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BRIEF VIEW OF OPTIMALISATION TOOLS OF EFECTIVITY IMPROVEMENT OF TECHNOLOGICAL PRODUCTUCTION PREPARATION IN NON-MACHINING TECHNOLOGIES

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ABSTRACT
The paper presents brief view of optimalzation methods of technological product preparation with aspect to non-machining technologies. This article provides an overview of optimalization non-machining technological process including a brief description of artificial intelligence using in this area. The presented article serves the foundations of elementary information about expert systems application and fuzzy approach to solving of specifics problems of technological preparation area
Key words*: technological product preparation, optimalisation, artificial intelligence, expert systems, fuzzy sets*

1. INTRODUCTION
The optimalization of technological process is key matter in design stage of technological documentation creation. The optimal job description should have been created accordance with prediction of potential mistakes in technological process design. It is necessary to ensure their elimination by optimalisation methods.
The determination of optimal job description and technological parameters already is not matter of experiences, intuition and sense of mechanical engineering. In spite of certain parts human sensitive activities stays in design process of technological documentation creation.

2. GOALS AND CONDITIONS OF OPTIMALISATION (OPTIMALISATION METHODS)
The optimalisation methods reduce time's costs for obtaining of optimal values of process (technological parameters for process definition.).
The routine works automation by computer support becomes standard in this area. Apart from the experimental – statistic methods it is possible to use the application of tools based on artificial intelligence. These equipments also get at importance in technological production preparation (expert systems, fuzzy set theory, genetic algorithms, etc.)
The experimental-statistic methods can be one-factor (dichotomic, golden cut /golden opinions/, Fibonacci, Newton, e.g.) or multifactor (Gauss-Seidl, random choice, relax, Box-Wilson, e.g.).
The key task of process design is information analyse and dates handling (filling base of date and base of knowledge in expert systems area) for example:

- Semiproduct spectrum (block, crow-bar, round bar, ...),
- Material properties,
- Forging temperatures range,

- Machinery (cutting, forging machine, heating machine, ...),
- Information about process (batch, automation level, ...),
- Information about product (shape, weight category, etc.

This task can be solving direct user inputs or through medium of database system. (Fig. 1).

