NOVATEUR PUBLICATIONS
INTERNATIONAL JOURNAL OF INNOVATIONS IN ENGINEERING RESEARCH AND TECHNOLOGY [IJIERT]
ISSN: 2394-3696 Website: ijiert.org
VOLUME 7, ISSUE 11, Nov.-2020

CALCULATION FOR STRENGTH AT VOLTAGES CYCLICALLY CHANGING IN TIME

NUROVA OLIYA SALOMOVNA,

MURTAZAYEV ESHMUROD MUSTAFAYEVICH,

SAFAROV MEGLI DJUMAYEVICH,

NAZAROV ASROR ALLANAZAROVICH

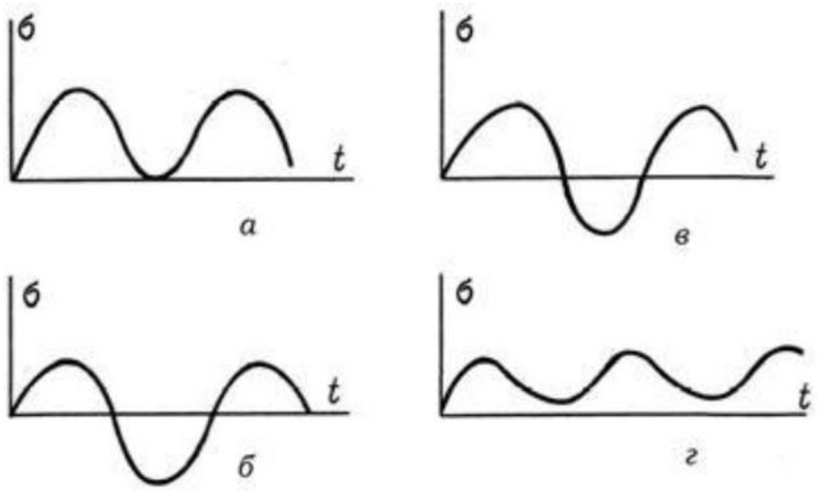
ABSTRACT
The action of variable loads is applied to such critical parts as axles of railway cars, gear wheels, crankshafts, turbine blades, piston rods, etc. Parts of machines and structures that are exposed to alternating loads for a long time can collapse suddenly without permanent deformations at stresses that are much lower than the ultimate strength.

KEYWORDS: fatigue, cycle, endurance, rods, dislocations, crystallographic, multiple, asymmetric cycle, crystal grains, amplitude, synchronicity, logarithmic.

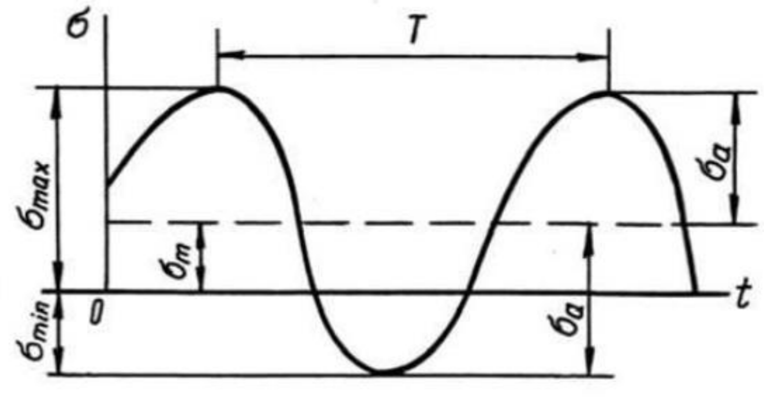
INTRODUCTION
To the action of loads, the resistance of materials that change in time in magnitude or in magnitude and sign is significantly different from the resistance of the same materials to static and shock action of loads. At the same time, under the action of variable loads, machine parts and structural elements are destroyed at significantly lower stresses than under the action of static loads. Such critical parts as axles of railway cars, gear wheels, crankshafts, turbine blades, piston rods, etc. are exposed to variable loads. Parts of machines and structures that are exposed to alternating loads for a long time can collapse suddenly without permanent deformations at stresses that are much lower than the ultimate strength. Since the fractures of parts usually do not occur immediately, but after a rather significant period of time of operation of a machine or structure, a hypothesis arose that under the action of alternating stresses, the metal "gets tired", changes its structure, becomes brittle from plastic. However, already at the beginning of the twentieth century, after studies of the structure of metals, it became clear that this hypothesis was incorrect, and the mechanism of fracture from variable loads was disclosed. Numerous experiments have established that if the level of stresses caused by alternating loads exceeds a certain limit, then irreversible processes of accumulation of 384 dislocations begin to occur in the material, which initiate the formation of cracks [3-6].
In turn, the concentration of stresses at the edge of the crack contributes to its further development. This process weakens the section, and when the crack reaches critical dimensions, the part or structure is destroyed without visible permanent deformations (suddenly). The process of accumulation of dislocations in a material under the action of alternating stresses, leading to crack formation and fracture, is called material fatigue. The ability of a material to resist fatigue is called endurance. It has been experimentally established that the mechanism of the fatigue fracture process is inextricably linked with the structural inhomogeneity of the material, the presence of various inclusions, crystal lattice defects, etc[1-6].
Failure under variable loads is usually local in nature and does not affect the entire material of the structure. Therefore, when developing cracks are found, in many cases there is no need to raise the question of changing the entire structure, it is enough to replace the damaged parts and eliminate the causes that caused the formation of cracks [2-5].
The physical theory of strength of solids is currently still at such a stage that it is impossible to create methods for calculating endurance on its basis. In this regard, the theory of fatigue strength of materials is built by accumulating experimental data, on the basis of which some rules for calculating endurance are formulated.

