a system-model?

This is relevant both for **structural-design** and for **system-modelling:**

• A **structure** which is designed to achieve optimal functionality will be extremely sensitive to imperfect knowledge of loads, material properties, constitutive relations and system-models upon which the design is based.

• A **system model** which is constructed or up-dated to provide high fidelity to measurements will be extremely sensitive to imperfections in the knowledge underlying the model.

We discuss two heuristic examples. The first is the design and reliability analysis of a cantilever subject to uncertain loads. The second is the up-dating of a structural model from measurements. Both examples illustrate the irrevocable trade-off between high functionality and high immunity to uncertainty.

Throughout the talk we will emphasize the conceptual tools from

Information-gap decision theory

which serve the designer and reliability analyst in deciding what to optimize, how to do it, and how dependable is the result.

The main idea underlying this talk is:

Functional optimality
must be **traded-off** against
robustness to uncertainty.

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