

# What Should We Optimize?

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

**Prof. Yakov Ben-Haim**

Yitzhak Moda'i Chair in Technology and Economics

Technion — Israel Institute of Technology

Visiting Professor at Georgia Tech

Venue:

Aerospace and Mechanical Engineering

University of Notre Dame

15:30, Tuesday, 18 March 2003

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.