

DESIGN OF INFORMATION SYSTEM FOR FMEA METHOD REALIZATION

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Abstract: Paper describes information system proposition for realization of FMEA risk valuation and possibility of its implementation at proposed technical devices error identification and realization of corrective steps in structural, technological changes and series of experimental operations

Key words: FMEA, risk valuation, risk score, no-failure operation

1.INTRODUCTION

FMEA analysis (**F**ailure **M**ode and **E**ffect Analysis) is currently the most used possible risks valuating and scoring method. Usage of this method can prevent or minimize risks, which rise by control system creation, product development and construction, in technology of process development and finally at lonely production. Object of *statistical FMEA method* at products and product processes is analyzing of possible errors presence and their effects for purpose of proposing such actions which eliminate present and potential errors. FMEA is method which allows identify errors with significant inference on product and process function in considered application. FMEA comes out from failure characteristic of product basic part and from operational structure of system where determines relations between part malfunction and system malfunction, function failure, operational constrains and degradation serviceability or entirety of system. This method is based on functional system parsing, or its subsystem in purpose of identifying all possible errors for each system part, their reasons and effects on system or subsystem operation. Criticalness of individual kind of errors is consequently **quantitatively valued** using so called **risk number** (RČ). Important part of this method is proposition on corrective steps for critical errors eliminating or decreasing their presence or effects. FMEA is method which allows valuating and ensuring no-failure operation. It is used from the very beginning of product design. Information obtained from FMEA parsing make possible to determine priority of manufacturing control and check exams during product manufacture and their usage in operation.

FMEA application mechanism [2, 3]:

- System description and its basic functions, minimal functions defining considered selected parameters (safety, reliability and so on).
- Elaborating of functional block structures which order parsed system in transparent units.
- Defining of basic rules and concept of progress documentation.
- Mode of errors identification, their reasons and effects.
- Method for identification and failure isolation selection
- Proposal for significant error constructional and operational arrangement.
- Instigation of specific combination of multiple errors.
- Recommendations

Range in which is needful go into certain failure situation depend on probability of its presence and from significance of its effect. Common criterion for criticality error evaluation based on risk numbers calculation does not exist, because their representation is strictly connected with importance of effects and probability of their occurrence.

Therefore realization group have to decide about significance of particular risks at each certain product

FMEA is one of the first systematic techniques for failure analyses. It is used from fifties.

Basic principle is examination of each system component and referring to following questions:

- *how can component break down,*
- *what will happened if component break down*

For requirements of computer aided process of risk rating and valuation usage was created program in Visual FoxPro which allows outputs connection resultant from activities made during risk valuation directly to documentation of technological preparation of production. After this manner complete documentation about safety state of production system used in certain manufacturing technology is created and it will be accessible to individual managing departments a departments cooperating in technological documentation creation – from designing office trough technological and economical office till attendance of machine. One of approaches, which can be realized by proposed informative system, is application of FMEA method.