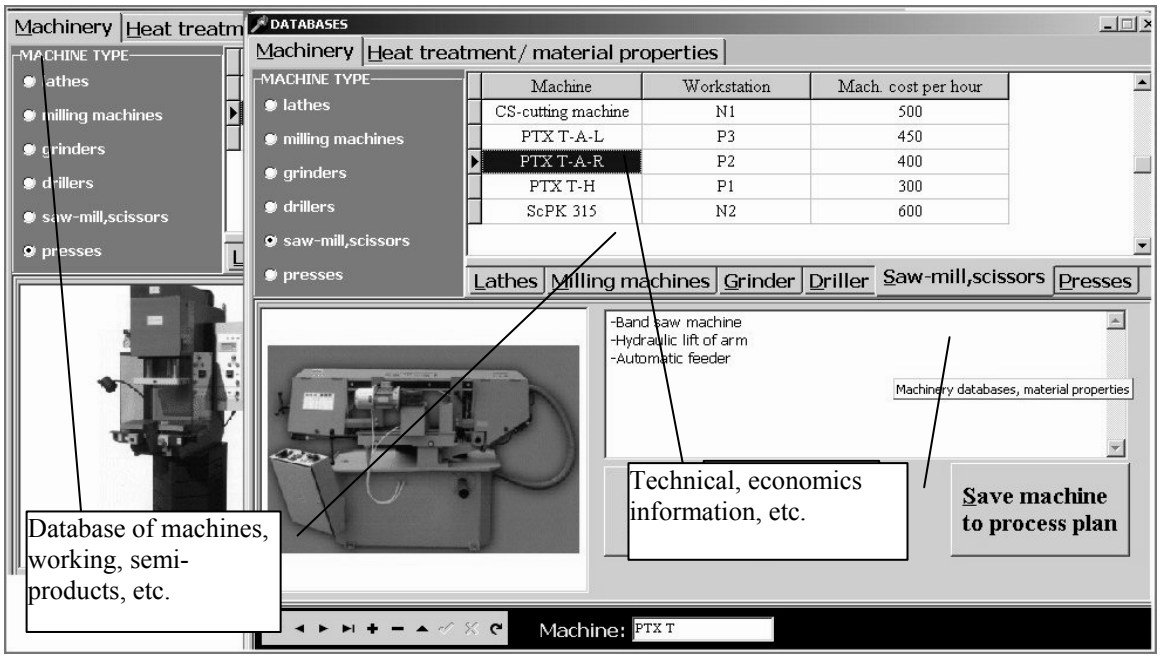

Figure 1. Information capture -Databases and dates handling (SQL)

The next important step is rules definition (for simulation of human thinking). It is practical algoritmisation of analyse (evaluation) information gained from knowledge base (database, user inputs ...).

Common writing of rule (Fig.2):

$f((p_1,... p_n), (vp_1,... p_n), (vp_1,... p_n), (d_1,... d_n), (vd_1,... vd_n))$, where

p – assumption, vp – assumption weight, d – implication, vd – implication weight.

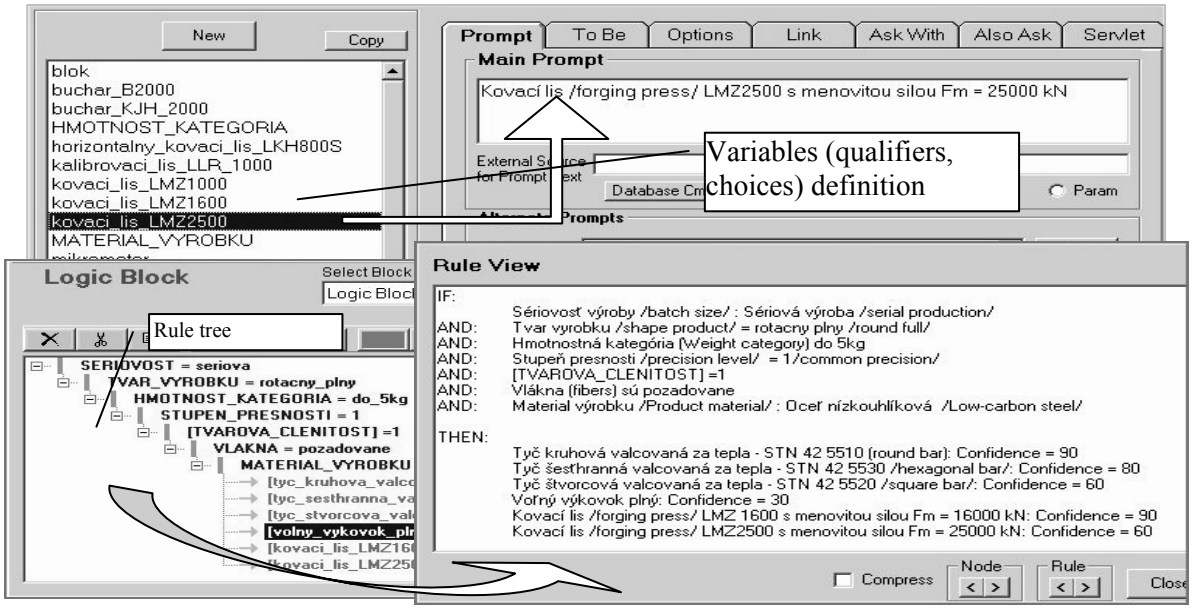

Figure 2. Base of rules creation

3. FUZZY APPROACH TO PROBLEM SOLVING

The table can be suitable foundation for creation of inference rules of type „ ***if –then*** " (representation of expert knowledge, skills) that are needed design stage of fuzzy-expert system.
Language variable characteristic (*special type of fuzzy variable*):

(X, T(X), U ...) where

- X – language variable name,
- T(X) – set of word values of language variable,
- U – Universe of possible numeric values of language variable.

