Section of Fundamental Sciences

ESTIMATION OF EXPECTING ENDURANCE OF SPECIMENS EXPOSED TO LOAD OF INCREASED AMPLITUDE

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The results obtained on the basis of the examination of specimens made of material BC-3 exposed to rotating bending fatigue test — the value of load was $R_e > \sigma > R_k$—compared with statistical test "F" and "t" it is clear that the load number (N_0) belonging to the appearance of the crack is dealt with the same relationship independently of the fact whether it is load of constant or that of increased amplitude. In case of load of constant amplitude the increase of surface of endurance failure is of form $F_{\dot{a}} = a(N - N_0)^m$). In case of load of increased amplitude the surface of endurance failure on a load level can transform to a surface of form and magnitude characteristic of an increased load, this load increases further with a speed characteristic of this load. The load numbers can be calculated in the knowledge of transformation of surface of endurance failure into each other and the crack increasing function and in that of the crack increasing function belonging to load level.

CONTRIBUTIONS TO CONTROL AND FORECAST STOCHASTIC PROCESSES OF CERTAIN AVIATION ENGINEERING MACHINERY

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Aviation engineering machinery is rapidly developed today, mainly complex automation. Different measuring and regulating systems are used for this purpose. Their data processing is ensured by microprocessor computers and their guidance on the basis of its results during operation, thus without dismounting the machinery. Important part of such complicated structure

are characterized by random parameters changing quickly or slowly, that are usually connected to each other. They have to be set into operation tolerance range at present, within it to forecast their behaviour expected in the future to estimate reliability and life time of their working order etc. To solve these aero and astronautic problems, the increasingly wider theoretical and methodological apparatus of stochastic systems and processes, prognostics, reliability, mathematical statistics etc. connected to each other has to be developed and increased. The lecture shows a part of it on the basis of earlier writings and continuous examinations of the authors. They are the following e.g. simple extrapolation and measurement control of certain board parameters, modelling of stochastic process by coordinate power functions of random coefficients, linear transformation of stochastic sample matrix for orthogonal statistical basis by triangular coordinate matrix (OTA), from it the development of linear extrapolated variant of prescribed initial trend (OTA) and its prescribed trend, computing experience etc. — About the expectable further trends and results of common research.

DEVELOPMENT OF STRENGTH DIMENSIONING OF GEARS

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Thomas Tredgold was the first in 1822 who published a scientific formula obtained as a result of extreme value calculation to calculate teeth load capacity, it was improved by Carl von Bach. The methods based on inaccurate approximation of the shape of the teeth did not satisfy the demands of American industry at the end of the century, so Wilfred Lewis developed a new dimensioning procedure based on tooth shape factor. At the end of the 20th century as a result of transmitted performance the problem of wear and pitting formation appeared, its inside relations were first revealed by Emil Vidéky but only Earl Buckingham's dimensioning procedure spread. After Almen H. Blok dealt with seizure who published a general solution in 1937 and introduced the concept of temperature flash. The development of strength dimensioning of toothed wheels has been intensified after World War II. In Europe first professor G. Niemann, in the USA Wellauer and Dudley introduced new and modern calculation methods. Systematic research work started in the Soviet Union, too. At present many modern dimensioning methods are at stake, they are characterized by the increase of informaton and an endeavour to one kind of integration. The research results are tried to put into a uniform

system, it is made possible by national and international standards. The increased information contents of the new dimensioning methods makes better adoptation to real load of toothed wheel pairs, better utilization of material and the increase of technical level possible.

THE INTRODUCTION OF EXPERIMENTAL RESEARCH WORK TO DECREASE ENERGY SAVING AND GAS FUME EMISSION AT THE OVEN OF GAS COOKERS

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Among public energy consumers — regarding the great number of appliances — the energy consumption of gas cookers is very important. At these appliances flue gas is not cleared away so it gets into the environment directly. The examination of the contents of dangerous materials in flue gas is important from the viewpoint of health and environmental protection. The aim of experimental research work was the determination of the development of a gas cooker being in mass production. The examinations were aimed at factors decreasing the energy consumption of oven and at the development of optimum burning. By ceasing the inflow of false air by changing the ratio of primary and secondary air getting to burning the energy consumption of the oven decreased. The suggested construction change can maintain the same temperature of the oven as the original one even if heat transfer is smaller by 25%. As a result of change the carbon monoxid contents of gas fume decreased, the concentration of nitrous gases practically did not change. Taking smaller heat release into account gas fume emission was smaller at both of the components.

THE EXAMINATION OF LINEARITY OF COMMERCIAL VEHICLES BY STATISTICAL IDENTIFICATION METHODS

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In course of load processes of road commercial vehicles the essential question is whether in case of excitation the process belonging to actual road condition and at given travelling speed the dynamical behaviour of the com-

mercial vehicle can be written by linear dynamic models (e.g. by differential equation systems of linear constant coefficient or by linear integral operators). If the application of linear models is not possible because of the non-linear character of the above statistical relation then the choice of the kind of linear (or perhaps "entirely" non-linear) model has to be determined. The hypothesis about the linear character of dynamical behaviour of commercial vehicles can be controlled among others by the determination of non-linear measuring numbers calculated from simultaneous measurement of the realization of road excitation load (as stochastic processes) on the basis of dispersion method of system identification (i.e. by the application of cross-correlation and cross dispersion function between the above two stochastic processes). By the application of non-linear degrees calculated on the basis of actual measurement results on bench the range where linear model can be used safely and the ranges where some linear or non-linear models are necessary to be used and at last the range where further examinations are necessary can be determined as a function of the relative standard deviation of the amplitude of road excitation and the characteristic travelling speed to ensure the choice of reliable model.

LOAD ANALYSIS OF MACHINES OPERATING UNDER CHANGING CIRCUMSTANCES

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In course of the design of machines we face three problems, structure, load and the analysis of the reaction of structure. The spread of finite element method — in spite of its evident limits — made the solution of satisfactory accuracy of engineering tasks possible i.e. under given outside load the structure regarded continuous supplies the approximate strain and stress tensor field. The analysis of load and the analysis of the reaction of the structure did not keep abreast of this development. The former one requires the examination of the operation of the structure, the latter is in the field of metal physics. This lecture deals only with some questions of load, analysis, the analysis of the reaction of structure — though it is of the same significance — is out of the scope of our examination. Assuming the outside load of structures — arbitrarily — three trends are existing at present: — At one part of structures institutions determine "legally" the load to be taken into account; — At an other part there are no "legal" regulations to upkeep standard load. They are structures produced in great numbers thus the standard load can be de-

termined on the basis of experiments. — At the third one there are neither legal regulations nor earlier experiences nor careful experiments. Then the designer chooses the standard outside load on his own responsibility.

CHARACTERIZATION OF GROUP CONGRUENCE OF SEMIGROUPS

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Let denote by S a semigroup. We say that a subsemigroup U of S is unitary in S of a, $ab \in U$ implies $b \in U$ and b, $ab \in U$ implies $a \in U$ for every a and b in S. A subsemigroup R of a semigroup S is called reflexive in S if $ab \in R \leftrightarrow ba \in R$ for every a and b in S. In the theory of semigroups, the reflexive unitary subsemigroups of semigroups play an important role, because there is a one-to-one transformation between the set of the reflexive unitary subsemigroups and the set of the group congruence and the group with zero congruence of a semigroup. The n-unitary subsemigroups — as special type of reflexive unitary subsemigroups — are no significant. By the help of the notion of the n-unitary subsemigroup we can generalize the concept of the normal chain and the composition chain of the group such that the classical Jordan—Hölder theorem can be generalized for the semigroups. The lecture deals with these generalizations and the results in connection with them.

A METHOD TO DETERMINE THE OPTIMAL NON-LINEAR CHARACTERISTICS OF DYNAMICAL SYSTEMS WITH STOCHASTIC EXCITATION

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Let g (v, t) and z (v, t) denote the input and output of an optimal system respectively. We assume that the system of differential equations of our model is of known structure. Then one can determine the optimal non-linear characteristics as follows (cf. [1]): 1. On the basis of the spectral density function of the input we determine, for each fixed v, the set of linear characteristics of the corresponding optimal linear system. 2. Each non-linear characteristics

$\varphi(a, x)$ is determined by decomposing the system into parts W and W* and generalizing the statistical linearization method of Booton and Kazakov. With a proper choice of the vector a we guarantee that for fixed v, $\varphi/a, X$ be statistically equivalent to the corresponding linear characteristics determined to v in step 1. Our method is applied to the optimization of swinging vehicle systems with stochastic excitation where the parameter v is the travelling speed.

[1] PÉTER, T.: Equivalence classes and optimization of vehicle swinging systems, Periodica Polytechnica 1982. No. 2.

SOLUTION OF SERIES REGULATION PROBLEM BY USING CIRCULAR TOUR MODEL (PROBLEMS OF HAMILTON ROADS)

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The article introduces a new method to solve series regulation problem starting from the optimum of coordination task the final results is reached by the minimum transformation sum. An example helps to understand the procedure. The advantages of the method: clear, intermediate storage is unnecessary, straight procedure, transformation values can be traced at every step, can be used by machine.

