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POSSIBILITY FOR APPLICATION OF SOME MOTOR VEHICLE'S MAINTENANCE STRATEGIES

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1. INTRODUCTION

Path of motor vehicle maintenance development might be divided in several stages and they are as follows:

First one (from the first usage of motor vehicles up till 1950), the main essence of this stage was to to remove breakdown when it appears;

Second (from 1950 till 1980), with the main characteristics were lower maintenance costs, longer durability and greater disposability of motor vehicles;

Third (from 1980 until now), the main characteristics of this stage are better relation of effect and cost, longer duration, conservation, higher reliability and disposability. Nowadays so-called classical strategies of maintenance are still dominating (corrective, preventive and combination of both). Preventive maintenance is mostly performed according to time (vehicle is stopped – it's not movable, it's technical state is defined, and all necessary and planned replacements are already done). Regarding the primarily used techniques during the maintenance management, several stages of it's application could be noticed:

First (fix the breakdown when it appears);

Second (planning, introduction of planning and control system performing and also introduction of information technology);

Third (taking care of reliability and maintenance facilities during motor vehicles projecting, development and monitoring of maintenance equipment condition, elaboration of risk study, usage of expert systems and microcomputer network, application of methods for vehicle analysis from the aspect of failure occurrence – FTA, FMECA, planned experiment and introduction of flexible service systems).

In the area of motor vehicle maintenance, importance of application of the theory of reliability, from the 40s of the 19th century, should be especially emphasized, esp. when the regularity of breakdown appearance was defined based on vehicle exploitation data. Introduction of concept of integral logistic support and maintenance facilities in the area of motor vehicle maintenance, during the 40's of the 19th century is also significant for the development of science and maintenance practice. Introducing previously mentioned scientific knowledge enables introduction of maintenance strategy according to the reliability and total productive maintenance in the 70's of the 19th century. Selection of maintenance procedures (preventive, corrective) which should be implemented during the motor vehicle maintenance, in order to provide their maximum reliability and disposability, in the literature is often called the conception of maintenance. Instead of term the conception of maintenance, other terms are used as well, such are: policy of

maintenance, strategy of maintenance, system of maintenance. Nowadays many products are applied and their work is based on the fuzzy logic application.

It is performed in the field of forming fuzzy database, sample recognition, decision-making system, processing of native language, technology of fuzzy computers development, fuzzy chips – fuzzy hardware, process and operation management in factories, realization of intelligent robots with the possibility to understand native language, understanding of scenes, with possibility to plan and to control the movement. It is performed in the field of usage of intelligent user's interface, cooperative work of people and robots, on adaptive fuzzy neuro systems, which can be adjusted according to changeable conditions in the environment. Nowadays it is obvious that fuzzy logic can be applied in all fields of human performance.

Introduction of information system for easier acquisition and data processing during motor vehicle maintenance represents a great improvement in it's maintenance system. It often occurs that objective conditions do not permit gathering of information necessary for statistic processing. If one bears in mind that gathering of such information, makes some expenses, which are often a reason for impossibility to gather relevant information. In a case when there are no high quality information, then information that are incomplete and imprecise are used. This is a particular problem, which is difficult to resolve.

Application of knowledge-based system, so-called soft computing, enables efficient methods in order to treat the maintenance problem from the aspect of imprecision. One of such systems is fuzzy logic. Fuzzy logic is rarely used individually. Mostly, this application is combined with neuro computing, genetic computing and expanding the possibility of expert systems. Application of fuzzy logic enabled many improvements, in large number of fields of human performance. Great possibilities of it's application should be used in systems of technical system maintenance. The goal of this work is review of significant motor vehicle classical and modern maintenance strategies with detailed review of fuzzy logic application during motor vehicle maintenance.

2. STRATEGIES OF MOTOR VEHICLE MAINTENANCE

At modern level of science and technology development, the greatest attention is dedicated to particular two maintenance strategies [1]: maintenance according to reliability and total productive maintenance

Methodology of maintenance according to the reliability is based on modern scientific knowledge, mainly from the field of reliability and system science. The base of this methodology is studying of vehicle behavior, mainly from the aspect of breakdown during the exploitation, with term and content adjustment of maintenance procedure. According to this methodology, maintenance is performed on the bases of reliability characteristics recognition that are used for future state forecast, i.e. breakdown is foreseen. According to the vehicle's reliability characteristics decisions about implementation of preventive maintenance are made (in order to prevent or postpone occurrence of sudden breakdown) and also about the procedure of corrective maintenance that is necessary to apply.

