The determination of the dynamic loading of the bearing structures of the main types of freight wagons with the actual dimensions under the main operating conditions is carried out. The inertial coefficients of the bearing structures of the wagons are determined by constructing their spatial models in the SolidWorks software package. Two cases of loading of the bearing structures of the wagons — in the vertical and longitudinal planes — have been taken into account. The studies were carried out in a flat coordinate system. When modeling the vertical loading of the bearing structures of wagons, it was taken into account that they move in the empty state with butt unevenness of the elastic- viscous track. The bearing structures of the wagons are supported by bogies of models 18-100. The solution of differential equations of motion was carried out by the Runge-Kutta method in the MathCad software package. When determining the longitudinal loading of the bearing structures of wagons, the calculation was made for the case of a shunting collision of wagons or a “jerk” (tank wagon). The accelerations acting on the bearing structures of the wagons are determined.

The research results will help to determine the possibility of extending the operation of the bearing structures of freight wagons that have exhausted their standard service life.

It has been established that the indicators of the dynamics of the load-carrying structures of freight wagons with the actual dimensions of the structural elements are within the permissible limits. So, for a gondola wagon, the vertical acceleration of the bearing structure is 4.87 m/s², for a covered wagon — 5.5 m/s², for a flat wagon — 5.8 m/s², for a tank wagon — 4.25 m/s², for a hopper wagon — 4.5 m/s². The longitudinal acceleration acting on the bearing structure of a gondola wagon is 38.25 m/s², for a covered wagon — 38.6 m/s², for a flat wagon — 38.9 m/s², for a tank wagon — 27.4 m/s², for a hopper wagon — 38.5 m/s². This makes it possible to develop a conceptual framework for restoring the effective functioning of outdated freight wagons.

The conducted research will be useful developments for clarifying the existing methods for extending the service life of the bearing structures of freight wagons that have exhausted their standard resource.

**Keywords:** freight wagon, bearing structure, dynamic loading, modeling of loading, dynamic indicators, service life, railway transport, transport mechanics.

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This research aims to simulate structural steel 400 (SS400) material as an alternative material for the electric bus's chassis structure. The kind of the material is low carbon steel. The SS400 material is produced from one of the largest steel mills in Indonesia, considered a local material. The local material used to increase the total domestic content in electric cars in Indonesia could be improved. Generally, the reverse engineering method of the R260 ladder frame type chassis is used to increase the local content in electric vehicles. However, this research used a ladder frame of type SS400 from local material to fulfill the local content of vehicle (EV)-bus chassis with the reverse engineering method. After the model was successfully created using the finite element software, statics analysis was carried out using the von Mises stress and the simulation results’ deflection. The meshing process of the chassis structure is carried out in such a way as to assume global contact. Loading was evenly carried out over the two main beam ladder frames totaling 14,200 kg. The elasticity modulus and tensile strength values used for the material are 190 GPa and 480 MPa. Furthermore, the support was placed in the mounting position of the front and rear wheel leaf springs at a front, rear overlay, and wheelbase distance of 2,380 mm, 3,290 mm, and 6,000 mm. The resulting approach was carried out using a beam model with a two-overhang beam model. The simulation results showed that type SS400 from the local material obtained a maximum von Mises stress value of 73.8 MPa, deflection of 2,568 mm, and the lowest safety factor of 3.2. Meanwhile, through theoretical calculations, the obtained stress occurred in 72.33 MPa and deflection of 2.594. There is no significant difference between simulation results and theoretical results.

**Keywords:** chassis, ladder frame, von Mises stress, low carbon steel, electric vehicle.

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A COMPREHENSIVE PROCEDURE FOR ESTIMATING THE STRESSED-STRAINED STATE OF A REINFORCED CONCRETE BRIDGE UNDER THE ACTION OF VARIABLE ENVIRONMENTAL TEMPERATURES (p. 23–30)

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This paper reports the full-scale experimental measurements of temperature distribution over the surfaces of bridges’ steel-concrete beams under the influence of positive and negative ambient temperatures. It has been established that the temperature is distributed unevenly along the vertical direction of a bridge’s steel-concrete beam.

