

A Mind for the Environment: A Mathematical Perspective

Nyamekye Kwame Jnr

Mphil. Scientific Computing And Industrial Modelling
National Institute for Mathematical Sciences(NIMS) - KNUST

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Hello World

George Cantor

In mathematics the art of proposing a question must be held of higher value than solving it- a case for Newton.

Bertrand Russel

Mathematics takes us into the region of absolute necessity, to which not only the actual word, but every possible word, must conform

Steven Banach

Mathematics is the most powerful creation of the human spirit

Transformed Skeptic

Having tasted a piece of humble pie and opening up my mind to learn from the sessions, these were some of the key pointers i learnt

- Our Environment needs our attention, our "micro-local" neglects have "macro-global" effects.
- Every one of us has something to contribute irrespective of our backgrounds.
- A case for 'iresearch' - our platform for accelerated development and growth
- A little bit of mathematics would not kill but enlighten.(iFence)
- Ubuntu in sharing knowledge and spreading the good news
- Now is the time to act.

Multiobjective Optimization in River Basin Development

Multiobjective Optimization

Optimization is a mathematical branch that basically looks at the search for an optimal solution or decision making scheme amongst a pool of equally good or feasible solutions subject to some constraints.

Decision Making

Decision making is a dynamic process: complex, redundant with feedback and sideways, full of search, detours, information gathering and information ignoring, fueled by fluctuating uncertainty, fuzziness and conflict: it is an organic unity of both pre-decision and post-decision stages of overlapping regions of partial decisions

The Problem

River Basin

A river basin is the land that water flows across or under on its way to a river. Just as a bathtub catches all of the water that falls within its sides, a river basin sends all of the water falling within it to a central river and out to an estuary or to the ocean.

The Solution Path

The Problem was looked at in a two tier-level approach

- An engineering level - which may be labelled a decision making aid phase.
- The managerial level of acceptance of solution.

Problem Formulation

Case Study

The case study was the long-range planning of water supply for the central Tisza River Basin in Hungary

A water resource problem may be studied at various design levels, from the design of a single structure to the design of a complex system including engineering and environmental elements such as network of surface and groundwater reservoirs.

The objective of the optimization is

$$\min_x \sum_{i=1}^n \alpha_i^p D_i^p$$

where D_i is the measure of the deviation from the ideal value

Compromise programming

The objective function of CP is thus written as

$$I_p = \left[\sum_{i=1}^n \alpha_i^p \left(\frac{|f_i^* - f_i(x)|}{|M_i - m_i|} \right)^p \right]^{\frac{1}{p}}$$

Feasible Solution Systems

As the aim was an optimization of the river basin, the alternative proposed feasible solution elements include;

- 1 The water resources from both the Tisza and Danube rivers are used; water is thus transferred from the Danube by a multipurpose canal-reservoir system.
- 2 A pumped reservoir system is built in the northeastern part of the region and is to be supplied from the Tisza river only.
- 3 Tisza River water is used to supply flat-land reservoirs.
- 4 This is a mountain reservoir system in the upper Tisza River Basin, located outside Hungary.
- 5 A conjuncture use scheme of Tisza river water and groundwater in the Debrecen region from the basis of regional water regulation.

Solution

After an array of alternative systems versus criterion has been established, and an after use of the CP algorithm, using ELECTRE, it was found that the nondominated set of alternative systems under hypothesis was composed of systems I and II.

Decision

If a choice had to be made at this point among the five systems, preference would be given to system II, because it represents a reasonable compromise between costs, shortage and international cooperation.

Conclusion Remarks

H. Jackson Brown, Jr

The best preparation for tomorrow is doing your best today.

F. Scott Fitzgerald

Vitality shows in not only the ability to persist but the ability to start over (Abe-Edison).

Jimmy Dean

I can't change the direction of the wind, but I can adjust my sails to always reach my destination.

THANK YOU.