It is also necessary to model membership function for considered interval of values:

$\mu(x) : \{ pre\ x \in < a_0, a_1), pre\ x \in < a_1, a_2 >, pre\ x \in (a_0, a_1 >, \}$

Illustrative example – Difficulty of dies production (semiproduct working and cavity shaping)

Language variable:
X = Production complicacy of tools (dies, forms)
Set of variable values:
T(X) ∈ {very low difficulty, low difficulty, medium difficulty, difficulty, very difficulty}

Look-up table: Production complicacy of die (tool cavity)

Shape complexity/ Weight category	**low**	**medium**	**high**
low	Very low difficulty	Low difficulty	Medium difficulty
medium	Low difficulty	Medium difficulty	Difficult
high	Medium difficulty	Difficult	Very difficulty

Assumed effects: „Increased demands on manipulation with semiproduct block, on heat treating and etc... (Intersection of problems)

The created tables would be corresponding with designed membership functions. The phase of membership function design of fuzzy system is relatively complicated (dependence on area of solving problems). The realization of design can be also based on the estimation; despite of handling of statistic gained information (if possible) is more suitable form.
In connection with the expert systems the design of fuzzy rules (knowledge base) is one of preferred tasks in solving of specific problems in frame of TPP.

The basic structure of problem model results from source of information is expert skills presentation as for example:

if X1-*shape complexity* is very *high*
and together *weight category* is *low*
....
then Y1-*complicacy of die (model production)* is medium *complicacy*
....

Uncertain information processed by fuzzy expert system can be used in connection with preliminary cost estimations, consumption of time and etc... It is naturally contingent on transformation of unsharp output in form of language variable to value „workable" by classic mathematic operations.

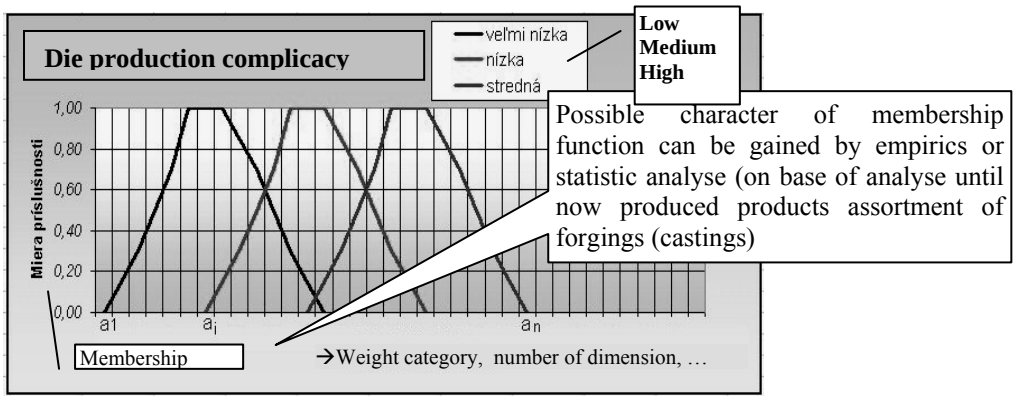

Figure 3 Preliminary fuzzy membership function

4. CONCLUSION

Fuzzy set theory and fuzzy logic dispose of mathematic tools for modelling of uncertainty (fuzziness), what be related to matter of fact, that various reviewers sense some vague parameters (terms) very different. By fuzzy approach gained dates can be used thereafter as correction coefficients (factors) in preliminary determination of factor cost, price of forging (casting), in the following determination of energy-force parameters production equipments (presses, hammers, ...) and etc.

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