It was found that the metal beam accepted higher temperature values. The maximum registered temperature difference between a metal beam and a reinforced concrete slab at positive ambient temperatures was +9.0 °C, and the minimum temperature difference was −2.1 °C.

The mathematical models for calculating a temperature field and a thermally strained state of bridges’ steel-concrete beams under the influence of variable climatic temperature changes in the environment have been improved, taking into consideration the uneven temperature distribution across a bridge’s reinforced concrete beam. The possibility has been established to consider a one-dimensional problem or to apply the three-dimensional estimated problem schemes as the estimation schemes for determining the thermo-elastic state of reinforced concrete bridges.

The temperature field and the stressed state of bridges’ reinforced concrete beams were determined. It was found that the maximum stress values are at the place where a metal beam meets a reinforced concrete slab. These stresses amount to 73.4 MPa at positive ambient temperatures, and 69.3 MPa at negative ambient temperatures.

The amount of stresses is up to 35 % of the permissible stress values. The overall stressed-strained state of a bridge’s reinforced concrete beams should be assessed at the joint action of temperature-induced climatic influences and loads from moving vehicles.

Keywords: road bridge, reinforced concrete beam, temperature fields, temperature stresses, ambient temperature.

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DEVELOPMENT OF A TECHNIQUE FOR COMPUTER SIMULATION OF THE STRESS STATE OF THE DRIVE DRUM SHELL OF A BELT CONVEYOR TO OPTIMIZE ITS DESIGN PARAMETERS (p. 31–39)

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The paper considers the method of computer simulation of the stress-strain state of the drive drum shell in the NASTRAN integrated environment. Due to the complexity of determining stresses and deformations in the drum sections by the analytical method, it is proposed to solve this important problem using the numerical finite-element method. At the preliminary stage of computer modeling, a mechanical design scheme was developed, including a variable pressure that changes depending on the angle of rotation of the drum, the deterministic relations describing the variable force factors are based on the Euler ratio. It is also proposed to take into account the pressure from the variable friction force, which depends on the changing coefficient of adhesion of the belt to the drum. As a result of the computer calculation, the equivalent Mises stresses of 65 MPa were determined, the safety factor was 4.2 and the components of the tangential stresses were determined using the...
stress tensor marker, the shear stress reached the level $\tau=16$ MPa for fabric tape and $\tau=5.14$ MPa for rubber tape. According to the results of the calculation, the dependence of the tangential stresses on the angle of rotation of the drum was constructed. A diagram of the change in the component of tangential stresses along the forming shell of the drum was constructed.

Analysis of stress-strain state allowed us to determine the factor of safety of the drum shell. Based on the analysis of equivalent stresses, it is proposed to further calculate the durability of the drum using the method of long-term fatigue. The computer calculation of shear stresses in the component allows choosing the rational parameters of the lining, based on such indicators as peel strength and break, as well as determining the angle $61^\circ$ of the slab lining required to improve the reliability and traction ability of the pipeline.

**Keywords:** conveyor belt, durability, drive drum, stresses, deformation, finite-element method, lining.

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**IMPROVING THE ALGORITHM OF CHOOSING SPACING AND NUMBER OF STIFF SUPPORTS AGAINST A CONCENTRATED FORCE IN STEEL-CONCRETE BEAMS (p. 40–47)**

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A steel-concrete beam was taken as the study object. The algorithm of selecting the number of stiff supports for the steel-concrete beam loaded with a concentrated lateral force in the middle of the span has been refined. Stiff supports served to join the steel strip with concrete to ensure their joint performance. The algorithm was refined based on the condition of equality of the longitudinal force in the steel strip from the action of the calculated load and the maximum longitudinal force obtained after setting the supports. In this case, the longitudinal forces in all stiff supports, as well as the spacing of the stiff supports should be the same.

