GENERAL SYSTEMS PROBLEM SOLVER

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Contents

Summary

A conceptual framework for systems problem solving, referred to as the *General Systems Problem Solver* (GSPS) is described. The core of the framework is a comprehensive taxonomy of systems based on epistemological and methodological criteria. This taxonomy forms a basis for defining types of systems problems. Methodological developments emerging from the GSPS framework are also outlined.

1. Introduction

The meaning of the term *general systems problem solver*, often abbreviated in the literature as *GSPS*, is threefold. First, it is a coherent conceptual framework through which the full scope of systems and systems problems can be characterized. Second, it is an integrated package of computer programs for systems problem solving within the conceptual framework. Third, it is an ongoing research program by which (a) the conceptual framework is extended and refined according to application needs, (b) the computer software is further developed to increase the domain of its applicability, and (c) strategies are developed for assisting the users (specialists in various subject areas) in identifying and formulating systems sub-problems of their overall problems of concern in the language of the GSPS conceptual framework. Most of the research on the GSPS has been done at the State University of New York at Binghamton.

Contrary to other conceptual frameworks intended to characterize the full scope of systems, which were introduced mathematically, the GSPS framework has evolved by an inductive process. That is, it evolved by collecting examples of systems and associated problems employed in various disciplines of science and engineering, abstracting them from their specific interpretations, categorizing them, and, finally, integrating them into a coherent whole. This inductive process began in the mid 1960s and was completed, by and large, in the mid 1980s.

The GSPS framework is capable of capturing all categories of systems we currently conceive. However, since the framework has evolved by an inductive process, it is open to potential extensions in the future. Such extensions will be required if new categories of systems, not yet conceived, will emerge in science, engineering, or other areas. Thus far, the current GSPS framework has been stable since its completion in the mid 1980s. This means that no new categories of systems have emerged that are not among the categories recognized already within the current GSPS framework.

It is now established that the categories of systems captured by the GSPS framework are actually categories in the sense of the mathematical theory of categories. They were not formulated for their own sake, but for the purpose of understanding and categorizing systems problems. Each basic category of systems problems is conceptualized either in terms of a transformation from one system type to another that satisfies some requirement type, or in terms of a relationship between two systems of certain types. Additional categories of problems are then represented by various sequences of the basic problem types.

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Biographical Sketch

George J. Klir is a Distinguished Professor of Systems Science in the Watson School of Engineering and Applied Science of the Binghamton University (SUNY - Binghamton). He is an author or co-author of 17 books including *Uncertainty-Based Information* (Springer-Verlag, 1999), *Fuzzy Sets and Fuzzy Logic: Theory and Applications* (Prentice Hall, 1995), *Fuzzy Measure Theory* (Plenum Press, 1992), *Facets of Systems Science* (Plenum Press, 1991), *Fuzzy Sets, Uncertainty, and Information* (Prentice Hall, 1988), and *Architecture of Systems Problem Solving* (Plenum Press, 1985). He is also an author of over 300 research papers and an editor of 9 books. His current research interests include the areas of intelligent

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Dr. Klir has been the editor of the *International Journal of General Systems* since 1974, and the editor of the *International Book Series on Systems Science and Engineering* since 1985. He served as President of the Society for General Systems Research (1981-82), President of the International Federation for Systems Research (1980-84), President of the North American Fuzzy Information Processing Society (1988-91), and President of the International Fuzzy Systems Association (1993-95). He has received numerous awards and honors, including three honorary doctoral degrees, the Gold Medal of Bernard Bolzano in mathematical sciences from the Czech Academy of Sciences, Lotfi A. Zadeh Best Paper Award, and Distinguished Leadership Award from the International Society for the Systems Sciences. He is listed in *Who's Who in the World, Who's Who in America, American Men and Women of Science, Outstanding Educators of America, Contemporary Authors*, and other biographical sources.