

RECENT DEVELOPMENT OF THE STRENGTH OF THEORY IN THE FIELD OF MATERIAL MECHANICS

1. Statement of the problem

In the course of Strength of Materials complex of rules and methods is worked out for solving simple tasks of strength in engineering.

At the same time, the practice demands to solve more complex problem. It is necessary to provide special research for solving.

The future mechanical engineers, the practical work of which is connected with problems of strength of structure, have to image the problems, which appear up the scientists on modern stage of technical progress.

These problems are in the design and calculation for strength and stiffness real parts, on which certain force and thermal loads act. It is necessary to select the most suitable materials for optimal work, conditions of exploitation, minimum weight, optimal design forms and technological treatment.

These problems are provoked by technical progress level and by perspective of its dynamic development.

In recent conditions of development of science and technics when new types of materials, having specific properties, are being appeared, the views on such materials and level their strength were changed. The creation of new materials, and in the first turn composites, is the problem not only material engineering, but also calculate engineers. In many cases, it is necessary to create the new materials, in which forming compositions are situated by rational manner. Very often many materials are being created with in advance given properties, obtaining optimal work of the part with due regard exploitation conditions and character of force and thermal loads.

In present time, imagination about modern problems is changed essentially. Such problems creates as a rule in connection with realization of government program for using the modernist discoveries in physics, mechanics, biology and other natural sciences. These are programs, connected with use of atomic energy and space-opening. Namely, in these branches, we have very exploitation conditions of work of constructional parts as in relation of intensity of environment influence and level of force and thermal loading so and in relation of these influences character in time. Generalizing these conditions, we have foundation to say, that in majority, these problems created during design of machine and constructors, which were working in external conditions, and its strength determined by safety and durability of whole machine.

2. Research analysis

Extreme conditions, essentially intensifying unstrengthening of materials in exploitation, are high temperature(up 3000–4000 K), low and very low temperatures, intensive irradiation, high

temperature gasses (products of combustion), containing chemical active mixture, metal alloys and seawater, and also combinations, acting simultaneously different enumeration factors.

The extremely conditions are also such conditions when we have lots of conditions of force and thermal fields, periodical or casual impulse loads and sharp change of temperature, i.e. real conditions, which there are in the most stationary energetic plants, planes, rockets turbines, bodies of ships and submarines, chemical plants, tube conductors, internal combustion engine, rolling stocks, excavators and so on.

The classical methods of strength theory without special investigation, especially experimental, do not allow to take account the influence of many factors, accompanying the real conditions of work, in problems of strength of constructor parts and to foresee its durability.

First of all, it is necessary to store experimental data about physic-mechanical properties for different materials in conditions, maximum closed to exploitation – extreme for this class of materials, that to get equations of material state in given conditions of force and thermal loads.

The simplest equation of condition, characterizing conduct of material under statically load, is graphic notion of dependence deformation of tested specimen from load, (diagram $P\Delta$ diagram of stress (σ_ε)). In other cases, there are graphic or analytic dependence, researched characteristics of strength (time, temperature, cycle ratio, intensity of irradiation and so on).

It is necessary to provide in the first turn experimental investigations of different aspects of strength of materials, because unstrengthening influence mentioned factors is impossible to calculate.

3. Conclusions

To correctly mention the-influence these factors to strength it is necessary to provide careful thinking over experiment. Analytic criterion dependence can be found only on foundation of many experimental data about material properties, o investigate strength and deformation properties of materials means learning it potential possibility to discover specific properties and conditions, in which using this material is optimal. In other case, it is necessary to determine additional modifications of technological and design character, which will be very important physics and mechanical properties of material, and for increasing its strength and durability for different conditions. The problems, which have to be solved in nearest time, are:

1. Investigation of strength in high temperature for hot strength and refractory materials in simple and complex resistance, under static momentary and long-time loads, alternating stresses and temperature change. Special attention has to be directed to learning long-time strength and endurance material in non-stable regimes force and thermal loads (separately and together).

2. Investigation of the main mechanical characteristics of strength and ductility of construction material in low temperature under static, alternative and impulse loads with account to design technological factors for obtaining equation of material state and basic centurions of limited condition and strength typical elements of construction in low temperature.

3. Research of influence of irradiation to momentary of longtime strength and ductility and also to other mechanical properties of constructional materials under different force and thermal loads, determination equation accounting effect of influence of irradiation.

4. Research of influence of aggressive medium (metal alloys, combustion, sea water and so on), to mechanical properties of constructional materials under longtime static and

alternative loads in conditional of normal and high temperatures to reveal effect of unstrengthening of material. It is necessary to select the optimal protective covers for such material.

5. To research of influence of different covers of materials to strength and ductility in high temperatures for optimization of cover type and technology.

6. To research of composite characteristics for optimization its, state and strength, determination of limited condition criterions for typical parts from.

Many institutes, academies, scientific institutes work out these problem in the worm.

The wide field of activities is open for students of mechanics, which are enlisted for investigations on the chair.

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Kravtsov M.K., Obolenskaya T.A., Sereda N.V., Beletskaya I.V. “Recent development of the strength of theory in the field of material mechanics”.

The article describes the problems in the design and calculation for strength and stiffness real parts, on which certain force and thermal loads act.

Key words: Extreme conditions, mechanical characteristics, strength.

Кравцов М.К., Оболенська Т.О., Середя Н.В., Білецька І.В. «Розвиток теорії міцності в області механіки матеріалів».

У статті розглядаються проблеми в галузі проектування та розрахунку на міцність і жорсткість елементів, на яких діють сили і теплові навантаження.

Ключові слова: екстремальні умови, механічні характеристики, міцність.

Кравцов М.К., Оболенская Т.А., Середя Н.В., Белецкая И.В. «Развитие теории прочности в области механики материалов».

В статье рассматриваются проблемы в области проектирования и расчета на прочность и жесткость элементов, на которых действуют силы и тепловые нагрузки.

Ключевые слова: экстремальные условия, механические характеристики, прочность.

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