KELLER FACTORIZATION OF FINITE ABEL GROUPS

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Let G be a finite Abelian group. An equation $G = K_1 K_2 \dots K_n$ ($K_1, K_2 \dots K_n \subseteq G$) is called a unique factorization of G if every element of G can be written uniquely $g_1 g_2 \dots g_n$ ($g_j \in K_j$, $j = 1, 2, \dots, n$). In the following every complex whose elements are $e, g, g^2, \dots, g^{r-1}$ ($\mathcal{O}(g) \geqq r \geqq 2$), is called simplex. This simplex is obviously a group if and only if the order of element g is $\mathcal{O}(g) = r$. In 1930 Keller in his expressed guess stated that the single field cover system of congruent cubes is always columnal. The group theory expression of Keller's guess by Hajós is the following: At every factorization

of shape

$$G = K[a_1] \cdot [a_2] \ldots [a_n]$$

of the finite Abel group G where K is a complex of group G at least one of the simplexes' terminal element that of $[a_i] = (e, a_i, a_i^2, \ldots, a_i^{z-1})$, or $(i = 1, 2, \ldots, n)$, and a_j^{zj}, $(1 \leqq ; \leqq n)$ can be made as a quotient of two K elements:

$$a_j^{zj} = k^{-1}k (k, k' \in K).$$

This lecture dealt with the results of the latest examination aimed at the solution of Keller guess.

THE FORMATION OF SHAPING IMPULSE OF BLASTING DEEP DRAWING WITH REFLECTORS

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To increase the efficiency of blasting sheet metal forming (deep drawing) reflection energy transmission has been introduced recently. By the reflectors applied above the blasting charge on the one hand the especially favourable time and space distribution of formation impulse can be achieved on the other hand the harmful environmental effects of detonation can be substantially decreased. In case of suitable reflector material and shape about 85% of radiated energy that theoretically does not form directly the initial sheet can be reflected to the work piece. In industrial practice this high value cannot be realized, 40% energy gain means outstanding efficiency. According to the examinations at Department of Mechanics, among many technological parameters the acoustic impedance and thickness of the reflector exerts the most decisive influence on energy guidance. It was clear that the shock wave reflection of energy is not momentary but a long process as a result of multiple reflection taking place on the boundary surface of the reflector of medium. The shock wave reaching the reflector surface is only partly reflected, a part of it having significant energy contents gets in the reflector and reaches its back surface. Here also partial reflection takes place that creates further similar impulse components. The ratio of the acoustic impedance of its own that of the medium at practical reflector materials results in phase inversion in most of the cases that creates an impulse series of negative sign just in the field at stake. The favourable effect of reflected wave of positive phase is deteriorated by this additive series of negative sign.

INVESTIGATIONS IN THE THEORY OF SEMIGROUPS

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A subsemigroup I of a semigroup S is called an interior ideal of S if $SIS \subseteq I$; if the equality $SIS = I$ is valid, then the interior ideal is called complete. Every ideal of S is an interior ideal at the same time. In case of the realization of certain conditions the inverse of the statement is true, too: if an interior ideal is complete or if it is prim, then it is an ideal, too. Contrary to the ideals the product of interior ideals in general is not an interior ideal but it is in commutative semigroups. Left group and left zero semigroup have no proper interior ideal. Certain classes of semigroups can be characterized by some properties of their ideals. Thus a semigroup is regular if and ony if $B \cap R \subseteq RB$ for any of its bi-ideal B and right ideal R; intraregular semigroups were characterized similarly and also those that are regular and intraregular at the same time (common result with Sándor Lajos). The separation of the element pairs by prim ideals is characteristic of the intraregular semigroups. Every ideal of a semigroup S is prim if and only if S is intraregular and its ideals form a chain with respect to the set-inclusion.

THE EXAMINATION OF INFINITE MATRIXES

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The lecture deals with the semigroups of infinite matrixes. It shows the examination of some special elements of this semigroup. Thus among others conclusions are drawn in connection with the increasing elements of half group. Further on the connection of semigroups of separating group part and the infinite matrixes is dealt with.

EMBEDDING PROBLEMS ON DESARGUESIAN PLANES

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We say that the incidence structure $I = (P, B)$ can be embedded into a plane S if there is a bijection from P to a subset of the points of S which takes the points in a block of I to points in a line of S. The solution of two embedding problems is shown in the lecture. Let $S = (S_1, S_2, \ldots S_n)$ a partition of the edges of a complete graph K_n consisting of the vertices $P_1, P_2, \ldots, P_n$ for which S_i $(i = 1, 2, \ldots, n)$ is not empty and contains pairwise disjoint edges. Let us see the following incidence structure $I_S = (P, B)$

$$P = \{P_1, \ldots, P_n\} \cup \{S_1, \ldots, S_n\}$$

$$B = \{\{P_i, P_j, S_k\}: \text{where edge } P_i P_j \text{ belongs to } S_k\} \cup \{\{S_1, \ldots, S_n\}\}$$

Theorem: A necessary and sufficient condition that a partition S of K_n exists for given n where structure I_S can be embedded in $PG(q)$ is that one of the conditions $n\ q - 1,\ q,\ q + 1$ should be realised. In the second part of the lecture a new elementary proof of an embedding theorem from Korchmáros is shown that makes the sharpening of the theorem possible as in the following:
Theorem: An affine plane of order at least four embedded in desarguesian projective plane can be completed to a projective subplane.

THE EXAMINATION OF EFFECTS INFLUENCING THE ENDURANCE OF GEARS ON THE BASIS OF FATIGUE TEST

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An important part of the research work was to determine the basic data necessary to calculate the endurance of gears. The problem is topical as on the one hand the very quick production of gear drive all over the world has increased on the other hand the national export possibilities can be helped. At dimensioning the basic problem is the knowledge of the root of strength, national material standards have no data for it but the knowledge of the value is necessary especially in hardened state. Thus a few experiments have

been carried out with hardened ground and unground gears. The obtained results were processed with mathematical statistics. The evaluation method was based on the supposition of logarithmic normal distribution. The fatigue test of three gears of different modulus and different tooth numbers was carried out. The material of the gear is chrome steel BC3 according to Hungarian standard, hardened after toothing. Pulsating load was applied at four different load levels on the teeth using level fatigue method. Full fatigue curves belonging to different fracture probabilities were determined for a basic form (modulus, tooth number). Then in the knowledge of them the effect of root geometry, tooth surface hardness and smoothness were examined comparatively and also the influence of tooth number, modulus and grinding on fatigue limit.

Section of Building and Material Handling Engineering

SIMPLE METHOD TO DETERMINE MOMENT NECESSARY TO BEND CONCRETE STEELS

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In special literature there are two methods to determine moment necessary to bend concrete steels of circular cross section: theoretical ideas where calculations are complicated inverse trigonometric functions and empirical formulas containing factors for different shapes and material quality. From the viewpoint of education a simple method — that can be used in practice, too — seemed to be necessary that is not complicated theoretically and offers more than an empirical formula. The moment (M_f) causing permanent strain necessary to bend concrete steel and the moment (M_h) in elastic layer that results in reamortization after bending could be determined by the introduced method. In the laboratory of the Department of Building and Material Handling Machinery the measurements carried out proved the correction of the theory.

EXAMINATION OF BUFFER FORCES OF HIGH STORE SPEEDER MACHINES

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The runway of high store speeder machines on rails has to be supplied by bumper preventing overrunning. Flexible buffers transform the kinetics energy of moving structures into strain energy by its compression. Mainly rubber bumpers are used for this purpose. The knowledge of forces in course of bump is essential from the viewpoint both the speeder machine and the stop buffer. The determination of buffer forces by calculation is possible on the basis of mechanical models of different intricacy. If the frame of speeder machine is regarded as a rigid body the maximum buffer force can be calculated by simple energy equation or can be plotted graphically. In this way

the effect of probable tilting of the frame can be taken into account. The flexibility of the structure can be modelled by a vibrating system containing masses and springs. The determination of the data of series of elements (masses springs) is done by the stiffness and vibrating characteristics of the frame. Time change of buffer forces is given as a solution of a differential equation for this substituting vibrating system. As a result of progressive spring characteristics of rubber bumpers the analytic solution of differential equation is usually difficult. In this case the numerical solution of the actual task is determined by machine solution.

MATERIAL HANDLING PROCESS DESIGN BASED ON TYPE TECHNOLOGICAL ELEMENTS (MODULUS)

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The loading-transportation-storing processes serving the national economic branches can be divided into identical partial processes and to elementary activities. It makes the elaboration of unified process designing methodology based on type technological elements (modulus) possible. The authors worked out designing methods based on type technology for warehouses as the first step of their research. The partial loading-transportation processes of the warehouse processes regarded typical can be divided into four simple and six compound partial processes; from them 4—4 characteristic transportation processes in and out could be developed. The number of important type technologies is 18 leading transportation 14 order picking and 15 storing processes. The type technologies suitable in the given case could be chosen from among them on the basis of logical model having 10 steps worked out by the authors. The loading-transportation variations worked out for the connection of the type technological elements into complex loading-transportation-storing processes can be connected directly to each other by mediation of the storing element. The authors suggest a complex comparative method to choose the optimum system variation that takes the factors which are not numerical into account.

