Design and Evaluation of Measurements With Info-Gap Uncertainty

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Measurement systems and data analysis provide quantitative geometrical information for quality assurance, manufacturing and assembly control, reverse engineering etc. Measurement and analysis systems must provide reliable performance at a level suited to the application.

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 must be traded-off against robustness to uncertainty.

This is relevant both for **measurement system design** and for **data evaluation:**

• A **measurement system** which is designed to achieve optimal performance will be extremely sensitive to deficiencies in the knowledge upon which the design is based. Immunity to information-gaps is enhanced only by decreasing performance requirements.

• An **estimation algorithm** which is constructed to provide high fidelity to measurements will be extremely sensitive to imperfections in the knowledge underlying the algorithm. Robustness to info-gaps is enhanced only by reducing the fidelity requirement.

Throughout the talk we will emphasize the conceptual tools from

Information-gap decision theory

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

Selected References

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◦ Yakov Ben-Haim, 2001, *Information-gap Decision Theory: Decisions Under Severe Uncertainty,* Academic Press, San Diego.

◦ Yakov Ben-Haim, 2004, Info-gap Decision Theory For Engineering Design. Or: Why 'Good' is Preferable to 'Best', To appear as chapter 11 in *Engineering Design Reliability Handbook,* Edited by E. Nikolaides and D. Ghiocel, CRC Press.

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