2. FMEA ANALYSIS DESIGN USING INFORMATIVE SYSTEM IaMR

Using *Analýza FMEA* button in main toolbar or selecting it from menu *FMEA-Analýza FMEA* one can call form for processing of specific task analysis of risks uprise possibility, their causes and effects. Form also contains three tabs, which make possible input entries into FMEA construction form. Name of valuated system, task number, assembly name, part name, pat number can be editable on tab *Popis modelu skúmaného výrobku*. Based on created scheme errors causes recur for all subsystems, so button *Kopírovať položky* helps to make work more comfortable. By using this button data from previous entry will automatically copy themselves into actual form (See Fig. 1) Tab *Analysis of error upraise, causes and effects possibility* allows to fill entries *Miesto, Funkcia* where is presented place and function of observed system, *Typ chyby – kind of error*, as error is regarded such case, where object fail of its design requirements (typical errors are: damaged system, inaccuracy, wrong measures, cut off etc.), *Dôsledok chyby - Effect of error*, for each error can be stated its effect from view of user (typical effects of errors are: fail operation, enormous function, parameters variation, product damage, safety jeopardy etc.). These entries have same repeatable information character that is their can be copied using *Kopírovať položky* button. Last entry to be field in is item *Príčina chyby – Error cause*. Here can be added all possible error causes such as of design or production type. (Typical causes are: wrong part material specification, wrong assembly, overload, allowed strength overrun, material squalor, damaged raw material, worn tools etc.). In Last tab's *Kontrolné opatrenia Bežné kontroly* entry is stated review of basic check activities which can prevent errors upraise, or eventually uncover possible upraise or presence of error (typical basic checks are: visual control, measuring control etc.). If the value of calculated risk number for given error cause of examined subsystem is in rage from “*dlhodobé skúšky s následnou zmenou konštrukcie, resp. technológie*” till “*konštrukčná zmena, resp. zmena technológie*” it is necessary to create proposal of correction remedies, which describes order and urgency in process of production process proposal or design. These remedies can have character of technological changes, design changes, production changes or control activities changes. Generally is preferable to take such remedies which will lead to error presence decrease in front of remedies, which will lead to probability of error detection increasing. Entry *Zodpovedný útvar* contains unit or worker, which is responsible for correction remedies execution.

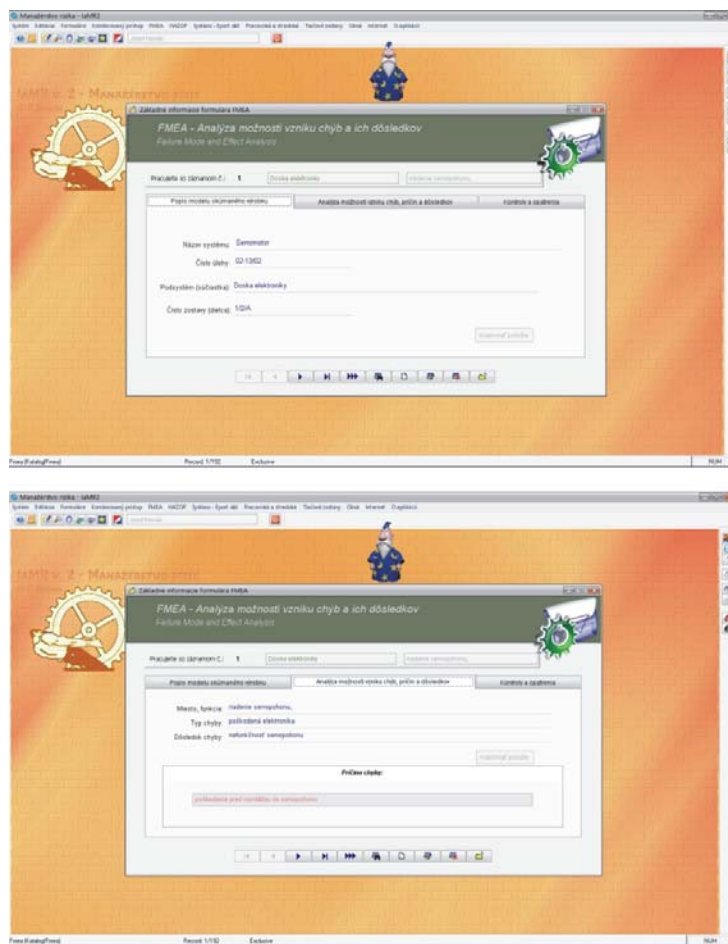


Fig. 1. Environment of FMEA analysis form

Calculation of risk number for error cause is realized in form *Stanovenie rizikového čísla metódou FMEA*. Error risk number express combination of error presence probability (PV), error weight (PZ) and probability of error uncovering (PO). This number serves for determining importance of error causes, which have to be fixed with remedial activities. In case of assuming remedial activities it is necessary to define value of risk number again. Because of this case form contains tab for risk number calculating for present and improved state. Lonely calculation is enabled after calculation prompt unblocking by selecting menu *Povoliť výpočet* and accepting the *OK* button.