Main objectives of application of the methodology of maintenance according to vehicle's reliability and safety are:

- Providing maintained vehicle's reliability and safety according to the level defined during the development and production. When breakdown occurs, vehicle should be returned into primary level of reliability and safety.
- Gathering data about vehicle's behavior during the exploitation and taking over particular measures in order to improve it's quality.

Previously mentioned objectives should be fulfilled with low costs (taking into account the costs of maintenance and costs of breakdown occurrence).

Application of methodology of total productive maintenance is based on the estimation of the current condition of maintained vehicle. With application of this methodology it is provided to implement the maintenance when it is necessary and not only when breakdown occurs, which resembles to the conception of preventive maintenance according to condition. Opposite to the conception of preventive maintenance according to the current state, based on database of reliability, methodology of total productive maintenance is based on data obtained from anyone who is in contact with the vehicle. For application of this concept all it is necessary is to have a domestic relation of experienced users towards to the vehicle. Implementation of this methodology does not exclude usage of reliable data, but the complete responsibility of all subjects that are in any way in contact with the vehicle.

During motor vehicle's maintenance, the key problem is to avoid consequences of breakdown, but not to prevent the occurrence of breakdown.

In existing literature related to the field of maintenance, "advanced" strategies of maintenance are mentioned. By these strategies, it is tried to remove the flaws of some other strategies. From these strategies, mostly mentioned is the following: PMO (Preventive Maintenance Optimization). For application of this strategy it is necessary to perform the following basic activities: defining the tasks of preventive maintenance; analysis of all breakdowns; analysis of consequences of arisen breakdown; definition of maintenance strategy. Objectives of this strategy application are: rationalization of preventive maintenance procedure (implement only those that are appropriate and both, technically and economically justifiable, with optimization of periodic implementation); including the equipment that enables maintenance according to the current state; sharing of work on maintenance between maintainer and user.

Besides previously mentioned strategy, other strategies are also mentioned in this group: statistic methods based on MILSTD2173 standard and method of Cost Minimization Algorithm Program. It is envisaged [2] that in the future large application will have so-called strategy of precise approach, based on removing of the cause of breakdown occurrence (if there is no cause for breakdown occurrence, breakdown will not happen), and then there is no need for maintenance. Such future is also envisaged for the strategy of total preventive maintenance (so that the vehicle itself implements adequate maintenance procedure).

3. APPLICATION OF FUZZY LOGIC BY MOTOR VEHICLE'S MAINTENANCE

3.1. History of fuzzy logic and principles on which it is based on

Words: indistinct, imprecise, undefined, indefinite, ambiguous, diffuse, vague, confused could be substituted by a single word. This word is fuzzy, which has an English origin.

Professor of Computer Science at California University in Berkley, Lofti Zadeh, is a founder of fuzzy logic.

He is considered to lay foundations for it in 1965. According to him, the fuzzy logic can have two different meanings. In wider sense, fuzzy logic is a synonym for the theory of fuzzy groups, related to objects with vague borders measured by certain degree. In inner sense, fuzzy logic is a logic system that is an extension of classical logic. Essence of fuzzy logic is in many ways different from the essence of so-called traditional logic. Fuzzy logic uses the principle of incompatibility, which means tendency that with the increase of imprecision of statement comes to its relevance. Fuzzy logic is multivaed logic that enables medium values defined between traditional opinions: true-false, yes-no, black-white etc. Fuzzy logic implements expert's experiences in the form of linguistic rules if-then, and mechanism of approximate reasoning is used as a control for definite case. Key aspect of fuzzy logic application is development of theory which formalizes everyday informal opinion that can be used for computer programming.

In order to explain previously mentioned, we would shortly explain difference between fuzzy system and theory of possibility.

Those who do not recognize the essence and possibility of fuzzy logic application often ask the following question: "Can a process be controlled by using the vague method?" Where there was no perplexity about the answer to this question, fuzzy logic had turbulent development in almost all fields of human life. Nowadays, Japan is a leader in fuzzy logic application.

Fuzzy technology represents the effort to imprecise present information and computer process. That is a way to enable closer connection between man and computer. It enabled it to categorize to so-called humane technologies.