A disadvantage of the known algorithm consists in the complexity of determining the coefficient $\phi_2$ taking into account the effect of long-term concrete creep on the element deformation without cracks. This coefficient fluctuates widely and depends on many factors. Besides, it is also insufficiently studied.

Calculations for determining the number and spacing of stiff supports in a steel-concrete beam were conducted according to the proposed algorithm and in the Lira software package. The forces acting on the supports and spacing of the supports were the same. The force acting in the support was $8941.5$ N. When selecting characteristics of the steel-concrete beam, maximum longitudinal force in the steel strip was obtained. The longitudinal force amounted to $35726$ N. The same longitudinal force was obtained from the diagram of longitudinal forces obtained after setting the supports.

This study was aimed at improving the design of steel-concrete beams. A rational number and placement of stiff supports ensure savings: the required amount of building materials is reduced and their cost is reduced due to cutting labor costs for their manufacture and operation.

Keywords: steel-concrete beam, stiff support, spacing of supports, force in a support, reduced stiffness, graphic-analytical method.

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SOLVING A ONE MIXED PROBLEM IN ELASTICITY THEORY FOR HALF-SPACE WITH A CYLINDRICAL CAVITY BY THE GENERALIZED FOURIER METHOD (p. 48–57)

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Designing and constructing underground structures for various purposes, such as tunnels, mines, mine workings, necessitate the development of procedures for calculating their strength and reliability. The physical model of such objects worth considering is a homogeneous isotropic half-space that contains an infinitely long hollow cylinder, located parallel to its border. One can explore problems related to the mechanics of deformable solids for such a multiply connected body.

This paper reports the proofs of addition theorems of the basis solutions to the Lamé equation for the half-space and cylinder written, respectively, in the Cartesian and cylindrical coordinate systems. This result is important from a theoretical point of view in order to substantiate a numerical-analytical method – the generalized Fourier method. This method makes it possible to solve spatial boundary problems from the theory of elasticity and thermo-elasticity for isotropic and transversal-isotropic multiply connected bodies. Similar to the classical Fourier method, the general solutions to equilibrium equations have been used here but in several coordinate systems rather than one.

From a practical point of view, this method has made it possible to investigate the mixed problem of elasticity theory for the multiply-connected body described above. The analysis of the stress-strain state of this elastic body has made it possible to draw conclusions on determining those regions that are most vulnerable to destruction. The highest values are accepted by normal stresses in the region between the boundaries of the half-space and the cylinder. Changing the σ₁ component along the Ox axis corresponds to the displacements assigned on the half-space. The τₓᵧ component contributes less to the distribution of stresses than σ₁ and σᵧ. The applied aspect of using the reported results is the possibility to apply them when designing underground structures.

Keywords: addition theorems, Lamé equation, generalized Fourier method, half-space, cylindrical cavity.
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DESIGNING A SHOCK TEST SYSTEM PROTOTYPE BASED ON A HYDROELASTIC DRIVE (p. 58–65)

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Laboratory shock tests involve the reproduction of simple one-time and repeated pulses of a certain waveform. In practice, such mechanical impacts on an object are implemented at specialized testing equipment – shock systems.

A promising direction in the development of shock machines includes the structures that operate on the energy of elastic deformation of the compressed liquid and the shell of the vessel that contains it. Such systems make it possible to improve the versatility, manageability, and accuracy of impact tests.

Underlying this study is the use of a hydroelastic drive to design a prototype of the automated electro-hydraulic system for a shock test system.

The proposed shock test system prototype makes it possible to expand the functionality of the installations to perform impact tests with a series of pulses, as well as improve manageability and increase the level of automation. The main feature of the proposed structural scheme is that the reconfiguration for a new impact pulse occurs very
quickly. Owing to the presence of a driven rotary drum with braking devices, the bench makes it possible to generate a shock pulse repetition frequency of 1–2 Hz.

