

What Should We Optimize?

The Info-Gap Case for Sub-Optimal Models and Structures

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Good performance is better than poor performance, but the need for reliability must temper the aspiration for high performance. To achieve this balance we must model and manage our severely deficient information about, and understanding of, the processes we confront.

The central idea in this talk is that:

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

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

- A **structure** which is designed to achieve optimal performance 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 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 performance and high immunity to uncertainty. We briefly examine a generic theorem underlying these results.

Throughout the talk we will emphasize the conceptual tools from

Information-gap decision theory

which serve the designer in deciding what to optimize and how to do it.

The main idea underlying this talk is that the

info-gap robustness function is a
supervisory decision criterion for
arbitrating between conflicting performance criteria.