DAMPING OF HARMFUL VIBRATION OF MATERIAL HANDLING MACHINES

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The loading and transportation performance of material handling machines of intermittent duty can be improved by the increase of the quantity of material transported in one portion and by that of the speed as well as by the decrease of starting and braking time. Besides thes decrease of dead load is an objective. As a result of them the flexibility and deformation of the structures also increase. The dynamical examination of material handling machines determines the dynamic load of the structure in a simple case but many times the dynamical design of the machines is also necessary. The method to minimalize the vibration at material handling machines can be classified as the following: a) The decrease of exciting effect (the choice of suitable driving and braking, elimination of unbalance). b) Modification of the structure (modification of parameters, building in vibration insulating and passive vibration decreaser, the elimination of resonancy caused by exciting forces). c) The standard deviation of mechanical energy of vibration (heat transformation is mechanical or in dampers operating on electromagnetic principle). d) Active vibration dampers that use outside energy, too. The tasks to be shown in the lecture were solved by analogue or digital computer simulation.

POSSIBILITIES TO USE TECHNICAL DIAGNOSTICS FOR MATERIAL HANDLING AND BUILDING MACHINES

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The prevention of unaccepted failure of material handling and building machines has been discussed increasingly more widely recently. The maintenance-failure prevention system based on instrumental inspection makes possible the reliable temporary or continuous examination of the technical state of a given producing equipment, thus unaccepted failure can be prevented. The measured marks show which machine part of mounting unit will break down soon thus the date of necessary change can be determined in advance for operation. The supply of spare parts can be designed reliably.

At the present phase of the department research work the aim is to find the applicability of up-to-date diagnostic methods known from other fields in connection with material handling and building machines. In order to do it measurement series were carried out first of all on gantry tower cranes and store speeder machines. On the basis of measurement results it is clear that vibration analysis method for the diagnostics of machinery units (drive, clutches, bearing support of electric motors), common analysis of mechanical stress and vibration for the examination of steel structures and the thermovision method for the examination of electric equipment are the most suitable. Further research work in this field is aimed at the introduction of the diagnostic parameters characteristic of the technical state of the machines.

INSTRUMENTAL MEASUREMENT OF THE INTENSIVE EXPLOITATION OF BUILDING MACHINES

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The continuous checking and analysis of the exploitation of production capacity is necessary to explore the reserves, increase the efficiency of production and utilize the performance of building machines better. To examine and analyse exploitation of capacity, to form and check extensive and intensive capacity factors, the values, changes and possibilities of objective measurement of production parameters of building machines have to be known. In course of our research the interpretation of the exploitation of building machines — mainly that of the earthwork machines — the possibilities to determine the basic parameters (time and performance data, product quantity, etc.) were dealt with special regard to instrumental measurement. Possible variation of measurement methods, the applicable instruments were discovered, instrumentation of significant earthwork machines was solved. On the basis of control measurement the effect of the circumstances of work, technology and power transmission systems on performance exploitation of the machine, on the load level of the built in power machine, the development of energy consumption were examined. Instrumentation solutions and the results of the measurement of capacity exploitation and the connection of influential factors are introduced in the lecture.

ENERGY SAVING HYDROSTATIC DRIVES

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The importance of the constant increase of the performance of hydrostatic drives applied at mobil equipment and energy saving require constant improvement of the efficiency of drives. To meet these requirements pumps of changeable liquid transportation are more increasingly applied instead of pumps of constant liquid transportation causing significant loss. Liquid transportation makes influencing performance on the one hand possible i.e. the performance of hydrostatic drive is changed in accordance with load thus the loss of hydrostatic system can reach minimum level. The condition of developing these regulated drives is to sense load in some way. It has two possible methods: — by hydraulic shaping unit (e.g. pressure sensing); — by electronic shaping unit (e.g. direct performance sensing). Other sensing possibilities are restricted only to special fields. To make this hydrostatic drive regulated according to load work suitably the static and dynamic characteristics of these systems have to be determined by model examination for different operations. The examination refers to energy transforming and regulating system models known at present and to different simplification possibilities. On the basis of the model developed in this way the principled possibilities of developing drives regulated according to load can be examined in harmony with the operation of different mobil equipment and technological requirements.

EXPERIENCES OF EDUCATION DONE BY A SINGLE PERSON

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A study group of students of material handling branch complete their studies at the Faculty of Transport Engineering every year. They attend two subjects in a great number of weekly hours from the 5. term on. Lectures, laboratory lessons, seminars, design practice, workshop visits belong to these two subjects. The educational form where the lessons of both of the subjects were taught by the same teacher was introduced in 1976 as an experiment. Furthermore the lecturer is the leader of the study group and the whole group

could take part in production practice at home and abroad under the leadership of this person. At first sight this educational form has many advantageous effects both on the professional training of the students and on the education but the dangers cannot be neglected either. The result of experimental education by one person has shown the dangers were not important, rather the advantages of this form were dominant. At graduation 11 students were in the group, three of them had scholarship of the People's Republic, the secretary of the Communist Youth Organization at the Faculty came from this group for two years, one student took part in dormitory work intensively, only one student left university but after a year postponement he also successfully completed his studies. After graduation two of them said that without this group they could not have completed university studies.

DESIGN PROBLEMS OF CHASSIS OF TOWER CRANES WITH REVOLVING COLUMN

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The examination was aimed at accurate determination of load influencing chassis of tower cranes with revolving column bearing up on four points i.e. statically unfixed and the favourable choice of the main dimensions of chassis. Within it the factor influencing bearing up possibilities and the effect of the elastic and geometric characteristics of the chassis and path on developing support force are revealed. The outside load of chassis — including support force, too — it is expedient to divide to three basic cases and to determine the load functions of the ring shaped middle part of crane chassis. The distribution of load caused by standard load possible from the viewpoint of dimensioning can be reconstructed by linear combination from the obtained relations. To achieve unified discussion three point bearing up is substituted by support force distribution divided into symmetrical and antimetrical components if the concepts of moment and antimetric load ratio are introduced. In this way so-called normal load functions can be developed depending only on load and geometrical relations. The flexibility of chassis is calculated by strength methods, the geometry and flexibility of the path are determined by measurement. Examining the optimum possibilities of main dimensions it is clear that the increase of the diameter of the ring decreases its own mass and the most favourable development is reached by the cross section optimum of case of complex load.

FIT EXAMINATIONS OF THE PARAMETERS OF MATERIAL HANDLING TASKS AND MACHINE DRIVEN TRUCKS

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Different material handling tasks lay different claims to trucks wished to be used at the same time trucks of different types, structural form, drive etc. are suitable to perform different tasks. The precondition of developing economical and efficient material handling by truck is to solve the tasks by the most suitable machine. The characteristics of material handling tasks can be determined in an actual case or they can be known. From the operation parameters of trucks (load capacity, elevation height, its own mass etc.) value limits (parameter bands) can be formed where certain truck types can be placed. The available (mainly socialist) trucks after their arrangement into parameter bands indicated that the material handling tasks could be performed at a suitable level but special trucks adequate for certain special tasks are not available. Examining the operation circumstances of trucks and the experiences obtained in this way it was established that in case of the presently used types in Hungary operation reliability is not satisfactory in general and its technical, operational and organizational causes are all clear.

NATIONAL REFERENCE OF UP-TO-DATE BUILDING MACHINE MAINTENANCE

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On the basis of methodological discussion "Maintenance" can be regarded as the subsystem of "Appliance economy". Within "Maintenance" "Machine maintenance" means a special field, that is the topic of the lecture in connection with building machines. This system was accepted by common knowledge nationally not long ago. Starting from it the whole framework of the system has to be developed that is concomitant with the clarification of the technical and economic organizational problems connected with it and also the technological methods that help to develop efficient rational maintaining activity from the viewpoint of national economic advantage. Regarding their operation building machines in many cases operate under difficult conditions.

National characteristic of building industry is that almost 80% of its machines are imported that is a special problem because of the supply of spare parts and so opening up, care, maintenance, repair and renewal are difficult to be performed by up-to-date methods. The expectable economic situation, the modest possibilities of investment specially emphasize the modernization of the maintenance of building machines and the reasonable decrease of wear.

EXAMINATION OF BRAKE DISCS AND FACINGS OF PORTAL CRANES

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The functional characteristics of brake discs and linings determine the operation safe working of portal cranes. The essay analyzes the forms of failure of brake discs and linings. They are fracture, crack and intensive abrasion. It points out the material characteristics, construction data that determine the reliability of these spare parts. On the basis of the analysis of performed literature research and operation conditions the production technology of nodular cast iron brake discs of increased strength and steel of about 45 HRC hardness was worked out. Further on these linings qualities and their components which are of increased abrasion hardness were chosen. The reliability and abrasion wear of linings and brake discs were controlled in course of operation measurements. On the basis of measurement conclusion was drawn in connection with the reliability of new brake discs and linings.

THE EXAMINATION OF COMPACTING EFFECT OF VIBRATION ASPHALT ROAD FINISHERS

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The increase of traffic, the bigger wheel and axis load lay increased claims to the load capacity and quality of the surface of roads. The compacting problems of pavement become increasingly more important. Vibration pouring of asphalt concrete spreads widely in road building. The lecture deals with the compacting capacity of asphalt finishers according to the following: 1. Different role of asphalt finisher at pouring structural layers of roadway

of bituminous binding material: — direction of modernization and further development of finishers, — dividing compacting work necessary to pour asphalt layer between finishers and rollers. 2. Short survey of the characteristics of modern asphalt finishers applied in Hungary from asphalt technological viewpoint. 3. Theoretical and practical questions of the interaction of asphalt finishers and materials to be poured. 4. Pouring experiments to examine the expedient operation parameters of finishers: — with finisher Marini on the settlement of BUV in Martonvásárhely, — with finisher Vogele S 160 on the right parking place at 103 km of motorway M1, — with finisher Blaw-Knox in the centre of Jászladány. 5. Summarizing evaluation of the compacting capacity of up-to-date asphalt finishers. The effect of operation parameters and pouring circumstances on the solidity of the road structural layer.