The constructed mathematical model of the shock machine takes into consideration the inertia of moving masses, the rigidity of the liquid or “one-way” spring of the charging chamber, as well as the influence of dampers on which the test platform rests. The variables in the mathematical model are linked by differential equations describing two periods within a shock system work cycle: charging and pulse generation. The model’s practical value is to determine the dynamic characteristics of the test installation, as well as to calculate the required structural and technological parameters.

The differential equations describing the movements at the shock machine have been solved in a numerical way. The study results have established the optimal value (in terms of minimizing the overload on an article on the return stroke of the rod) for the damping factor of the braking device, which is 13,000 kg/s. In this setting, the ratio of the amplitude of acceleration on the reverse stroke to the amplitude of effective acceleration during tests is reduced to a minimum of 0.195.

**Keywords:** shock test system, hydroelastic drive, damping factor, impact acceleration.

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**ANALYTICAL STUDY OF AUTO-BALANCING WITHIN THE FRAMEWORK OF THE FLAT MODEL OF A ROTOR AND AN AUTO-BALANCER WITH A SINGLE CARGO (p. 66–73)**

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This paper reports the analytically established conditions for the onset of auto-balancing for the case of a flat rotor model on isotropic elastic-viscous supports and an auto-balancer with a...
single load. The rotor is statically unbalanced, the rotation axis is vertical. The auto-balancer has a single cargo – a pendulum, a ball, or a roller. The balancing capacity of the cargo is equal to the rotor imbalance.

The physical-mathematical model of the system is described. The differential equations of motion are recorded in dimensionless form relative to the coordinate system that rotates synchronously with the rotor. The so-called main movement has been found; in it, the cargo synchronously rotates with the rotor and balances it. The differential equations of motion are linearized in the neighborhood of the main movement. A characteristic equation has been constructed. It helped investigate the stability of the main movement (an auto-balancing mode) for the cases of the absence and presence of resistance forces in the system.

It was established that in the absence of resistance forces in the system:

- the rotor has three characteristic rotational speeds, and the first always coincides with the resonance frequency;
- auto-balancing occurs when the rotor rotates at speeds between the first and second ones, and above the third characteristic speed;
- the value of the second and third characteristic speeds is significantly influenced by the ratio of weight to the mass of the system;
- the second and third characteristic speeds monotonously increase with an increase in the ratio of cargo weight to the mass of the system.

Resistance forces significantly affect both the values of the second and third characteristic speeds and the conditions of their existence. Small resistance forces do not change the quality behavior of the system. With high resistance forces, the number of characteristic speeds decreases to one.

The paper reports the results applicable to an auto-balancer with many cargoes when it balances the imbalance that equals the balancing capacity of the auto-balancer.

**Keywords**: passive auto-balancer, rotor, automatic balancing, static balancing, motion stability, static imbalance.

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**THEORETICAL STUDY OF THE GRATE-SAW-TYPE LARGE-LITTER CLEANER OF THE MOUNTED TYPE**

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This paper reports a theoretical study into the saw-type-grate section of a large litter cleaner in mounted cleaners that operate on a cotton harvester, as well as the theoretical and experimental justifications for its parameters. The effect exerted by a mounted cleaner on the process of cleaning raw cotton when processing in a cotton gin has been studied.
A theoretical model of the impact of grates on weeds in cleaning processes has been developed. A condition for repelling the litter by grates and removing it from a cotton technological flow has been studied. The use of grates with a flat-shaped front edge allows for a steady reduction in the amount of damage in the raw cotton fiber, which improves the fiber quality and leads to a decrease in the number of defects and debris.

The experimental and theoretical studies have produced evidence that enables the efficient operation of mounted-type cleaning machines in the cotton-cleaning industry.

The movements of raw cotton as a viscoelastic body at the free impact of litter with the teeth of the saw against a stationary surface of the grate were investigated; the force schemes between the grates and saws were considered. The effect of a saw-type drum on the technological properties of raw cotton was investigated, namely on seed damage and the formation of the free fiber.