From Japan, by the professor from Tokyo Institute for Technology, Toshiro Terana, and professor from University for telecommunications in Osaka, Kjodji Asaia, there was an idea for broad usage of fuzzy logic as an engineer tool. Nowadays, fuzzy engineering has been developed into a powerful scientific branch. In all segments of computing, fuzzy logic application is present today. Due to it's application, systems which use fuzzy technology within fuzzy database are realized, fuzzy systems for qualitative modeling, for fuzzy data analysis, fuzzy identification of system and data generalization, recognition of forms, fuzzy data analysis, fuzzy system for image process, development of intelligent interface and other computing fields.

Development of fuzzy idea is long-term, and its roots originate from far antique days, from Pluto and Aristotle. There are many famous persons, in a long chain of development of fuzzy idea, that contributed to the development of this idea, and on whose knowledge is based the learning of the founder of fuzzy logic and those who succeeded in implementation of its systems that have a base in fuzzy logic application. It is interesting that in that chain is the name of Verner Heisenberg, who defined the principle of uncertainty in 1927, and Max Black, who defined now called function of belonging in 1937. Professor Zadeh finally formulated theory of fuzzy logic, on which all developed systems are based. Basis of his theory is understanding that instead of rigorousness and tendency for greater precision of description and thinking about appearances, one should move in the opposite direction, i.e. descriptions should be imprecise. Historical facts in fuzzy logic development and application are also: development of first industrial fuzzy controller in London in 1974, first application of fuzzy controller for cement production management in 1980. In 1987 began the activities of first subway with fuzzy management. In 90s of the 19th century, many products whose work was based on fuzzy logic application appeared on the market.

Intensive work in this field was continued because of amazing results of fuzzy logic application. It is about the field of forming intelligent users' interface, cooperative work between people and robots, adaptive fuzzy neuro that can be adjusted to changeable conditions. Nowadays it is obvious that fuzzy logic may be applied in every field of human performance. Previously mentioned facts seem impressing.

If something more should be shortly told about the fuzzy logic, then it would be the following: principle of humanity in engineering is the necessity of application fuzzy engineering depends on how much engineer takes care about man when he develops each system. Principle of incompatibility is the more realistic the problem is viewed, the more its solution becomes fuzzy. Characteristics of fuzzy application, as a new approach to worlds are gradualness, imprecision, usage of qualitative description and expert's knowledge. Fuzzy technologies are humane technologies and represent the relation between man and machine. Skill is being received through the practice, by learning and practicing. By using neuro technologies, training of computer systems can be done. By using fuzzy technologies expert's knowledge can be described and represented by the computer.

3.2. Possibility of fuzzy logic application in motor vehicle maintenance

Advantages of fuzzy logic application during complex technical systems maintenance are:

a) Conceptually fuzzy logic is easy to understand, because its mathematical outline of fuzzy reasoning is simple;

b) Fuzzy logic is flexible – it is possible to correct analyzed system in each movement without the need to return to start;

c) Fuzzy logic tolerates imprecise data, because it is based on existence of imprecise data;

d) Fuzzy logic may modulate linear functions, it is possible to create fuzzy system that may be adjusted to any set of input-output data;

e) Fuzzy logic may be used to describe expert's experience, because it leans on the experience of those who are excellent knowledge of analyzed system;

f) Fuzzy logic is based on native language, since its basis is human communication.

Common sense should be used during the fuzzy logic implementation and should be applied only then when it is possible to get effective solution – unless there is a simpler way to solve the set problem.

3.2.1. Fuzzy logic

Classical logic uses phrases that are whether totally incorrect or completely correct. Fuzzy logic represents extension of classical logic. It actually represents multivalued logic. It means that phrase is with a definite level of correctness.

By application of fuzzy logic, complex calculations are not used, but the rules in the form: if < condition > then < conclusion >. Those are so-called expert's rules.

Expert states his opinion in that form. One has an opportunity to express his knowledge about some process by words from everyday speech.

3.2.2. Fuzzy groups and functions of belonging

Group of elements with the *same* qualities is called classical - discreet group. It means that every element of discreet group belongs to that group 100%. Each element of discreet group belongs to that group with level from 1, on a scale from 0 to 1.

