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OPTIMALIZATION OF PRODUCTION PROCESS DESIGN IN FORGING FRAME WITH ASPECT TO SIMULATION EXPERIMENTS

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ABSTRACT
The article is focused on using of optimalization tools according to the design stage of production process with aspect to forging in frame of the technological production preparation. The possibilities of information technologies application in the production process complex analyse by means of the database modules and cognitive systems are presented too.
Keywords: optimalization tools, technologic production preparation (*TgPP*), forging, information technologies (*IT*), simulation experiments

1. INTRODUCTION
Only IT product, respectively the analyzer (*optimalization*) tool is not satisfactory according to complex design of the production process.
The necessity is to consider the instruments combination, variations and methods. That is mainly the data and process management during the order realization or revision process.
„*In IT technology we can meet huge numbers of terms and common user can be undistinguished in that mass*„ (Svoboda, J., 2008).

2. BRIEF VIEW OF PROCESS ANALYSING AND OPTIMALIZATION TOOLS
The absolute solution should be „complex" analyzing of the production process and its consecutive optimalization. Production processes have to adapt to the actual requirements and possibilities. It means they are not static, but contrariwise dynamics.
In the frame of process analyze should be applied the relations with some quality tools, for example FMEA in input analyze frame of the tendering procedure (*potential errors detection → activities duplicity, missing operations, optimum batch,*) or SPC during the production process realisation (*target values monitoring*,).

The optimalization methods application can decrease of the time and material consumption according to the optimal technological parameters gaining and to increase their measure of precision.
Automation of the routine works by means of digital management becomes standard in TgPP frame.
In interoperation with experimental-statistics methods that is possibly to use application tools based on artificial intelligence, respectively cognitive calculating (*expert systems, fuzzy sets theory, genetic algorithms, relational database systems etc.*).

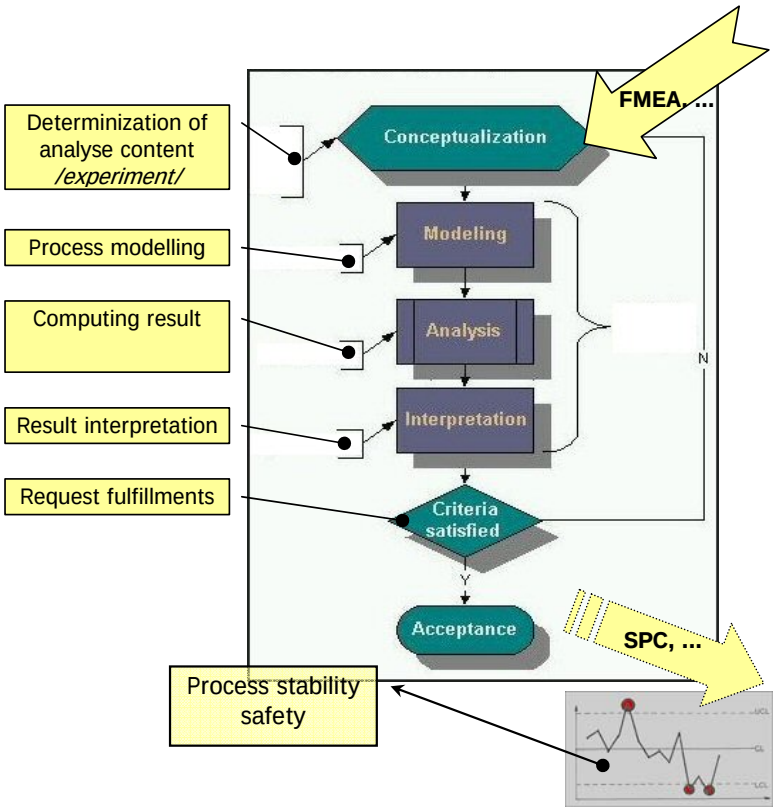

Figure 1. Brief analyse cycle

2.1 Optimizing methods brief

The applied experimental-statistics methods can be single-factor or multi-factor. The method option of the parameters determination depends on relation complexity according to the factors that influence the process /e.g. strength R_m (*temperature*), forging power F_t (R_m, *forging area ,...)*/ or the analyse simplification degree, naturally that can not be at the expense of the analyse quality.

Single-factor mathematics methods example:

- dichotomic /*consistent interval dividing where it is expected extreme to two equal parts*/,
- golden section /*symmetric points determination according to the centre of the uncertainty interval*/,
- Fibonacci /*symmetric method*/,
- Newton /*linear extreme research with using of derivation*/ ...

In frame of the single-factor optimalization only value of the optimized factor is changed. The values of other factors are changeless up till the achievement of the desired optimality criterion /*local extremes - maximum, respectively minimum*/.
If number of optimized factors is greater than one that is multi-factors optimalization.