A model of interaction between weed particles and grates was considered; the trajectories of the litter flight were shown in the function of the slope of the grate and the recovery factor.

The issues of the relationship between the physical-mechanical properties of raw cotton, the elastic characteristics of raw cotton, and the impact force of cotton flies against the grate with a flat working face. Solving these issues could make it possible to determine the optimal structure of the raw cotton cleaning mechanisms, which would improve the effectiveness of cleaning raw cotton from weeds.

Based on the identified functional links, it has become possible to construct new or improve existing structures of the saw-type grate section of mounted cleaners. Practical experience shows that the use of the designed structure in large litter cleaners of the mounted type produces a significant increase in the cleaning effect of the machine.

**Keywords:** mounted cleaner, large litter, grate, seed damage, free fiber, cleaning effect.

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**DESIGN OF IMPACT DAMPERS FOR TRANSPORTING CARGOES BY TWO-LINK VEHICLES (p. 85–94)**

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This paper considers the influence of the transitional modes of movement (acceleration, braking) of a multi-link vehicle on the vibration protection of transported non-fixed or partially fixed cargoes. The impact phenomenon, in this case, can be strengthened by the existence of coupling mechanisms between the links of a multi-link vehicle. To reduce such horizontal impact loads, it is advisable to use elements with viscoelastic damping in the coupling devices of a multi-link vehicle. To study the actual impact phenomena during the transportation of non-fixed or partially fixed cargoes under the extreme modes of movement of two-link vehicles, it is proposed to use a flat two- and three-mass dynamic model with viscoelastic damping. At the same time, the theory of elastic impact has been applied while the elastic-damping characteristics of vehicles’ suspensions were not taken into consideration.

It has been shown that the reported research results make it possible to estimate the approximate values of the mechanical parameters for restrictive devices that protect non-fixed or partially fixed cargoes from impact, during the transition modes of transportation, depending on the conditions of motion.

This practically makes it possible to select the rational design parameters for the elements of viscoelastic restrictive devices, in particular elastic elements and dampers, in order to reduce impact loads...
on non-fixed heavy cargoes during transportation under extreme modes of movement.

Based on this study, a procedure of vibration protection of non-fixed or partially fixed cargoes in the body of a two-link vehicle during its uneven movement has been proposed, which implies determining the maximum dynamic loads on these cargoes as well as the possibility of choosing the rational design parameters for restrictive devices in order to prevent or reduce the impact of these cargoes hitting the restrictive devices.

Keywords: transportation, cargo, multi-link vehicle, estimation scheme, extreme mode, impact, vibration protection, differential equations.

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Визначення динамічної навантаженості несучих конструкцій вантажних вагонів з фактичними розмірами (с. 6–14)

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Проведено визначення динамічної навантаженості несучих конструкцій основних типів вантажних вагонів з фактичними розмірами при основних експлуатаційних режимах. Інерційні коефіцієнти несучих конструкцій вагонів визначені шляхом побудови їх просторових моделей в програмному комплексі SolidWorks. До уваги прийнято два випадки навантаженості несучих конструкцій вагонів – у вертикальній та повздовжній площинах. Дослідження проведені в плоскій системі координат. При моделюванні вертикальної навантаженості несучих конструкцій вагонів враховано, що вони рухаються у порожньому стани стискою верністю пружно-вязкою колією. Несучі конструкції вагонів обираються на візки моделей 18-100. Розв'язок диференціальних рівнянь здійснений за методом Рунге-Кутта в програмному комплексі MathCad. При визначенні повздовжньої навантаженості несучих конструкцій вагонів розрахунок проведений для випадку маневрового співударяння вагонів або “ривка” (вагон-цистерна). Визначені прискорення, які діють на несучі конструкції вагонів. Результати досліджень сприятимуть визначенню можливості подовження експлуатації несучих конструкцій вантажних вагонів, які вичерпали свій нормативний строк служби.

