

## ENGINEERING GEOMETRY AND COMPUTER GRAPHICS

**Эдвин Козневски**

Статический момент для многоугольника и его применения

Обсуждается применение геометрии крыш (прямой каркас) и, связанных с этим, диаграмм Вороного для полигонов, применяемых при решении задач оптимизации, таких как определение маршрутов съемок областей с минимальными статическими моментами по сторонам многоугольников. Объясняется специальная интерпретация понятия статического момента относительно отрезка линии и многоугольника относительно границы, и сформулирована и доказана соответствующая теорема. Также указаны примеры потенциальной занятости этих понятий.

**Ключевые слова:** геометрия крыши, прямой каркас, диаграмма Вороного для многоугольника, статический момент относительно границы многоугольника, земляные работы, навигационная система ГИС

## MECHANICS

**P. D. Balakin, I. P. Zgonnik**

Long-stroke mechanisms with minimal side reaction in translational pair

Long-stroke mechanisms with minimal side reaction in the translational pair are presented. The variants of technical solutions of long-stroke mechanisms that meet inconsistent criteria for minimization of both lateral reaction in the progressive pair and dimensions-mass characteristics are given. A promising solution has been proposed and recommendations on composition of geometric constraints in kinematic pairs has been developed. The proposed technical solutions are generally aimed at increasing the resource of long-stroke mechanisms.

**Keywords:** long-stroke mechanisms; minimization of lateral reaction; increasing the resource.

**Yu. A. Burian, A. V. Zubarev, S. N. Polyakov**

On possibility of creating hydrodynamic noise distributed silencer in single-flow rubber cord pipe

The paper considers the principal possibility to increase the efficiency of rubber-cord single-flow pipe branches with the help of an organization in the framework of a single construction with flexible insertion of a waveguide silencer absorber of hydrodynamic noise.

It is shown that the filling of the space between the pipe branch body and the inner rubber tube with flexible walls with porous rubber with metallic inclusions forms a waveguide sound silencer.

In the model example, the frequency range boundaries of the sound wave locking in the device under consideration are determined.

**Keywords:** rubber-cord pipe branch, hydrodynamic noise, waveguide silencer, bulk modulus, frequency range.

## POWER AND CHEMICAL ENGINEERING

**V. I. Karagusov, I. S. Kolpakov, V. A. Nemykin, I. N. Pogulyaev**

Experimental investigation of radiation life support system with vacuum and air heat insulation

Radiation heating systems for residential, office, industrial and other premises are actively used in many regions of the planet. Nevertheless, the potential of radiation energy is involved in small amounts. Moreover, radiation systems can not only heat the rooms, but also cool them or other objects.

If to place the radiation panel in a certain way, it can radiate more energy than getting back from the environment or vice versa, getting more energy than radiating it to the environment. As a result, its temperature can be lower than the ambient temperature, which allows to obtain a cooling capacity without energy consumption. The temperature can be higher than the ambient air, which makes it possible to obtain thermal energy from the sun. These processes are environmentally friendly and refer to renewable energy sources.

**Keywords:** radiation life support systems, vacuum heat insulation, multi-layer screen insulation, heating, cooling, solar radiation, renewable energy sources.

**V. L. Yusha, G. I. Chernov, A. M. Kalashnikov**

Comparative analysis of efficiency of different types of thermal insulation in heat exchanger-utilizer of heat loss recovery system of mobile compressor units

In this paper, a comparative theoretical analysis of the efficiency and applicability of some known types of thermal insulation in relation to the regimes typical for the MCU recovery systems is carried out. The study is carried out numerically by modeling heat transfer processes in the «coolant-wall-hot gas-snack-insulation-environment» system, i.e. in a simplified version of the recuperative heat exchanger. As the external insulation of the heat exchanger, four most common types of insulation are used: foam insulation materials, fibrous, vacuum and active water insulation.

**Keywords:** heat recovery, heat flow, heat exchange, heat losses, heat exchanger, thermal efficiency, pipes.

**A. D. Vanyashov**

Application of methods of recalculation of gasdynamic characteristics of multi-staged and multisection turbocompressors on other conditions of work in various technological installations

The analysis of influence of methods of count of gasdynamic characteristics of multistage and multisection centrifugal compressors on other working conditions (productivity, pressure, temperature, composition of gas on an input in the compressor, rotating speed of a rotor), on the form of the gasdynamic characteristic, the range of operating modes is made. Real production objects on blueprint stages, tests, maintenance are considered. In the course of approbation of calculation methods of count project data are used as the experimental. Recommendations are given and scopes of an advanced method of stage-by-stage count of gasdynamic characteristics of the compressor taking into account a mismatch in operation of steps are defined.

**Keywords:** turbocompressor, multistage centrifugal compressor, recalculation of gasdynamic characteristics, compressor station, mismatch of steps.