ORGANIZATIONAL AND MECHANIZATION PROBLEMS OF BUILDING INDUSTRIALIZATION

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The resolution of the Central Committee of Hungarian Socialist Workers Party on 21 October took a position on the continuation of building industrialization and on the increase of its qualitative level. It means first of all the increased role of system view. The initial uncoordinated attempts — as the application of building systems of panels, reinforced concrete and light structure — gradually have to be substitute by system principles building from structural, technological, mechanization and organizational viewpoint. The system principled building makes possible the satisfaction of national changing building requirements by the integration of operating building system into system of high level — by the reconstruction of existing industrial background and prefabrication basis — further on increased utilization and flexible application of constructing capacity and existing machine stock. Within system principled building the relation of organization operating the system and the partial systems of the building process — within it first of all the partial systems of the enterprising and construction process — the organization methods coordinating their operation are essential problems. Complex building mechanization, their characteristics in connection with system building, further on the organizational problem in connection with building mechanization, further development of the technological systems are fields to be examined.

THE INTERACTION BETWEEN THE MACHINES COMPACTING BY IMPACT AND VIBRATING EFFECT AND THE SOIL, THE DETERMINATION OF OPTIMUM OPERATION PARAMETERS OF MACHINES

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The knowledge of the motion of soil compactor operating by dynamic effect and the determination of their optimum parameters is a precondition of the design and economic application of modern machines. The lecture introduces the research work and its results in connection with this field in order of the following main topics and research works: — Characteristics of the interaction of machine-soil system, the examination of motion process at the application of different compactors. — Results of laboratory and field examinations. — The choice of the machine suitable for compacting and that of optimum operation parameters. — Instrumental measurement and control of operation characteristics of the machine. — Continuous checking of compacting because of economic work on the basis of the effect exerted on the soil, checking of the evenness of compacting and necessary run number. — The examination of the interaction of machine-soil system in order to determine parameters suitable for the measurement of compacting different compactors. — Laboratory and field examinations of a complex instrumentation assembly for measuring of compaction effect and the results of checking measurements.

STRESS AND STRAIN OF RUBBER BELTING OF CONVEYORS

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Among material handling machines suitable for the transportation of both bulk goods and parcels the belt conveyor is one of the most common ones. One of its special part the belt is often made of cord embedded in rubber. The lecture analyzes the connection of structure and elastic behaviour of rubber belts on the basis of the interaction of matrix and reinforcement. Mechanical loads appearing under the influence of load are listed, the continuous material models of belts are introduced. All the examinations are

based on the connection of rubber and reinforcement taking the mechanical guiding role of the cord into account. The elastic behaviour of conveyor belts is examined on ideal rubber cord material models. These models according to the deformation of reinforcing frame are in the groups of elastic continuity reinforced by tensile ($\varepsilon_k \gtrless 0$) and intensile cords ($\varepsilon_k = 0$). Nowadays the belts reinforced by steel cord spread widely in the field of material handling. In belt produced from steel rubber material-pair the Young modulus ratio of the components is $7 \cdot 10^4$. This figure on the one hand supports specific elastic behaviour of a complex system on the other hand calls attention to great modulus ratio on the boundary surface of the two materials.

NEW METHOD TO DIMENSION CONCRETE MIXERS OF PLANET BLADE, FORCED SYSTEM

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The basic requirements in connection with up-to-date concrete mixers is that they should produce mixture of even quality with minimum time and energy. This condition can be satisfied if the effect of the parameters of concrete mixer (form of blade, revolution number etc.) on mixture process (extent of mixing, mixing time) are known. The lecture introduces the results of the research work in this field, the most important statements are the following: — The calculation method worked out for the driving performance demand of concrete mixers of planet blade — that is based on the actual motion relations of the blade (looped cycloid) — leads to more accurate results than those of the previously known methods. — The research covered the examination of the relation between the most important machine, concrete characteristics and the specific mixing resistance factor ("k") of the concrete. From the approximating functions determined on the basis of measurements factor "k" can be calculated. — On the basis of measurement almost identical "remixing number" has to be used to a given level of the quality of mixing (having the same variation factor) independent of the blading and revolution number of the mixer. To reach suitable remixing number the necessary mixing time depends on the basic data of the mixer that can be counted from the published relation by good approximation. The examinations were performed by an equipment transformed for this purpose that has changeable parameters. They were followed by control measurements under industrial circumstances.

EXAMINATION OF PINNED JOINTS OF CRANE STEEL STRUCTURES

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The field mounting of the structural parts of crane steel structures is possible by riveting, welding, bolts of high strength and pinned joint. The quickest and most reliable is the pinned joint. Its dimensioning is tiring and is not worked out for dynamic load. The damage of the fitting surfaces of cylindrical pinned joints fatigue by swinging load is similar to that of rolling bearings and by the increase of relative clearance the endurance of joints decreases. Contact pressure cannot be calculated from Hertz elasticity equation. The use of Hymans—Hellborn model is better. Relative clearance can be reduced to zero by the application of split conic sleeve, its mounting is simple. Their damage is shown by the appearance of relative clearance. Between load and the dynamic stress number allowed until damage the relation is like that of rolling bearing. Its parameters are determined by regression calculation. Dimensioning of these joints for endurance can be solved with the help of it.

Section of Vehicle Engineering

REDUCTION OF PROPELLER REVOLUTION NUMBER DETERMINED BY MODEL EXPERIMENT

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The results of model experiments are calculated on the basis of the so far known regularities for ships. The methods used at present are not perfect at all. Certain characteristics, thus the reduced value of expected operation revolution number of the propeller deviate from the real one. The deviation of reduced and real value is taken into account by scale effect. Scale effect factors were determined mainly for ships of low propeller load by ship experiment tanks. In case of ships of high load built in our national industry the propeller revolution number substantially deviated from values given by experiment tanks. The lecture introduces a method that besides more accurate reduction takes the roughness of ship screw into account. The method is based on the consideration of the deviation of friction characteristics of model screw and full scale ship screw by determining the data of open water characteristic curve of the ship screw. The comparison of the open water characteristic curve and the characteristic curve of the driving motor and those of thrust demand helped to determine some operation revolution numbers, they are quite identical with values measured on trial trip of some ships.

CERTAIN VIEWPOINTS OF CONSTRUCTION OF VEHICLE ENGINES

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The development of piston vehicle engines have started about a century ago. At present it is desirable that the engine should be of great output, small volume and weight and to meet environmental protection prescriptions, too. First of all four stroke Otto and Diesel engines meet the extreme operation conditions. At present construction the two engine types originally having

different characteristics approach each other. The design of engines is always a compromise where mainly application viewpoints are dominant. The engine can be almost modelled, that means that the desired characteristic comparative data, parameters can be fixed in advance. They are e.g. general characteristics of the engine (performance, brake mean effective pressure etc.), geometrical ratio (stroke-bore ratio, compression relation etc.), mechanical relations (liter performance, moment relation etc.), thermal effects (e.g. heat load), problems of economicalness and environmental protection (consumption, air pollution, noise etc.). Relatively big revolution number of the engine and low thermal and mechanical loss can achieve great output at economical operation. Because of the former one the dynamical effects and because of the latter one the analysis of the combustion process, mixture supply, charge change have become significant but the geometrical construction determining everything cannot be neglected.

THE EFFECT OF CONSTRUCTION PARAMETERS OF AUTOBUSES ON THE DYNAMICS OF ROAD TRAFFIC

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The increase of urban and interurban traffic requires the construction of buses being able to watch the required traffic conditions. The dynamics of road traffic is influenced by the technical-ergonomic parameters of vehicles in traffic, drivers and environmental effects. Examining them, besides the evaluation of measurement results, a program system was worked out that examines the construction effects of buses and trucks on road traffic. The lecture introduces the construction viewpoints of the elaborated mechanical and mathematical model, the requirements of the parameters and their effect on the dynamic behaviour of the vehicle.

EXAMINATION OF POSSIBILITIES TO SAVE FUEL AT OTTO ENGINES OF VEHICLES

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Fuel consumption of the vehicle depends on factors besides the vehicle (road condition, traffic organization), on the construction, technical condition of the vehicle and on the driving style. Vehicle construction also influences fuel consumption in many ways. One of them is the engine within it the construction of fuel supply system. The increase of the price of crude oil resulted in the appearance of a great number of structures operating on different principles, promising saving. Some structures influence constant, the other transient engine operation. The lecture introduces the operation principle, the conditions and limits of efficiency of the so-called "saving appliances" available in our country.