Ключові слова: вантажний вагон, несуча конструкція, динамічна навантаженість, моделювання навантаженості, динамічні показники, ресурс експлуатації, залізничний транспорт, транспортна механіка.
У статті розглядається метод комп'ютерного моделювання напружено-деформованого стану обичайки приводного барабана в інтегрованому середовищі NASTRAN. У зв'язку зі складністю визначення напружень і деформацій в секціях барабана аналітичним методом пропонується вирішити що важливу задачу чисельним методом скинчених елементів. На попередньому етапі комп'ютерного моделювання була розроблена механічна розрахункова схема, що включає змінний тиск, що змінюється залежно від кута повороту барабана, детерміновані співвідношення, що описують змінні коефіцієнти зусиль, засновани на залежності Ейлера. Також пропонується враховувати зміни залежно від змінної сили терті, яка залежить від змінного коефіцієнта залежності стрічки барабана.

В результаті комп'ютерного розрахунку були визначені еквівалентні напружения по Мізесу 65 МПа, коефіцієнт запасу міцності 4,2 і компоненти дотичних напружень з використанням маркаера тензора напружень, напружения змінюються від 16 МПа для тканиної стрічки і та 3,14 МПа для гумової стрічки. За результатами розрахунку побудована залежність дотичних напружень від кута повороту барабана. Побудована діаграма зміни складової дотичних напружень по формуючій обичайці барабана.

Аналіз напружень проведений на основі аналогічних напружень на основі обчислених напруженнях пропонується швидко розрахувати приводні барабани методом триалої витoku. Ком'ютерний розрахунок змінних напруження в компоненті дозволяє вибрати раціональні параметри футеровки виходячи з таких показників, як міцність на відновлюваність, як також визначення надійність і кількості зусильля при протитрібному транспортуванні. 

| Ключові слова: | комп'ютерна стрічка, довговічність, приводний барабан, напруження, деформація, метод кінцевих елементів, футеровка. |

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В дослідженні розглянуто метод комп'ютерного моделювання напружено-деформованого стану сталебетонних балок. Розглядалися уточнення і примітки до вдосконалення комп'ютерного моделювання напружено-деформованого стану сталебетонних балок.

- Установлено, що випадки згідно з температурним полям для сталебетонних балок.
- Визначення температурного поля в сталебетонних балках встановлено.
- Математичні моделі застосування сталебетонних балок.
- Установлено, що випадки згідно з температурним полям для сталебетонних балок.
- Встановлено, що випадки згідно з температурним полям для сталебетонних балок.

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[Спрощена версія]
При проектуванні і будівництві підземних споруд різного призначення, таких як тунелі, шахти, гірничі вироби, виникає необхідність в створенні методик розрахунку їх міцності і надійності. Фізичною моделлю таких об'єктів можна вважати однорідний ізотропний напівпростір, що містить нескінченно довгий порожній циліндр, розташований паралельно до його границі. Для такого багатозв'язного тіла можна досліджувати здатні механіки деформівного твердого тіла.

Наведено доказ теорем додавання базисних розв'язків рівняння Ламе для півпростору і циліндра, записаних відповідно в декартовій і циліндричній системах координат. Цей результат є важливим з теоретичної точки зору для обґрунтування численно-аналітичного методу – узагальненого методу Фур'є. Цей метод дозволяє розв'язувати просторові крайові задачі теорії пружності та термо-пружності для ізотропних та трансверсально-ізотропних багатозв'язних тіл. Як і в класичному методі Фур'є, тут використовуються загальні розв'язки рівняння, риновани, але не в один, а в декількох системах координат.