Multi-factor mathematics methods example:

- Gauss-Seidel /*multi using of the single-factor optimalization*/,
- random sampling /*random sampling of movement direction to optimum*/,
- relaxation /*gradient method, it requires the process preliminary description by regression equation, the movement to optimum operates in coordinate axis direction* /,
- Box-Wilson /*gradient method, exigent of the process preliminary description by regression equation, the movement to optimum operates in biggest grade-up direction* /, …

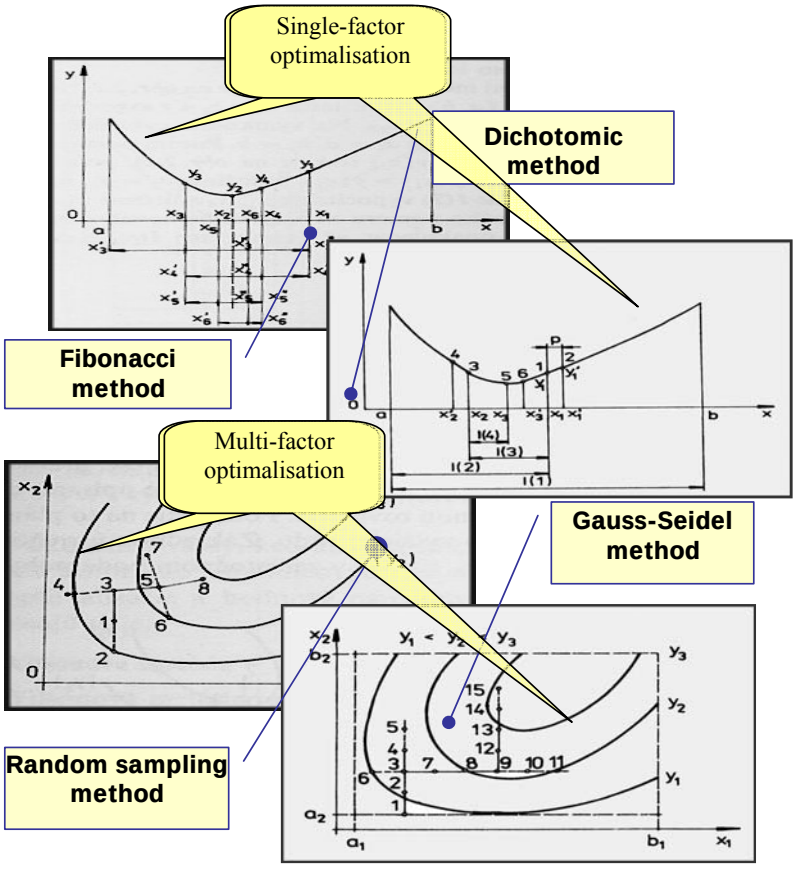

Figure 2. Some optimizing methods graphics presentation

2.2 Analyzing and optimalization by means of simulation experiment

If the product physical realization is linked with more material loss possibility, with relative high requirements to work safety, etc., the process simulation is effective tools.

It is necessary pay regard to simulation experiment it is serious to skills according to that badly conceptual design of the simulation */without the clear specification, respect of all basic influences and badly software and method option* / may be useless waste of the time and resources.

One the way of the forging process experiment replacement can be its modelling by the verification of forging operations according to modelling machines and tools in the smaller scale. Modelling experiment tests the tool function */e.g. cavity filling, material flowing way, corners filling, fibres course, preform suitability, etc./*.

The modelling verifies forging design process convenience and optimizing by the effective way. The matter of course is necessity to consider the similarity coefficient between real forging and model.

The experiments often basically explore, respectively create fundament for forgings technological manufacturability analysing, what means the valid production in frame of the product quality preservation (*favourable relationship of the utility value and total cost*)

The technological manufacturability and related attributes are totally verified by means of the production runs proving test. The absolute elimination mistakes can be hardly realised by reason that mathematics-physics model can simulated real process only to the conditional measure. In spite of that the suitable designed simulation process is instrument of the process cost and time reduction.

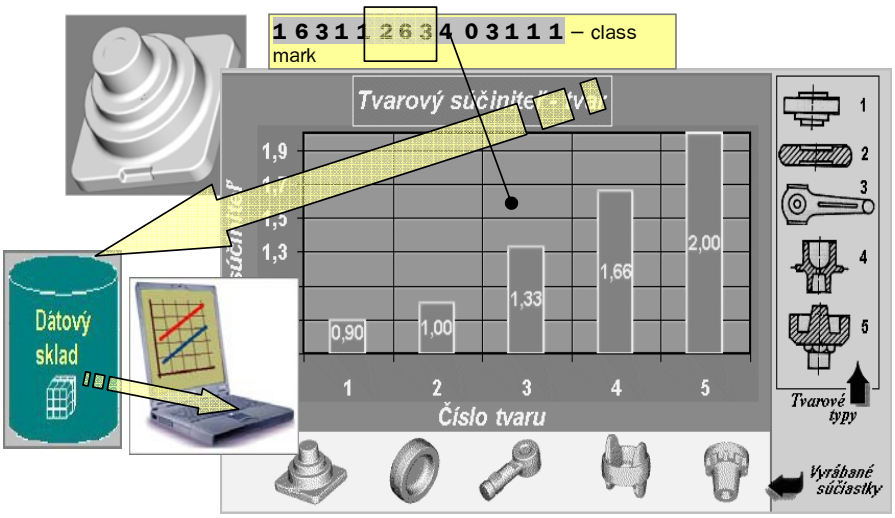

Figure 3.Group technology application principles

Consequently it is relatively simple the modification of the digital model dimensions (*shape*) and realization of the complicated variant analyses (*stress, deformation*…)
According to the forging process optimalization it is suitable to apply the conjunction of group technology principles (Fig.3) and database systems, respectively expert systems with aspect to flexible work on the basis of the usable knowledge in TgPP frame (*information sorting, filtering*).
Neither wide spectrum of the optimization and analyze tools indeed does not eliminate human factor effect *(inattention, impassivity, inexpertness*...).

3 CONCLUSION

In frame of the production process analyze it is convenient to have considered ICT systems and analyzer (*optimizing*) methods, that are available for automated treatment activities in TgPP. Implication is suitable choice, respectively innovation of ICT systems and technologies (*ERP, PDM, CAx, ES*,...)

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