In fuzzy technologies, fuzzy group is a basic element for imprecision introduction and processing. It represents extension and generalization of classical discreet group. That is actually a group of elements with similar qualities. Each element belongs to fuzzy group in a certain degree. By fuzzy function of belonging, level of belonging to some fuzzy group is described. With different levels of belonging, element can be placed in several groups. In that case, overlapping of intervals of confidence in those groups occurs. Input function of belonging can have discreet or continuating values. In continuating intervals of confidence, by means of parameters, function of belonging is defined. In the form of vectors, with definite number of parameters, discreet function of belonging is defined. In that case, it is necessary to specify range of confidence interval and level of each point.

Element of fuzzy group is each element in confidence interval with a definite degree of belonging. There are two questions during fuzzy groups forming: How many fuzzy groups are necessary and sufficient? How to choose definite function of belonging? Response to those questions is: by experience. Definite number of functions (false) of belonging can use program package Mat lab: triangular, trapezoid, linear, bell-like etc. In many cases standard functions of belonging are used: Z – type, Λ - type (lambda), Π - type (pi), and S – type. These functions are always normalized, so their maximum is always 1, and minimum 0.

Since fuzzy groups are extension of classical groups, union, section or complement operational are used as modifiers of function of belonging. They are defined by operators. Union is defined by maximum operator, and section by minimum operator

3.2.3. Linguistic variables

In fuzzy logic, linguistic objects are words, not numbers. Linguistic phrases represent relation between numeral representation of computer data and way of man's thinking[3].

For example, if variable quality of maintenance can have following values: good, bad, not bad, very good, more-less good, then the quality of maintenance is linguistic variable. In that case, good, bad, not bad, very good, more-less good are called values of linguistic variables or linguistic values. Also, more or less, similar phrases are called linguistic modifiers.

3.2.4. Basis and format of rules

Group of rules where words describe solution to a problem is called base of rules or expert's rules. In order to easily understand, rules are written in adequate order.

Group of rules may be represented not only in form if-then, but in more compact presentation, in so-called relation form, or more compact in table linguistic form.

If input fuzzy variables are first input and second input, then this format is called linguistic fuzzy plan. Graphical format is used that shows curves of the functions of belonging (picture 1).

3.2.5. Mechanism of approximate reasoning

Mechanism of conclusion is a mechanism of approximate reasoning. It is a three-phase process: aggregation, activation and accumulation.

First step in solving some problem in fuzzy systems is fuzzification. It is a process that converts each numeral input data in a level of belonging, examining one or more functions of belonging. There is a level of belonging for each linguistic variable, applied on definite input size.

By aggregation there is a process of joining definite values of the function of belonging to the measured numerical value, that is, definition of confidence level (level of truth) of dome input numerical value has the belonging to given fuzzy group. Aggregation is equivalent to fuification when there is only one input. In every group, it can be realized with how much truthfulness each rule applies.

Activation is a conclusion made in a part of rule. It is actually deduction of conclusion. As an activated operator min or algebra product is used, mostly used methods of direct conclusion – Mamdani's methods. At those forms of conclusion, only true premises are taken into account. By application of these methods, fuzzy groups are in input and output. Takagi-Sugeno-Kang method does not differ from other methods of direct concluding, but there is a great difference in structure of fuzzy rules. There is a difference that in conclusion instead of fuzzy groups there is a linear function between input and output, Often used case is when linear coefficients are equal to zero and then function of belonging is known as singleton.

Accumulation consists of conclusion activating that is accumulated by addition. As an accumulative operator max or algebra total is used. By approximate reasoning (e.g. min-max), it is necessary to emphasize which method is used.

During defuzzification, resulting fuzzy group converts into a number. The following methods of defuzzification are used:

a) COG - Centre of gravity or COA - centriod of area

Output numeral value u is abscise of the center of gravity of fuzzy group:

b) COGS - Centre of gravity method for singletons

This method has a relatively good computer complexity, and u is differentiable in relation to singleton s_i , which is useful in neurofuzzy systems.

c) BOA - Bisector of area

d) MOM - Mean of maximum

Searching for the point which has max belonging is basis of intuitive access. If there are few maximums, then we search for the mean of maximum. This method disregards form of fuzzy group, but its computer complexity is good. It is often used in problems of recognition forms and classification.

e) LM -Leftmost maximum is greatest on RM - Rightmost maximum

Next possibility is selection of largest maximum on right or left side. In case of robot movement management, it must be chosen between left and right, in order to avoid obstruct in front of him. Defuzzificator must choose one or the other, and not something between. This method is indifferent to form of fuzzy group, but its computer complexity is small.

