APPLIED POSSIBILITY THEORY

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The category Possibility was originally studied in ancient and modern Philosophy as a contradiction to Reality. The contemporary Theory of Possibility (Zadeh, Dubois, Prade) can be applied to the System Science, e.g. in problems of prediction, design and reconstructability.

The uncertainty stems from the problemful, contradictory and evolutionary character of our world. In the science, the word uncertainty covers three categories:
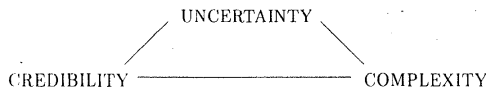
1. probability (a lack of necessity),
2. possibility (a lack of reality),
3. generality (a lack of specificity).

The three pairs Random-Law, Possible-Real, General-Specific were studied in Philosophy by Aristotle, Kant, Hegel and others. They gave an excellent explanation of these dialectic contradictions. So, Possibility can be described as formal or real, as subjective or objective, as the potential (a family of possibilities).

The recent Possibility Theory brings a number of formal definitions allowing to compute the potentiality exactly. Zadeh [7] proposed to determine the degree of possibility of an event so that the complement to 1 gives the degree of necessity (certainty) of this event.

The already "classical" approach to the Theory of Possibility using fuzzy sets does not explain the terms uncertainty, possibility or necessity. Next studies. e.g. of Klir [3], has shown more precisely the nature and the relation of uncertainty, probability, possibility and plausibility.

In this way, some new measures were introduced to express different aspects of uncertainty. The research starts from the scheme:

$$\begin{array}{ccc} & \text{UNCERTAINTY} & \\ & \diagup \qquad \diagdown & \\ \text{CREDIBILITY} & \text{———————} & \text{COMPLEXITY} \end{array}$$
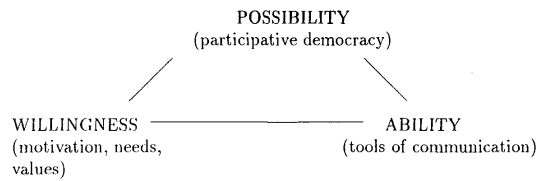
According to the Dempster-Shafer theory of evidence (see also Shafer [4]) the belief measure and the plausibility measure are defined, which in special cases turn in a probability measure or a possibility measure. Four types of uncertainty are recognized: fuzziness

(vagueness), nonspecifity (lack of informativeness), dissonance (pure conflict) and confusion (potential conflict).

Dubois and Prade [1] elaborated applications of the possibility theory to the representation of knowledge in Informatics. They presented procedures and programs for evaluation and classification of objects, for approximate reasoning in experts systems, for heuristic search in an inexact environment and for handling of incomplete information and vague questions in databases.

New ways to applications of the possibility theory are open in Prognostics and Design. Gál [2] stresses the importance of the choice from a set of possibilities during predictions. He proposed problem oriented participative predictions unifying conditioned and warning, explorative and normative prognoses. In his considerations the mathematical apparatus of system dynamics is surpassed by quantifications in the scheme:

<div style="text-align:center">

POSSIBILITY
(participative democracy)

WILLINGNESS ———————— ABILITY
(motivation, needs,   (tools of communication)
values)

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Vítek [5] exposes the idea of seeking possibilities in design and self-design activities. A working group chooses its own evolution steps on the trajectory beginning in a social cluster, going on in a "hard" and "soft" system over and aiming in a synergetic organization. The multi-criteria evaluation and decision-making among proposed variants can use methods based on fuzzy sets. The practical tackling of possibilities follows the scheme:

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PREDICTION

DESIGN ——————— PLAN

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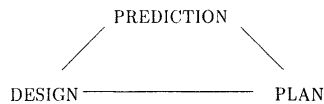
This approach is near to the Reconstructability Analysis proposed by G. J. Klir, where the search for components is governed by the definition of the structured system as a framework. However the possibility means not only the incompleteness within a given framework, but also the insufficiency of the framework itself, i. e. the inner and the outer incompleteness of the system.

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