Referee determines values of PV, PZ, PO from interval of 1 to 10. Characteristic of these values is described in side “meno” fields. Selected values have to be allocated to certain cause of error by clicking on *Kategorizuj* button. After clicking on *OK* button new value of risk number is defined.

The next step is assigning names of referee and official, which approved executed analysis (Button *Registrovať*) (Fig.2).

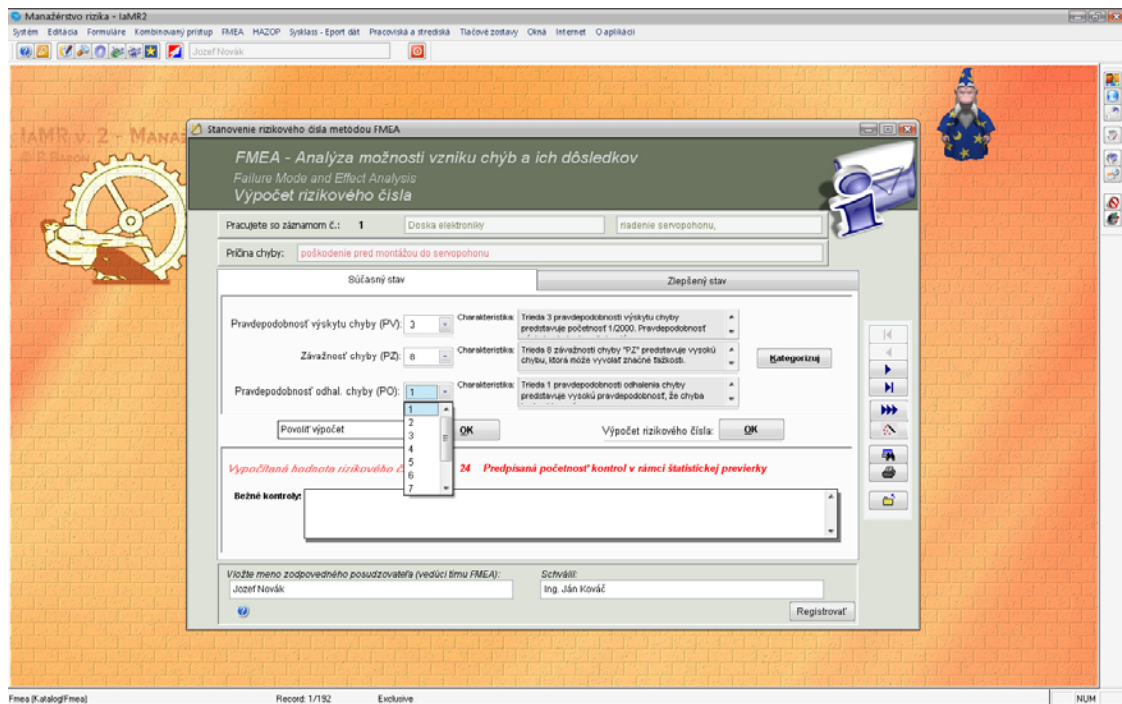


Fig. 2 Risk number calculation using FMEA method

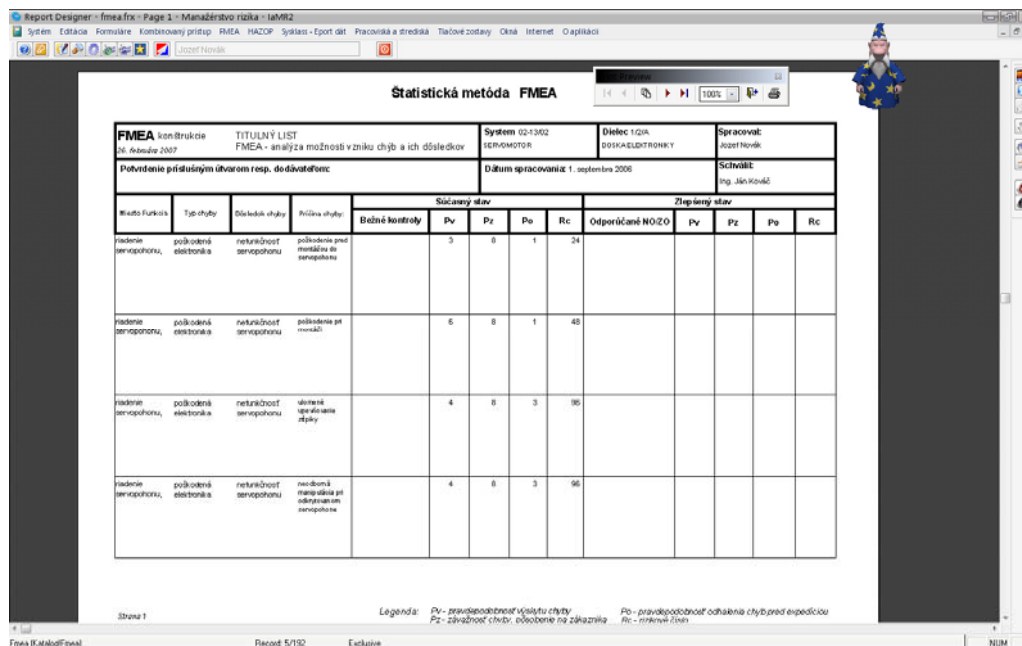
3. CONCLUSION

All secondary expenses which occur by unsuitable chosen technical devices safety philosophy forming 10-30 % of device acquiring price. [4, 5] That's why it is eligible to involve safety elements into projective phase. Here can be used method of FMEA and HAZOP for final product risk valuating using management informative system IaMR. Results of elaborated analysis in shape of final reports and documents can be attached to documentation as design plans, technological proceeding etc. Analysis form in similar shape can be printed or saved in pdf format by clicking on *Tlač vystupnej zostavy* button or via menu item *Tlačové zostavy – Tlač výpisu hodnotenia metódou FMEA* (Fig.3).

In realization stage of product development often income problems which where not considered in stage of proposing or design. Steps realized with software application of risk management allow identifying changes in this phase on product technical life. Analyze and evaluate them and according to obtained conclusions propose additional