LOS ALAMOS UNCERTAINTY QUANTIFICATION WORKING GROUP

Special Event, Hosted by ESA-EA

INFORMATION-GAP THEORY

A Series of Four Lectures

Thursday, August 30, 2001

DR. YAKOV BEN-HAIM

Professor, Faculty of Mechanical Engineering
Technion — Israel Institute of Technology
Haifa, Israel
www.technion.ac.il/~yakov

The lectures will discuss a non-probabilistic paradigm of uncertainty that quantifies the information gap between what is known and what needs to be known for an optimal decision. These "info-gap" models of uncertainty underlie a decision procedure which is particularly suited to situations where probability theory breaks down such as extremely unstructured and deficient information.

10:00 am — Info-gap Decision Theory: Decisions Under Severe Uncertainty
11:30 am — Info-gap Reliability: Non-probabilistic Theory of Reliability
2:00 pm — Info-gap Decision Theory: Applications
3:30 pm — Value Judgments in Decisions With Uncertainty

When … Where …

Thursday, August 30, 2001, 10:00 am—12:30 pm & 2:00 pm—5:00 pm
San Ildefonso Conference Room, J. Robert Oppenheimer Study Center
TA-3, Building 207 (2nd Floor of the Research Library), LANL

Info: **http://public.lanl.gov/kmh/uncertainty/meetings/haimabs.pdf**

Contact: **Ken Hanson, CCS-2; 7-1402 (Voice); kmh@lanl.gov (E-mail)**
François Hemez, ESA-EA; 5-7955 (Voice); hemez@lanl.gov (E-mail)

LOS ALAMOS UNCERTAINTY QUANTIFICATION WORKING GROUP

LOS ALAMOS UNCERTAINTY QUANTIFICATION WORKING GROUP

Special Event, Hosted by ESA-EA

Lecture 1. Info-gap Decision Theory: Decisions Under Severe Uncertainty
(Thursday, August 30, 2001, 10:00 am, Study Center)

Strategic planners, engineering designers and decision-makers in general often face severe lack of information. In this talk we discuss a non-probabilistic paradigm of uncertainty which quantifies the information gap between what is known, and what needs to be known for an optimal decision. These "info-gap" models of uncertainty underlie a decision procedure which is particularly suited to extremely unstructured and deficient information.

We begin with a brief discussion of the axiomatic distinction between probability and the info-gap perception of uncertainty. We then formulate the basic decision functions of info-gap decision theory: Robustness function: protection against adverse uncertainty; Opportunity function: exploitation of propitious uncertainty. We consider simple examples from engineering design, economics, and management.

Lecture 2. Info-gap Reliability: Non-probabilistic Theory of Reliability
(Thursday, August 30, 2001, 11:30 am, Study Center)

This talk develops a theory of reliability which is based on info-gap models of uncertainty, and is entirely devoid of probabilistic information. This theory is particularly suited to structural engineering design and reliability analysis under severe lack of information about loads, operating conditions or geometrical and material properties.

Lecture 3. Info-gap Decision Theory: Applications in Economics and Management
(Thursday, August 30, 2001, 2:00 pm, Study Center)

This talk discusses info-gap decisions in economics and management. We consider specific examples such as risk assessment in project management, and principal-agent negotiation under uncertainty. We also discuss the info-gap analogs of classical concepts in the economics of uncertainty: risk-sensitivity, gambling and the value of information.

Lecture 4. Value Judgments in Decisions With Uncertainty
(Thursday, August 30, 2001, 3:30 pm, Study Center)

The need for value judgments is widespread in engineering analysis and design. Frequently the engineer is called upon to choose between competing considerations and to make trade-offs between conflicting interests. It is sometimes difficult to decide that a given option or outcome is desirable. Knowing how desirable it is, or how much better than a given alternative, is often far more challenging.

What we need is an explicit linguistic evaluation, in natural language whose meaning we can relate to everyday values, of the results of an engineering analysis. The format for this is REASONING BY ANALOGY. We will apply analogical reasoning to two classes of problems: (1) design certification of safety-critical systems and (2) calibration of reliability assessments. Our discussion will be made in the context of information-gap decision theory.

Info: **http://public.lanl.gov/kmh/uncertainty/meetings/haimabs.html**

Contact: **Ken Hanson, CCS-2; 7-1402 (Voice); kmh@lanl.gov (E-mail)**
François Hemez, ESA-EA; 5-7955 (Voice); hemez@lanl.gov (E-mail)

LOS ALAMOS UNCERTAINTY QUANTIFICATION WORKING GROUP