В результаті цих робіт встановлено, що основна задача теорії пружності в описаному вище багатозв'язному тілі. Про-ведення аналізу напівпростору в однокомпонентному прикладі дає змогу розробити висновки про визначення областей, які є найбільш узагальненими для розрахунку. Знайомство з цим полегшують визначення зазначених вище напруження багатозв'язного тіла. Зміна компоненти $\sigma_t$ по осі $t$ відповідає заданій на півпросторі переміщення. Компоненти $\sigma_r$, $\sigma_\theta$, $\tau_{\theta r}$ вносять менший внесок в розподіл напружень,

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Розроблено аналітичну модель ударного випробувального стенду. Переналаштування відбувається дуже оперативно. Завдяки наявності демпфування у підземних споруд.

Ключові слова: теореми додавання, рівняння Ламе, узагальнений метод Фур'є, напівпростір, циліндрична порожнина.
– у роторі існують три характеристики швидкостей обертання, причому перша завжди співпадає з резонансною частотою;
– автобалансування настає при обертанні ротора з швидкостями, що знаходяться між першою і другою, та над третьою характеристиками швидкостей;
– на величинах другої і третьої характеристик швидкостей істотно впливає співвідношення маси вантажу до маси системи;
– друга і третя характеристики швидкості монотонно зростають із зростанням відносної маси вантажу до маси системи.
Сили опору істотно впливають на якість другої і третьої характеристики швидкостей, так і на умови їх існування. Малі сили опору не змінюють якоїсь поведінки системи. При великих силах опору кількість характеристичних швидкостей зменшується до однієї.
Одержані результати застосовують для автобалансира з багатьма вантажами, коли вони балансирують незрівноважені вантажі.

Ключові слова: пасивний автобалансир, ротор, автоматичне балансування, статичне балансування, стійкість руху, статична незрівноваженість.

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ТЕОРЕТИЧНІ ДОСЛІДЖЕННЯ КОЛОСНИКОВО-ПІЛЬЧАТОГО ОЧИЩУВАЧА ВЕЛИКОГО СМІТТЯ НАВІСНОГО ТИПУ (c. 74–84)

Husnu Karimov, Esmira Mustafayeva, Elman Jafarov, Terane Safarova, Fazil Veliev

Проведено теоретичні дослідження пильчато-колосникової секції очищувача габаритного сміття в навісних очисниках, що функціонує на багатоланковій машині, теоретичні та експериментальні обґрунтування його параметрів. Вивчено вплив навісного очищувача на технологічний процес очищення землі при переробці на звітно-полів. Розроблено теоретичні моделі впливу колосників на сміття з інших процесів. Внутрішню умову відображено в очищувачі колосниками, що змінюють кількість пошкоджень у власному засобі очищування, яка призводить до зниження сили відносної маси і засміченості у транспортних засобах.

Досліджено вплив перехідних режимів руху (розгон, гальмування) багатоланкового транспортного засобу на віброзахист транспортованих вантажів. Розглянуто вплив віброзвоз закону, величини резонансної частоти автобалансера, а також вплив величини швидкостей обертання ротора на віброзвоз закону, величини резонансної частоти автобалансера, а також вплив величини швидкостей обертання ротора на віброзвоз закону, величини резонансної частоти автобалансера, а також вплив величини швидкостей обертання ротора на віброзвоз закону, величини резонансної частоти автобалансера. Розглянуто вплив перехідних режимів руху (розгон, гальмування) багатоланкового транспортного засобу на віброзвоз закону, величини резонансної частоти автобалансера, а також вплив величини швидкостей обертання ротора на віброзвоз закону, величини резонансної частоти автобалансера, а також вплив величини швидкостей обертання ротора на віброзвоз закону, величини резонансної частоти автобалансера. Розглянуто вплив перехідних режимів руху (розгон, гальмування) багатоланкового транспортного засобу на віброзвоз закону, величини резонансної частоти автобалансера, а також вплив величини швидкостей обертання ротора на віброзвоз закону, величини резонансної частоти автобалансера, а також вплив величини швидкостей обертання ротора на віброзвоз закону, величини резонансної частоти автобалансера.

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