safety remedies. All risks which cannot be eliminated by these steps are required to be mentioned in user manual. Created software application of risk management fulfils requirement of team job by risk valuation and it also allows exchange of analyzed information as well as results and

knowledge base sharing between work team members which are involved in risk management.

Finally there is an effort of this risk management system integration into CAPP system to fulfill request of informative technology – in coexistence of integrated informative system with applied connection of company informative processes and systems as one working unit.



Miesto funkcie	Typ chyby	Dôsledok chyby	Príčiny chyby	Súčasný stav				Žiadaný stav			
				Bežné kontroly				Odporúčani NOZO			
				Pv	Pz	Pe	Rc	Pv	Pz	Pe	Rc
hádene servopohonu,	poškodená elektronika	netužičnosť servopohonu	poškodenie pred montážou do servopohonu	3	8	1	24				
hádene servopohonu,	poškodená elektronika	netužičnosť servopohonu	poškodenie pri montáži	6	8	1	48				
hádene servopohonu,	poškodená elektronika	netužičnosť servopohonu	skrátenie spracovávacej záhyby	4	8	3	96				
hádene servopohonu,	poškodená elektronika	netužičnosť servopohonu	necelá montážna pri odstraňovaní servopohonu	4	8	3	96				

Legenda: Pv - pravdepodobnosť výskytu chyby, Pz - závažnosť chyby, ovládenie na závažnosť, Pe - pravdepodobnosť odhalenia chyby pred expedíciou, Rc - rizikové číslo

Fig. 3 Shape of summary print out of FMEA form

This paper was elaborated in frame of KEGA 3/4135/06 project.

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