CHARACTERISTICS OF STRESS CYCLES
Fatigue failure occurs when one of the following load application features are present**:**

1) Multiple application of a load of the same sign (for example, 386 periodically changing from zero to maximum, pic. 1.2, a);
2) Repeated application of a load that periodically changes not only in magnitude, but also in sign (alternating loads), when the material endurance is simultaneously influenced by both repetition and variability of the loaded. At the same time, there are changes in the load in a symmetric cycle (Pic. 1.2, b) and an asymmetric change in the load (Pic. 1.2, c, d). The laws of change in loads, and therefore stresses in time, can be complex. Basically, in engineering practice, there are alternating voltages that repeat at regular intervals (cyclic voltages), and voltages that change according to the sinusoidal law.



Pic: 1.2. Load change laws**:**
а, г - loads, periodically varying in magnitude;
б - periodically changing in magnitude and sign;
в - asymmetric change in loads
The period of voltage change T is the time during which the voltage takes on its original value.
A cycle of alternating voltages is a set of voltages during one period.
Cycles of alternating voltages characterize its parameters (Pic. 1.3):



Pic. 1.3. AC voltage characteristic
1) Maximum stress b max in terms of algebraic value;
2) Minimum voltage $\sigma_{\min}$;
3) Average cycle voltage σ_m:

$$\sigma_m = \frac{(\sigma_{\max} + \sigma_{\min})}{2} \qquad (1.1)$$

The average value of the cycle is the time constant (static) component of the cycle (positive or negative);

4) cycle amplitude σ_a (half voltage difference $\sigma_{\max}$ and taking into account $\sigma_{\min}$ the sign):

$$\sigma_a = \frac{\sigma_{\max} + \sigma_{\min}}{2} \qquad (1.2)$$

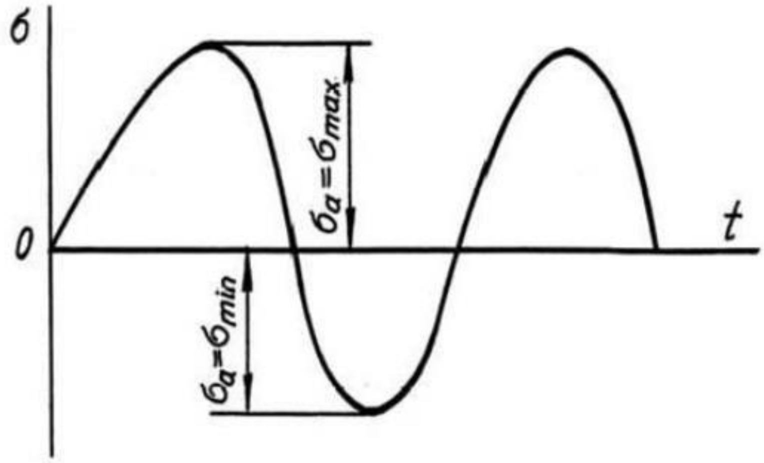
5) coefficient of asymmetry of the cycle R:

$$R = \frac{\sigma_{\min}}{\sigma_{\max}} \qquad (1.3)$$

If the signs of stresses $\sigma_{\max}$ and are different $\sigma_{\min}$, then the asymmetry coefficient is taken with a "-" sign [1]. Stress cycles that have the same value of the asymmetry coefficient are called similar.