THE SCALE LENGTH AS A VEHICLE SERVICE LOAD PARAMETER

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Most service loads determining the fatigue life of vehicles are resulting from random environmental effects (e.g. road surface roughness, rail unevenness, sea waves, atmospheric turbulence, etc.) to be modelled as stationary stochastic processes. Autospectra formulae for preliminary fatigue life calculations as well as for fatigue test load program generation are to be expressed in terms of natural parameters of the process. The scale length L — respectively the time scale T — thought originally only as a special turbulence concept is in fact a full natural parameter with and complementary to the standard deviation σ. Its value is characteristic of the coherent road length and of the coherent span of time. Introduction of the scale parameter automatically eliminates the singularity at zero wave number of the negative power law PSD formulae. The standard deviation σ_m measured on a finite base length S can be converted to the theoretical value σ_0 by use of the appropriate dimensionless parameter Ln_1. Direct calculation of the wheel displacement $x(t)$ time spectrum $G_x(f)$ for a vehicle running at speed V on a road characterized by its space spectrum $G_x(n)$ is also possible when using the scale

parameter. Incorrect choice of the base lengths for evaluation and assessment of road test records may cause substantial errors, because a collective processing of different road sections is giving a weighed average of the respective parameter values. Best value of the base length can also be determined from the scale length L.

THE WEAR OF THE EFFECTIVE AREA OF RAILWAY WHEELS

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The wear of the effective area of railway wheels is usually caused by adhesion or abrasion, sometimes by fatigue wear. The wear of the wheels is influenced by — the quality of the material, heat treatment state, — quantity and character of load, — contact relations of the wheel and the rails. The magnitude of stress on the contact area of the wheel and the rails is generally calculated by equation Hertz. The magnitude of stress developing in the surface layer is influenced by the geometrical relations of the contact surfaces of the wheel and the rail besides wheel load. Calculation method was developed to determine stress appearing under different wheel load in possible contact cases of wheel and rail profiles of different shape. During braking skid shoes tightened to the effective area of the wheel wear the wheels, motion energy transformed into heat energy heats the material of the wheel. Under the influence of heating the blind type becomes loose, hardened nodes can develop, the rim of block wheels can crack. By the application of brake wheel pairs the running performance of the wheel pair between two turning can be increased but the character of wear shifts into the direction of fatigue wear because — skid shoes do not regulate the surface, — the same material layer is loaded by greater number of load, — skid shoes have no heat treating effect on effective area.

THE INFLUENCE OF ACTIVE MASSES ON THE VIBRATION OF VEHICLES

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The payload takes part in vehicle vibrations (active mass) not only by its mass but by damping and spring rigidity. The dynamic load of the frame of the vehicle loaded by passengers can be determined by suitable transformation without the increase of the number of degree of freedom of the vehicle. The examinations proved that the modelling of the payload approximating reality better decreases the stress of the vehicle (mass force) at model of elastic frame than the passive model.

AIR POLLUTION CAUSED BY VEHICLES

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The effect of exhaust gas on human body. Mechanism of action of certain harmful components. Measurement technics and analysis of poisoning components of exhaust gas. Air pollution of the capital. Emission limit values and procedures for the examination of the emission of motor cars of petrol operation (Otto engine). Methods to decrease poisoning components of exhaust gas of motor cars of petrol operation. Limit values and procedures suitable for the measurement of the poisoning components of exhaust gas for the smoky exhaust of vehicles of Diesel fuel. Methods suitable to decrease the emission of smoky exhaust of vehicles of Diesel fuel. The values of harmful material components measured inside the vehicle. Relations between air pollution and fuel consumption.

OPTIMUM OF SHOCK ABSORBING CHARACTERISTICS OF VEHICLES OF AIR SPRING SUSPENSION

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The lecture deals with the mathematical determination of optimum shock absorbing characteristics that takes both the pitch comfort of autobus of air spring suspension and the connection of wheel and soil into account.

Supposing the parameters of tyre and spring elements as given, the following method was suggested for the determination of optimum asymmetrical nonlinear pitch characteristics: The first step is the optimum realization carried out on linear models at different speed. Then the only nonlinear optimum absorbing characteristic is determined by inverse statistical linear method by suspensions. At last the contradiction of optimation according to different viewpoints and the possibilities of their elimination is analyzed by digital simulation method.

METHOD TO MEASURE CHARACTERISTIC FIELD OF DIESEL ENGINE TURBO CHARGERS

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The suitable cooperation of Diesel engine and charger at variable operation is characterized by the fact that the conveys charging air of prescribed pressure, temperature and quantity and the temperature of exhaust gas is not greater before the turbine than the allowed value. The desired characteristics of the turbo charger are determined by expedient experiments and calculation. The application of computers lays greater claims to the knowledge of these characteristics during the design of Diesel engines and the examination of the common operation of the machine group. The expedient experiments are carried out by the operation of the turbo charger as a gas turbine of open work process operating by artificial load. A great advantage of this operation is that the charger and the turbine are in pneumatic connections with each other that limits the measurement range. In order to extend measurement range, to adjust operation simply to create the operation conditions of turbine approximating reality better the use of a gas generator where the pressure, temperature and mass of gas current can be changed and adjusted independently of the compressor, e.g. a Diesel engine operating without load can be used as gas generator — its air occlusion can ensure the greatest mass current of the turbine — and the combustion chamber built in the exhaust pipe of the gas generator helps the adjustment of the temperature of gas current. The lecture deals with the construction, measurement method of such an appliance, the process of measurement data and the introduction of characteristic fields plotted from these data.

MODEL FORMATION PROBLEMS OF LONGITUDINAL DYNAMIC EXAMINATION OF TRAINS

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The aim of the longitudinal dynamic examination is the determination of connection forces between neighbouring vehicles by calculation. The train is a longitudinal swinging system consisting of masses connected by springs that are excited by outside forces and damped by dissipative elements. In case of vehicles of draft gear with split construction chain like in case of vehicles of transient split construction or at train composition inhomogeneous from the viewpoint of the split construction branch models are given. Continuous and discrete models are compared. Inhomogeneous mass distribution, elastic and dissipative characteristics of buffer and split constructions the finite spring stroke, carcass elasticity are taken into account and many methods are compared to treat non-linearity originating in them. Driving moment and strain shoes time functions are different by vehicles and also dependence on speed and running relations of resisting force. The consideration of power transmission on friction relation between wheel and skid shoe and wheel and rail necessitates the examination of the motion of rotary mass of vehicles. Numerical solution of non-linear differential equations describing motion processes gives the connection forces to be looked for the kinematic characteristics of certain vehicles in case of stop braking, it can be used as a braking length calculation method more accurate than known so far.

ANALYSIS OF ERRORS IN COURSE OF CARRIAGE CONTROL OF VEHICLES AND THE POSSIBILITY OF THEIR ELIMINATION

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The decrease of operation costs and the achievement of suitable road safety of the vehicles greatly depend on accurate setting of wheel alignment. The checking of correct setting of wheel alignment is based upon the measurement of different angles of the steered wheels. The errors possible in course of measurement were analyzed by a mathematical model that is suitable for the simulation of the latest suspensions constructions where the inclination of the

castor of the steered wheel is two or threefold of the value known so far, by suitable development of suspension the extent of post running is 5—10 mm. The errors possibly occurring in course of the checking of this type of suspensions, too, significantly increase. The inaccuracy of wheel alignment was compared to the tolerance field of setting value examining the measurement accuracy that can be achieved by the introduction of narrowed tolerance field. After the analysis of errors possible in course of the measurement the methods of checking of wheel alignment were compared from the viewpoint of the examination of the errors. The mathematical model makes the examination of suspension measuring device possible that can be achieved theoretically in case of suspension of different setting parameters. It makes the use of the more advantageous multiplication number possible when making the scale of the instrument.

INDUSTRIAL ELECTRONIC APPLICATIONS IN TRAFFIC ENGINEERING

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The appearance of semiconductor in heavy current electrical engineering opened up new prospects in the field of traffic applications, too. The industrial electronic group working at our department carried out research and utilization activity mainly in the field of accumulator production and utilization. The quality of continuously excellent product is ensured by automation from oxidation of lead powder through control in course of production to the test of the ready product. The products: feeding automation, formation and charging rectifiers of different characteristic curves, cycle examination equipment, charge counting instruments of wide spectrum in construction one by one and in combined variation. Our cooperation with Accumulator Factory and Medicor Works and with Accumulator Workshop in Szászberek has been lasting for years. Our service patent is in connection mainly with chopper controlled vehicles driven by accumulator power. Our production contract with a cooperative refers to the control of electric trucks. During automatization of electrical equipment of ships, we cooperated with Hungarian Shipyard and Crane Factory. The speed control of Ward-Leonard driven hook elevating engines for a floating crane was made. Our department designed and partly constructed the electric automation of noise insulated Diesel engine test room in the town Szolnok for Hungarian Railways that was opened up recently. The automation of engine elevation equipment of logical relay control made for Western Haulage Plant in Budapest is of railway reference, too, with it the elevation engines operate at the same speed.