**A. A. Dzino, A. N. Noskov, O. S. Malinina**

Ways to increase efficiency of aggregates on gas pumping gas trunk pipelines

When transporting produced natural gas with the help of gas-pumping units, a large amount of low-temperature heat is generated. When calculating the direct thermodynamic cycle, water and alternative working substances are considered. For the more efficient use of waste heat in the forward cycle, instead of a blade turbine, the use of a screw expander with dry saturated steam at the inlet is proposed. Results are obtained on the calculation of the compressor station and gas turbine plant, on the basis of which the most preferred working substance for the forward cycle is chosen.

**Keywords:** natural gas, gas-pumping units, waste low-temperature heat, direct cycle, water, alternative working substances, screw expander.

**V. A. Maksimenko, V. V. Maksimenko, A. Zh. Shirazhiev**

Development of design and methods for soil directional thermostabilizer simulation

This article is devoted to the study of the directional thermostabilizer efficiency. A parametric analysis determining the freezing radius on the central angle of the evaporation zone active surface dependence is performed. The frost halo results comparison, that is obtained in the ANSYS environment made around a symmetric and directional action thermostabilizer.

**Keywords:** directional action thermostabilizer, symmetric action thermostabilizer, thermostabilization, frozen soil, seasonal cooling device, ANSYS.

**E. V. Svichkar, N. K. Nikulin, K. E. Demikhov**

Method for calculating pumping characteristic of high-vacuum system with turbomolecular vacuum pump

The pumping characteristic of a high-vacuum system depends on a number of factors: the pumping characteristics of a high-vacuum turbomolecular pump (TMN), the conductivity of connecting lines, the pumping characteristics of a for vacuum pumping system, the leakage of gas into the system, namely gas release streams, gas flows due to leakage of structural elements. The influence of these factors on the pumping characteristic of the vacuum system with TMN is considered in the work. A method for determining the parameters of a fore-vacuum pump providing an improvement in the vacuum characteristics of a vacuum system with TMN at elevated suction pressures is proposed.

**Keywords:** vacuum system, pumping characteristic, forvacuum, pressure, turbomolecular pump, conductivity, speed of action, flow.

**N. Yu. Filkin, V. L. Yusha, A. A. Kapelyukhovskaya**

The increase in gas-dynamic efficiency of filters with short diffuser when operating in swirling flow

The article is devoted to the problem of increasing the gas dynamic efficiency of gas filters with a short diffuser when working in a swirling flow, the perturbation of which is caused by the presence of local resistance. To increase the gas dynamic efficiency, installation of a concentric guides in the flowing part of the short diffuser is suggested, as well as an engineering technique for calculating such guides. Numerical and experimental studies of the gas filter are carried out when working in a stream swirling by means of a tee, with the installation and without the installation of a concentric guides in a flowing part, comparative results of the studies are presented. Based on the results of the research, the efficiency of concentric guides in the conditions of a swirling flow is confirmed, and the gas-dynamic

efficiency of the gas filter is improved in comparison with the version without the installation of guides in the flowing part of the short diffuser.

**Keywords:** gas filter, short diffuser, gas dynamic efficiency, swirling flow, concentric guides, velocity field profile, aerodynamic resistance.

## AVIATION AND ROCKET-SPACE ENGINEERING

### **V. I. Kuznetsov, O. A. Sharikov**

Vortex method of complex purification from mechanical pollution by impurities of surface and bottom layers of water bodies with use of vortex separators: (separators-confusers, cyclones-confusers)

The method of purification from mechanical pollution by oil, oil products, other materials of surface and bottom surfaces of water bodies with the use of vortex equipment: swirlers, vortex tubes, separators – confusers, cyclones is described – confusers, as well as floating vehicles, overpasses, storage tanks, which consists in a consistent separation of the surface layers of polluted water reservoir, de-buoyancy of the bottom layers and, subsequent separation formed, at the same time, the mechanical mixture to the required concentration and combination therein, components, simultaneous enrichment of the resulting semi-finished products and their separation into specific, used in practice materials and substances, transportation of these materials and substances to the packaging for further sale or environmentally friendly disposal.

The problem is solved by using the properties of vortex flows of mechanical mixtures, the system application of separators – confusers, cyclones – confusers and creating a new method of complex purification of impurities from surfaces and bottom layers of water bodies by forming counter main flow, swirling flows of mechanical mixtures and managing them in space. The technical result is achieved by improving the technological process of separation of mechanical mixtures, its depth, integrated use of equipment and improve the efficiency of processes.

The analysis of literary sources confirms the conclusion that the proposed method has no analogues in the world practice.

**Keywords:** separator-confuser, cyclone-confuser, swirl, vortex flows, swirl effect confuser.