Fuzzy reasoning does not insist on sophisticated techniques of defuzzification. It requires great flexibility while forming rules, which is not a case when applied in automatic management, that is, in fuzzy control.

3.2.6. Analysis of input-output copying

This analysis is done in order to see the influence of selection of function of belonging and its order, on output, or group of possible solutions. Two-dimensional table is caused by two inputs and one output. It can be drafted as a surface suitable for visual examination. Relation between one input and one output can be drafted as a graph of function. Graphs help during selecting functions of belonging and rules forming. Surface form may be controlled to a certain degree by functions of belonging.

3.3. Application of fuzzy controller on motor vehicles

Fuzzy controller is a central part of configuration for management of motor vehicle. Fuzzy controller can be realized by program that is performed on PC and is connected to the process in a usual way, as in classical management. In that case, fuzzy controller is used for intelligent management, so that the knowledge of expert-operator is used in management. When it is necessary, fuzzy controller can be built as a microprocessor in smaller devices.

Possibilities of application of fuzzy logic are enormous. Let us mention some of examples of application of fuzzy controller on motor vehicles in Japan and Korea, countries that are leaders in practical application of fuzzy technologies.

Fuzzy brakes (Nissan): manages breaks in dangerous situations in view of speed and acceleration of vehicles, and in view of speed and acceleration of wheels.

Engine of the car (NOK, Nissan): manages fuel injection and ignition depending on condition of valve for fuel supply, oxygen flow, temperature of cooling water, number of rotation per minute, fuel volume, crankshaft, vibration of motor and pressure in absorb branch.

Transition system in car (Honda, Nisan, Subaru): selection of transition level depending on motor pressure, way of driving and road conditions.

Management of vehicle movement (Isuzu, Nissan, Mitsubishi): adjust valve for fuel supply in the respect to vehicle's speed and acceleration.

Beside given examples of application of fuzzy management, there is also a large number of fuzzy management systems used on motor vehicle. Also, beside large application on motor vehicles, fuzzy controllers have found great implementation in medicine (diagnosis of illness), traffic (management of crossroads), house devices etc.

4. SOME VIEWS OF VEHICLE'S MAINTENANCE FUTURE STRATEGIES

In order to achieve maximum of effectiveness of usage of motor vehicles, in future there will be more attention given to their maintenance, both through improvement of maintenance system, and increased engagement of those who are involved in their development, production and exploitation.

Previously given activities may be expressed in a following way:

- Connection between manufacturer and user of maintenance equipment with the manufacturers of motor vehicles;
- Application of adequate methodologies when defining strategy of motor vehicle maintenance, which shall give best results in given conditions;
- Application of adequate equipment for motor vehicle maintenance;
- Increase in implementation of IT in detection, diagnostics and foreseeing of breakdown (by usage of decision-making support system, expert's system, artificial intelligence….);
- Increased level of knowledge of all participants in motor vehicle maintenance;
- Application of strategy for motor vehicle maintenance without breakdown, primarily owing to remove the cause of possible breakdown.

Nowadays it is spoken about successful system of motor vehicle maintenance if the following indicators are evident:

- Planned jobs in maintenance are much larger scale (over 90%), in relation to unplanned maintenance;
- Existing capacities for maintenance (equipment and personnel) are correctly engaged (usage of capacities is more than 70%);
- There is an optimum amount and assortment of spare parts and material in warehouse;
- Preventive maintenance is done when it is cheaper than corrective and without excluding vehicle's exploitation;
- Planned activities of motor vehicle maintenance are done in due time;
- There is precise and accurate database necessary for realization of maintenance strategy;
- Usage and maintenance of equipment is adequate;
- There is an adequate staff that participates in the realization of motor vehicle maintenance, with constant improvement of knowledge;
- There is maximum of people security that is involved in the realization of tasks of maintenance.

Without usage of integral logistic support, esp. CMMS (Computerized Maintenance Management System), we cannot speak about possibility of application of modern strategies of motor vehicle maintenance.