THEORETICAL AND EXPERIMENTAL EXAMINATION OF COOLING OF ROTARY MACHINES

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The increase of the performance of rotary machines by volume unit results in the increase of temperature of operation. At the same time operation safety requires that the temperature peaks do not exceed the value compared to the mechanical and electric strength of structural and insulation materials. Material saving construction coordinating the two viewpoints can be developed in the knowledge of local distribution of temperature. Temperature field can be calculated from the enthalpy balance of flow at known speed distribution. At nonisothermic flow, however, speed space also depends on temperature field thus the equation of continuity, the motion equation and the enthalpy balance, the non-linear second order differential equations form a system that is hard to be solved. A characteristic element of cooling systems of rotary machines is the longitudinal channel parallel with the axis and rotating around it with radius R. Cooling effect is exerted by the agent flowing through. Here the mentioned problems increase on the one hand because centrifugal field and Coriolis force induce secondary flow in the plane of cross section as a consequence of rotary and density inhomogeneity, on the other hand the motion of coolant getting into the channel from quiescent stage becomes relatively turbid. Consequence: During the important improvement of middle heat transfer local intensities become uneven along the region of the tube that is increased by the fact that the centrifugal field promote and hinder the increase of turbulent heat exchange at the far and nearby constructive field. The complicated physical image supports the systematic experimental examination.

OPERATION OF TURBO AIR RADIATOR, THE DETERMINATION OF THEIR OPTIMUM CHARACTERISTICS, THEIR APPLICATION POSSIBILITIES

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The cycle of turbo air radiator, advantages and disadvantages originating in volatile (air) agent, their comparison with compressor refrigerator of steam cycle. The analysis of loss in the machine units of turbo air radiator, the effect

of loss on specific characteristics. The determination of optimum characteristics, their relation with the loss of certain machine parts. The significance of optimum pressure relation. The determination of specific characteristics of turbo air radiators equipped with two degree intermediate cooling. The analysis, the significance, economicalness of the effect of recooling between compression. Perspectives of turbo air radiator, taking the expected measure of the decrease of loss in certain machine parts into account. The application possibilities of turbo air radiator to solve air conditioning tasks. Air conditioning of passenger cabin of autobuses by suction and charged engines operated by turbo air radiators. Air conditioning of low lying mines by turbo air radiators operating by network compressed air. Application of turbo air radiators for air conditioning the passenger cabin of aeroplanes. Hungarian results achieved so far.

APPLICATION OF IDENTIFICATION METHODS TO DETERMINE WORKSHOP AND OPERATION CHARACTERISTICS OF VEHICLES

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Further development of design and operation methods of vehicles depends on two essential problems. On the one hand the actual characteristics of the vehicles have to be known. On the other hand the effect of complex operation process built on maintenance, service and control machines, on organizations, people, prescriptions exerted on the actual state of vehicles have to be determined. Both tasks can be solved on the basis of workshop measurement by the evaluation and identification of actual characteristics and state. The aim of identification is the choice of an optimum system from the class of model systems determined on the basis of in- and output signal of the system (project) according to a viewpoint (design, production, operation, economicalness) that is equivalent with the examined system. In course of identification the state of the system is identified with a variable (state vector) that in the knowledge of input signals determines its expectable behaviour forms. The lecture introduces the identification methods that can be used, the modes and aims of their realization. The examination of dynamic workshop circumstances offers the most expedient solution to identify the actual characteristics and state of vehicles. Then the transfer function of the project can be given relatively simply by matrix built up from polynoms. In the knowledge of transfer functions the state equation of the vehicle can be written.

MATHEMATICAL MODEL OF AEROPLANE JET POWER PLANT AND THE APPLICATION OF MODELS IN DIAGNOSIS OF POWER PLANT

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With the mathematical model of jet power plants there is a possibility to perform examinations that cost much or cannot be carried out on the project. From the viewpoint of operation the mathematical model is highly significant at the choice of diagnostic parameter groups, at the examination of degeneration of transient processes appearing as a result of certain damage. It reveals the factors influencing fuel consumption within power plant, chooses the optimum flying operation built in the mathematical model of the whole plane. The lecture contains the general principles of the construction of power plant model, deals with the characteristics appearing in course of model formation of transient processes and during mathematical simulation of power plants of single throw one and two rotor and two throw two rotor power plants. The elaborated model in non-linear, takes compression and turbine characteristics into account and contains their approximation calculation, too. At last introduces the application possibilities of results obtained in course of application for two rotor plant for diagnostic purposes and conclusions are drawn.

RUNNING TECHNOLOGICAL DIMENSIONING OF RAILWAY VEHICLES

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The aim of running technological dimensioning of railway vehicles is the determinations of the optimum vibration parameters of the vehicle from the most important running technological viewpoint during design. The development of dimensioning method may shorten the running technological experiments carried out by a prototype. In course of dimensioning the vehicle is modelled as a linear vibration system of many degrees of freedom and many times the examination of two plane models, the vertical and horizontal transversal models independently of each other is sufficient. In course of dimensioning the excitation forces on the contact area of wheel-rail are regarded stochastic

functions. The performance during spectrum of these functions — determined on the basis of measurement in many ways of different quality — is used directly or substituted by function approximating them. On the basis of motion equation system described for plane models the transfer characteristics typical of the vibration system can be determined. With them and the performance spectrum of excitation the acceleration performance spectra referring to arbitrary points of the vehicle can be calculated. The comparison of the acceleration performance spectra calculated in case of continuous change of vibration parameter makes the determination of parameters ensuring optimum running character possible.

GEOMETRICAL PROBLEMS OF WHEEL AND RAIL WEAR

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The lecture introduces some partial results of research work aimed at the elaboration of calculation method serving the determination of the worn shape of wheel and rail profile. This examination deals only with the effect of the macrogeometrical factor from among the many influential factors of wear, first of all with the effect of wheel and rail profile shape on the process of wear. In course of wear one shape of wear was supposed unchanged — theoretical extreme cases were reached for "absolute" wheel and rail wear — the profile shapes belonging to them can be determined by calculation. In the knowledge of "absolute" wear curves the wear curves approximating reality can be reached by wear hypothesis chosen expediently. Further on the lecture deals with the possible cases of the contact of wheel and rail and mentions the geometric and kinematic characteristics of join on flange and effective area. It emphasizes the significance of motion of join appearing on the effective area of the wheel and introduced density function on wear load at certain profile phases. At last it suggests viewpoints to determine profile shapes favourable from wear point of view.

LOAD EXAMINATION OF VEHICLE CARCASS OF REINFORCED CYLINDRICAL SHELL IN CASE OF KINEMATIC LOAD

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The slightly conic shell outrigger tail of helicopters can be modelled quite accurately in strength measurement as cylindrical shell reinforced longitudinally and laterally. The outrigger is connected to the body by bolted joint. The flange serving joint is not of perfectly plane because of the indispensable production inaccuracy, thus the drawing of the coupling bolts forces local deformation on the structure. This effect causes relatively great load in stiffeners and sheet fields connected to the flange that weakens quickly leaving the flange. Measurement inaccuracies causing kinematic load can be regarded in pairs as independent probability variables of normal distribution according to experience. Thus their effect can be taken into account already in course of design. In the knowledge of the operation load of the structure and allowed load the production tolerance and mounting technology ensuring suitable strength reserve can be prescribed.

MODERN ANALYSIS OF ROAD ACCIDENTS

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Advanced technical means are at our disposal to reconstruct the antecedents of accidents. I want to show the necessity of the photogrammetrical evaluation by examples and also the necessity of the application of electron microscope. The decisive role of infrared spectrum analysis in accident analysis is introduced by an example and at last the role of computer is introduced in course of the analysis of road accident. I introduce the new accident analyzing methods ensured by advanced technology and I emphasize that technology is only a device in the hands of the experts. The results of computer essentially depend on the data and the programs fed by the analyzer. The possibilities offered by advanced technology have to be known in the situation. Their results have to be accepted by suitable criticism. The analysis of road accidents has to be performed more profoundly than so far by the application of modern technical devices that requires higher qualification than the usual practice and new view from the ones dealing with the topic.

CRITICAL ANALYSIS OF CERTAIN BRAKING PRESCRIPTIONS OF THE UNION OF INTERNATIONAL RAILWAY (UIC) BY MEASUREMENT DATA

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Many factors influence the braking process of railway carriages equipped with brakes. The influence and extent of these factors cannot be determined theoretically thus operation and laboratory experiments are made to know braking process. The Union of International Railways (UIC) gives the arrangement order of operational experiments and measurements in so-called bulletins. Because of the development of brake systems of railway carriages the harmony of UIC prescriptions — in the lack of suitable experimental results — deteriorated in certain fields. The physical characteristics of these processes could be revealed by the application of test stand experimental results simulating a great number of real braking processes in the laboratory of the Department of Railway Vehicles at the Technical University of Budapest and on the basis of the results modifying proposals for the modernization of UIC prescription were made. The efficiency of the brake assembly of railway carriages — in accordance with the UIC prescriptions — has to be given by the so-called "braking load". UIC prescriptions assume constant "braking load" of the vehicles. Test stand experiments and operation experiences prove it is not so. The effect of so-called "mass load" — mass falling on one braked wheel from the viewpoint of braking — is especially significant. On the basis of brake stand experiments it has become clear that UIC-like brakedness of wagons built on greater speed ($V > 120$ km/h) and greater axle load ($Q > 20$ t/axle) cannot be ensured by traditional cast iron.

ANALYZING EXAMINATION OF THE BRAKE FORCE REGULATING STRUCTURES OF HYDRAULIC BRAKE SYSTEMS

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The growth of vehicle traffic and the development of vehicles of great output and speed emphasized the development of the brake system, one of the most important parts from the viewpoint of the active safety of the vehicle.

The application of structures regulating braking force automatically are widespread nowadays. The analysis, systematization, applicable criteria, the determination of parameters changing in course of operation, the elaboration of reliable examination method have become necessary. The lecture systematizes and analyzes critically the brake force regulating structures of hydraulic braking systems after the analysis of the braking diagnosis of the vehicle. A simulation model of real static characteristics taken up on the basis of a great number of laboratory measurement after static theoretical examination covering the full braking process of the most common type is determined. On the basis of the laboratory examination of the used adjusters the parameters changing in course of operation and their tolerance value are determined. On the basis of the dynamic laboratory model examinations and road dynamic examinations carried out in the vehicle and the static theoretical and laboratory examination the criteria and brake force adjuster are given. The lecture deals with the diagnostic possibilities of brake force adjuster and suggests an examination method independent of the other elements of brake systems and the development of the instrument necessary to perform it.

LOAD RELATIONS OF THE DRIVE SYSTEMS OF RAILWAY HAULING CARRIAGES

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The drive systems of railway hauling carriages operate under stochastic load relations in course of destination like operation. The design and operation of hauling vehicles raise the question that can be solved in the knowledge of the characteristic probability distributions and parameters of stochastic load process. The first step of the knowledge of load relations and analysis is the elaboration of the state characterization of the driving system. In course of it we have to take into account that useful information can be obtained about load relations carried out in long time. The essay points out that in the knowledge of the control and speed of the hauling carriage the load relations of drive systems for the solution of several practical problems can be characterized by satisfactory approximation. After setting the characterization method of load relations the observation and analysis of the time running off of marked variables can be carried out. The examination of dwelling period as random variable of the load process under given load level is a precondition of it that serves the basic relations of the estimation of load state distribution. The paper gives a

diagram system to evaluate the accuracy and reliability of the estimation. The distribution characteristics, correlation spectral and coherence characteristics obtained as a result of performed operation measurement and also the questions in connection with the static dependence of state characteristics are introduced. The paper gives an outlook, the main relations of construction and operation analysis and synthesis problems that can be solved in the knowledge of load state distribution.

Section of Transport Engineering

OPTIMUM CRITERIA OF TRANSPORT SYSTEM DEVELOPMENT

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The basic aim of transport is the satisfaction of transportation requirements of society with the possible fewest resources and significant roadworthiness. The satisfaction of this main aim is carried out by complex transportation system that consists of a great number of systems and subsystems and elements in (partly not) interconnection with each other. The measurement of the efficiency of transport system, its influence and role and social production can be carried out and revealed by scientific system analysis. The main question is how to express the value of transport, how to measure the system efficiency of transport. One possible optimum criteria is the minimum of integrated loss. Transport system has to be developed that material production, the integrated loss of traffic sphere should be minimal.The second solution is the interpretation of the efficiency criteria of the development of transport system as the minimum of the economic loss due to the insufficient development of economic system or poor transportation performance. The above criteria enforce the following requirements, too: — integrated economic utilization of material, energy and labour force; — keeping natural and environmental protection prescriptions (ecological requirements); — protection of man (roadworthiness, noise harm).

COMPLEX MEASUREMENT SYSTEMS AND PROCEDURES FOR ROAD TRAFFIC DIRECTION AND ORGANIZATION

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Two traffic measuring instruments operating on different measuring principles were developed on microelectronic basis in the framework of state commission: one operating with ultra sound and the other one is a measurement

mushroom operating on inductive principle. Both of them can collect and store traffic data for a long time — but during minimum 24 hours — by its own energy (battery) suspended above the lane or fit into the asphalt into standard holes. Apart from it the *ultra sound instrument* — by the built in microprocessor — is able for *vehicle selection* on the basis of the obtained measurement data. The mentioned research work has double aims: on the one hand the *development of the two measuring devices* on the other hand *that of the measuring method* ensuring their utilization. In the latter case special measurements can be carried out, too, when the flow of vehicles from where to where also can be examined and measured. Both the structural research development and the development of new measurement methods include the reading and processing of the stored data of the measurement devices.

AUTOMATIZATION OF THE ORGANIZATION OF TRANSPORTATION PLANTS (COACH STATIONS AND SETTLEMENTS) BY MICRO-ELECTRONIC DEVICES

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The automatization of organization tasks of transport plants has been dealt at the Section of Transport Automation at the Technical University of Budapest for years. The experimental field is the coach station of Enterprise 7. VOLÁN in Szolnok where an automatic dispatcher centre (SZDK) controlled by microprocessor was built. On the basis of the year timetable on punched paper tape the microprocessor makes the vehicles depart and arrive automatically while displaying the pieces of information asked by the dispatcher helps to make operative measures. The presence of vehicles are sensed by inductive loops, while the traffic number, the relation and run numbers were laid down on plastic cards that have to be put into the identification unit mounted at the starting points by the driver. The events of the day can be laid down on punched paper tape at the end of the shift. Modular construction of SZDK ensures the possibility of improvement (e.g. the operation of passenger information device, adjustment to computer systems, etc.). A microprocessor based dispatcher diary was made at the settlement VOLÁN in Szolnok. Its task is the registration of the vehicles being at different parts of the settlement for technological operations. The stored data give an overall picture about the state of settlement to the dispatcher who can evaluate the events according to given viewpoints

and carry out statistical process. The lecture summarizes the hardware and software parts of the design and construction of the two systems and the operation experiences accumulated so far.

MACROECONOMIC STRATEGIC CONCEPTS OF MODERN TRANSPORT DEVELOPMENT

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The fundamental task of transport as the subsystem of macroeconomic reproducing process in the traffic sphere is the possible best quantitative and qualitative and economical satisfaction of transport needs in connection with the spatial structure of social economic processes. The better transport satisfies this requirement the greater its national economic efficiency can be. The main influencing often determining factors of its increase are: 1. the direction and organization of the connection of transport market demand and supply; the increase of the operational level of transport; 2. the development of the field with transport; 3. the increase of transport engineering level; applications of innovations of great efficiency with special regard to energetic requirements and exports (vehicles); 4. the increase of transit transportation services; 5. promotion of tourism (motorist tourism); 6. factor group dominating in perspective; building on the development strategies of different branches (industry, building industry, agriculture, trade, settlement network); 7. the possible acceleration of the general increase of the level of transport backwarded compared to economic development; 8. increased rationalization of division of labour between urban public and individual transport; 9. schedule of motorization in accordance with economic policy. The development of macroeconomic strategic concepts of the improvement of transport can be realized by putting the listed and other factors and their suitable development dynamical combination into adequate program of great efficiency.

EXAMINATION OF LOADING-TRANSPORTATION-STORAGE PROCESSES BY SIMULATION AND STATISTICAL IDENTIFICATION METHOD

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The paper discusses the results od modelling loading-transportation-storage (LTS) systems. The examinations were carried out by two modelling approach: 1. The simulation model of modular construction of the adaptive control (LTS) system has been worked out. The simulation model consists of three main moduls: — modul forming environment system where demands come dynamically while looking forward (EXT01); — modul simulating the processes of physical, service systems; — modul simulating adaptive control for the LTS systems. 2. The different external and internal stochastic characteristics of simulation model are analyzed statistically. On the basis of them the conditions of applicability for statistical methods were examined, and the basic parameters of system behaviour were also estimated.

THE CORRELATION OF THE DEVELOPMENT OF PUBLIC TRANSPORT REQUIREMENTS

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Public transport requirement can be regarded as a projection of human relations in space and time. They are related to production on one hand (work and study) and to consumption on the other hand as far as their motivation is concerned. To characterize the requirements of public transport we used macro and micro quantitative and qualitative data depending on time and space. To characterize the requirements starting and terminal points, furthermore the change of locations have to be provided. To provide a qualitative characterization for the requirements of public transport we use the requirements set up for safety speed, convenience, regularity, and for economic and environmental demands. To determine the requirements of public transport can be accomplished by macro- and micro-economic methods. The macro-economic measures serve to forecast the global travel requirements for a shorter or longer duration. Based on influencing factors the requirements of public transport can be determined by the employment of the probability theory. Public transport require-

ment can be expressed for a certain period as a demand function:

$$U = f(x_1, x_2, \ldots, x_n) \text{ where}$$

U = public transport requirement, x_1 = influencing factor. Our investigations calculated and analyzed different planar and spatial demand functions.

DETERMINATION OF OPTIMUM MAINTENANCE PERIOD OF CARS BY RELIABILITY METHOD

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Suitable maintenance of cars ensures the requirements of traffic safety and economic operation. The maintenance periods of a unit consisting of a great number of parts are expedient to be determined on the basis of technical economic criteria. The scheme of the maintenance system of a unit that cannot be dismantled from the viewpoint of examination:

Preventing	*According to necessity (forced)*
Of fixed period	(The maintenance system is constructed in this way)
According to requirement Diagnostics Reliability theory	
Within it: Repair without change Without dismantling With dismantling	Failure occurs by chance does not show regularity
Change In itself Connected to other operation	

The maintenance system is combined of preventing and forced elements.

The aim function of the optimum maintenance system is the minimum of specific total expenditure within examined period (run). The parts of total expenditure: — cost of work without change (preventing); — cost of work with change (preventing); — cost of accidental work, change (forced). The cost is slightly increased by the cost of taking down reliability data (failure rate, life time etc.) and that of transformation of registration system.