Usage of information system for management of motor vehicle maintenance provides data necessary for application of modern strategy of maintenance. These data are useful for the realization of the following activities:

- Organization of maintenance jobs (type of jobs, plans, stop, costs, labor, equipment, material, spare parts, documentation);
- Labor arrangement (according to tasks, skill…);
- Realization of training, studying and giving instructions to staff employed at motor vehicle maintenance;

- Generating of work order for realization of preventive maintenance, mainly in view of follow-up of all requirements for maintenance and given resources;
- Classification of maintenance tasks according to priorities, location...);
- Analysis of income and expenses;
- Selection of most suitable offer of spare parts and materials used for motor vehicle maintenance (owing to existing of data basis about manufacturers, quality and prices of spare parts and materials);
- Follow-up and analysis of breakdown of equipment used for maintenance;
- Realization of statistical analysis and data processing in order to acquire information that provide adequate management of maintenance;
- Increase of safety of personnel and equipment during motor vehicle maintenance;
- Follow-up of realization of taken obligations by adequate contracts about maintenance and realization of transport work.

According to acquired data by application of information system for maintenance management, analysis of adequacy of strategy for motor vehicle maintenance can be done (evaluation and defining of current problems when implemented).

Evaluation of the strategy for motor vehicles is done according to the responses to the following questions:

- Is preventive maintenance done in due time and what are the results of its realization?
- Are the plans and programs of preventive maintenance adequate (what is a relation between work on the realization of preventive and corrective maintenance, legality of appearance of corrective maintenance during time…)?
- For realization of which activities the most time was spent?
- For realization of which maintenance activities are the most investments needed and what are the costs of maintenance?
- What is the scale of unrealized tasks of maintenance, esp. those that are taken over by contracts?
- What are the common problems in maintenance?

Information system for management of motor vehicle maintenance is satisfying if it fulfills the following:

- Generates output documents in a useful way;
- Gives review of labor arrangement (according to tasks, skill…);
- Gives review of available equipment for motor vehicle maintenance (according to location, condition, belonging to organizational entireties, possibilities…);
- Gives review of available supplies (minimum and maximum level of supplies in parts, current condition in segments, locations);
- Gives work orders in a satisfactorily way;
- Analyze preventive maintenance procedure (needed resources);
- Gives feedback about effectiveness of performed maintenance procedure and technical condition of motor vehicles.

5. CONCLUSION

In order to achieve maximum effectiveness of motor vehicle's exploitation, in future more attention will be given to their maintenance, both through improvement of maintenance system and increased engagement of those who participate in its development, production and exploitation.

Without integral logistic support, esp. information systems for management of maintenance, we cannot speak about possibility to apply modern strategy for vehicle maintenance.

Two types of preventive maintenance are mostly used. First is preventive maintenance based on reliability information (on empirically defined distribution of possibility of work time until breakdown). By application of this type of preventive maintenance, maintenance procedure is planned in order to provide required level of reliability, most often by preventive replacements after a definite work periodicity. Other type of preventive maintenance is based on connection of information about reliability and information acquired in view of constant and systematic follow-up of vehicle (follow-up of selected parameters and indicators that with enough security show its condition).

Strategy of total productive maintenance is based on statement that only by maintenance it is not possible to maintain projected level of reliability during exploitation, but it is necessary to have active participation of users and everyone who is in relation to the maintained vehicle.

Main application of so-called accelerated strategies of maintenance is not to conduct any activity of preventive maintenance if it is not economically justifiable.

Nowadays there is a tendency towards combined application of existing strategies of maintenance. The reason is placed in variety of maintained vehicles. Second reason is existence of flaws of current strategy for maintenance.

By application of knowledge based system, or so-called soft computing, we come to efficient methods used for treatment of problems during technical systems maintenance, from the aspect of imprecision. One of such systems is fuzzy logic. Fuzzy logic is rarely used individually. Mostly its application is combined with neuro computing, genetic computing and expanding the possibility of expert systems.

Application of fuzzy logic enabled many improvements, in large number of fields of human performance. Great possibilities of its application should be used in the systems of technical system maintenance.

Geometric model of management of preventive maintenance process by fuzzy logic, which essence is showed in this work, should enable: defining of parameters in uncertainty of work of technical system; defining influence of specific parameters on the process of technical system preventive maintenance; defining most influential parameter and order of activities that should be done, as defining moment to start preventive maintenance. Procedure of forming geometric model should be defined by maintenance manager, who is in authority of decision making about preventive maintenance of technical system.

Application of fuzzy logic during technical system maintenance is justifiable by the fact that the model of maintenance is complex, esp. if it is taken into account that description of maintenance problem includes work and breakdown condition and also mid condition. By its application, we are closer to the goal of acquiring maximum readiness, effectiveness and minimal costs.

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