EXAMINATION OF TRANSPORT SUPPLY AND DEMAND FUNCTIONS FOR COMPETITIVE TRANSPORT MARKETS

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The basis of the determination of transport demand functions is the function of "transport requiring" that appears in both passenger and goods transport. Taking transport demand and supply function as a bivariate function (depending on transportation volume and distance) the so-called demand and supply surface are given. In case of competitive transport market the equilibrium price is determined from the intersection curve of the two surfaces. The examinations of the one variate demand and supply functions are more important in the case s = constant because the transport price depends rather on transported volume than the distance of transport according to theoretical consideration and practical experiences. The paper contains the basic mathematical formulas of supply and demand functions.

POSSIBILITIES OF DEVELOPMENT FOR CONSTRUCTION OF RAILWAY TIMETABLES

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Recently computerization has greatly increased, also in railway transportation in Hungary especially in the creation of timetables. The experiences of the last years have shown that the computer technics has more and more possibilities in this field. The paper emphasizes that many theoretical, methodological questions important from practical viewpoint have to be clarified in order to use computers efficiently in course of timetable construction in Hungary. In connection with them the paper points out the results expected by the "automatization" of timetable construction and the results of "optimization"; what tasks can be given to normative and operative timetables prepared for different periods; where decentralized construction work can be carried out, and where greater centralization is advantageous; how timetable construction can be connected to the complex design-control system of the whole railway network; what kind of experts are necessary as "the key figures" of computerized timetable construction, etc.

EXAMINATION METHOD OF TRAFFIC CAPACITY LIMITS OF URBAN PUBLIC TRANSPORT

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The condition to satisfy the requirements of travelling by public transport is the coordination of traffic engineering capacity of transportation plants and travelling requirements. Capacity is characterized by cross section permeability and dynamic transportability. These measuring numbers and parameters influencing them are in stochastic connection with each other, that is why the determination of the changing regularity and the most probable occurrence limits are necessary. The examination method takes into account that the parameters influencing capacity limits change by cross sections as a result of disturbance. The changing regularity of parameters is revealed by development of inequality index along the line. In the knowledge of the parameters the traffic engineering application limit can be determined for public transport branches in three steps. They are the expectation, lower and upper limits of capacity. Capacity value ranges can overlap each other in different, technical branches. Within overlapping other factors than traffic engineering ones have to be taken into account to state load applicability (e.g. economicalness, environment protection, energy use etc.). The examined model and the parameter stock collected on the basis of it can be used in development, design and guidance of public transport.

CONTROL OF MODELS OF LOGISTIC PROCESSES

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The control theory examination of the flows of material and goods as the supply processes in wide range of production (service) i.e. logistics — has been one of the most important research tasks in this field recently. The logistic system consists of information, design and control operations of given transportation, loading and storing systems. Within the scope of this problem we examined the actual application possibilities of modern control methods from the viewpoint of development for building of the adaptive control processes of logistic systems. It is emphasized that the effective work of the adaptive control processes of logistic systems can be ensured by the application of operative and strategic system identification methods.

MODERNIZATION OF ELECTRIC EQUIPMENT OF AUTOBUSES BY MICROELECTRONIC DEVICES

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We have been commissioned to deal with the modernization of the electric equipment and network of buses by Carcass and Vehicle Factory IKARUS for years. Information of passengers is already an indispensable part of civilized transport services. Boards with changeable pieces of information could be seen only on buses produced in western countries. These devices are able to display some texts fed in advance. A new passenger informing device adjusting to the requirements of the moving bus has been developed. Information can be displayed on a special field of point matrix arrangement. It is controlled by micro-electronic devices making the display of arbitrary letter, number, signal on the board in different size possible. Several boards of different size and construction can be placed on one bus connected to the same control. The solution is patented. Other significant field of our research is the modernization of electric cable network. At present many kilometer long "spider web" of electric lines is characteristic of buses, their construction significantly changes by types. An information system was developed that is simple, clear and ensure unified network for different vehicles, too. It could be realized only by micro-electronic devices, its application was concomitant with the significant expansion of services (e.g. electric diagnostics, continuous observance of data, serving as a "black box" etc.).

MODERN METHODS IN RAILWAY SAFETY ENGINEERING

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Microelectronics and computer technics offer favourable possibilities for the automatization of different railway operation processes. Computerized data processing almost lays the ever increasing mechanization of railway administration at our feet, the spread of process controlling computer systems, data remote processing, the widespread application of distance control make the new organization and running of the whole railway possible. From the viewpoint of the development of this process the widespread application of computers (micro) is of significant importance: they help to achieve the opti-

mum ratio between local and centralized automations. In course of the compilation of safety requirements for the application of electronics and computer technics in railway traffic control, the used traditional devices, their safety level should be the starting point as we summarize the experiences of several experts for generations. The accumulated experiences give a suitable basis to work out and improve the philosophy of railway safety devices. Several, possibly automatic control at every step of the establishment and operation is highly important besides design and production of safety devices. Suitable tests and examining automations are necessary. The Institute of Transport Engineering and Organization at the Technical University of Budapest takes part in their development and its activity in certain fields, it has a determining character.

IMPROVEMENT OF THE EFFICIENCY OF RAILWAY OPERATION BY OPERATION RESEARCH METHODS

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The changed economic conditions compel every enterprise — thus Hungarian Railways, too — to flexible adaptation to the changing market — in our case to transport market — conditions by the modernization of their economic planning systems and to the improvement of their operation efficiency by revealing reserves within the system. The realization of these aims is significantly promoted by those of mathematical programming methods in practice adapting the results of operation research, they have not been used so far. The lecture surveys the linear programming methods suitable for optimisation taking the economic criteria of transportation activity into account. The problems of the development of technological matrix taking the change of transportation technology into account are dealt in details. The methods for the solution of railway economic multiple criteria decision problems are analyzed and evaluated. The lecture examines the measurement and optimisation possibilities in connection with it that is ensured by the present information system among the applicability conditions of methods known from literature. Pointing out the defects of information system suggests the collection and processing of data necessary to economic planning using mathematical methods, too.

EFFECTS OF ENVIRONMENTAL DAMAGES OF ROAD TRANSPORT ON THE EFFICIENCY OF THE SUB-BRANCH SYSTEM

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Road transport is the most dynamically developing subsystem in the entire transport system. Besides favourable effects, due to spreading of means in masses, negative ones come increasingly into prominence, e.g. air pollution, noise injury, etc., as well as significant specific energy demand. The factors mentioned cause considerable losses to both the sub-branches and the national economy, thus reducing the efficiency of road transport. In order to duly consider the losses, characteristics of the loss factors must be revealed. Another scope of the problem is the examination of factors influencing the harmful effects and clearing up the relation between them. Knowing all this, a method suitable for an economic evaluation of the harmful effects may be elaborated, lending itself for quantitative evaluation of losses by value in money, or by natural indexes of measurement. Having a suitable information basis available, the method permits to evince the influence of losses on system efficiency. In relation with the above mentioned complex problem, the lecture deals more in detail with the methods of determining losses caused through air pollution by road transport.

SOME CHARACTERISTICS OF THE OPERATION SAFETY AND RELIABILITY OF ROAD AND RAILWAY TRANSPORT

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The concomitant phenomenon of the development of motoring age is accident. Society reacts to a road accident less keenly than to a railway one. Although specific value of the number of accidents in case of railway is much more favourable. Transport regarded as man-vehicle-environment — which includes way, too — is only mentioned. Examining the cause of accidents in driver-vehicle system the weak subsystem is the man, but his problem can be solved only together with the vehicle. The functions of driving are control, regulation of speed and hauling capacity. Their development with technical and organization methods can result in the improvement of efficiency. Several

models were prepared and research work was carried out to solve the problems but method suitable for practical use has not been developed because of the difficulty of numerical determination of the parameters. All the theoretical considerations are based on information theoretical basis and finds the cause of accident in the insufficiency of the information receiving and processing capacity of man under fluctuating load. Starting from information theoretical or other basis it is essentially psychological problem and the main part of research is in this field. On the basis of them comparing road and railway transport, the disadvantageous situation of road transport is an objective necessity, it makes the sacrifice concomitant with it because of the development of society but does its best to eliminate it.

EXPECTABLE EFFECT OF TRANSPORT SYSTEMATOLOGY ON THE DEVELOPMENT OF TRANSPORTATION SCIENCES

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The technical planning of mobil and immobil components of transport is carried out by several, specific scientific means. Now we are able to realize the organization of these components into a transportation process by scientific methods, too. And recently one of the main research fields adjusting to special needs of transport is the planning of operative control of transportation processes and the information systems of transportation organizations by scientific means based on computer technics. Interdisciplinary knowledge, especially the definitely developing transport system theory, will result the research and systematization of scientific knowledge that make the planning of static and dynamical structures of complete transport organizations possible. In the centre of this work is the structure and function analysis of the mentioned organizations that they should be treated more exactly and integrated by the application of information technics and control principles. System theoretical research is oriented to organizational components not to subbranch ones. It is to ensure the integrated treatment of transportation demand, way, vehicle, technology, transport information technics among the subbranch and each other. Besides the wide use of existing scientific fields it requires and results in the further development of branches of disciplines that are able to treat transportation only, specially and scientifically.