VARIETIES OF STRESS CYCLES

A symmetric cycle is called such a law of voltage change, in which the maximum and minimum stresses are equal in absolute value $|\sigma_{\max}| = |\sigma_{\min}|$: (Pic. 1.4).



Pic. 1.4. Symmetrical voltage cycle

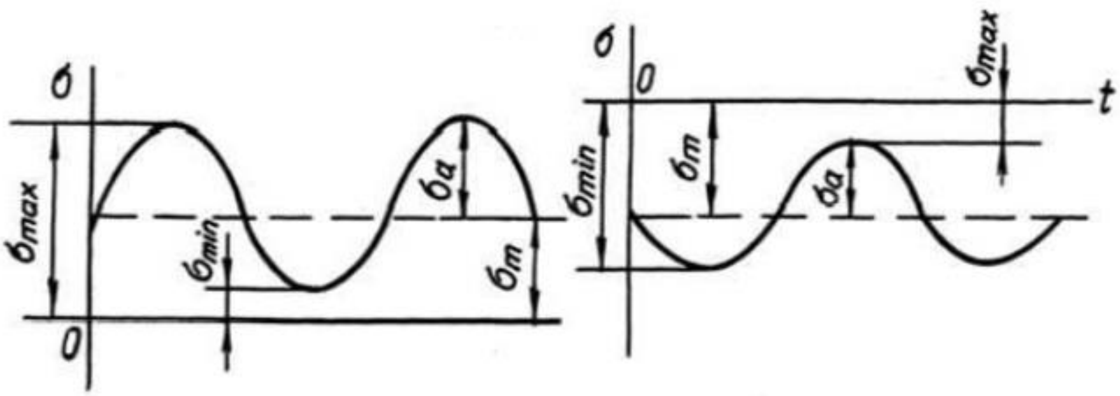
For symmetrical cycle voltages: $\sigma_{\max} = \sigma_{\min} : \sigma_m = 0$:

An asymmetric cycle is such a law of voltage change in which the maximum and minimum stresses are different in absolute value: $|\sigma_{\max}| \neq |\sigma_{\min}|$.

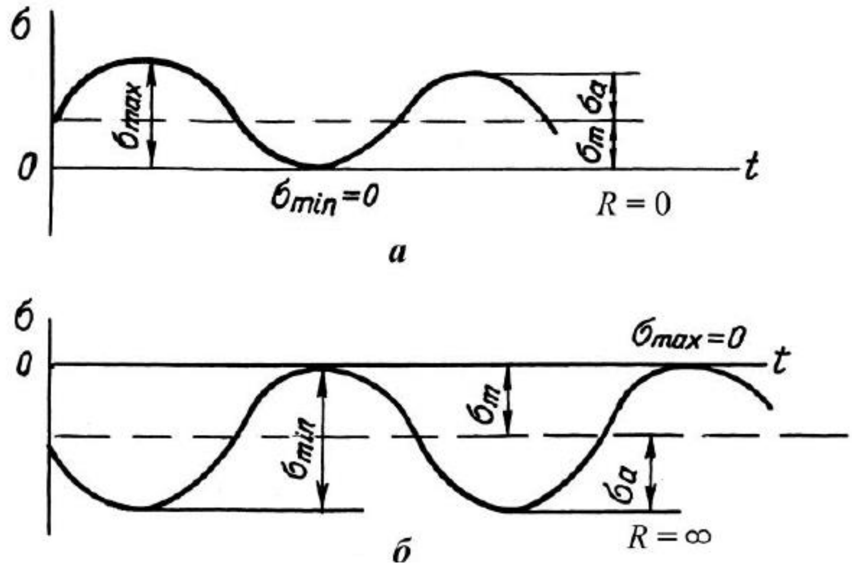
If the signs of $\sigma_{\max}$ and $\sigma_{\min}$ are different, then the cycle is called a variable sign; if the signs of σmax and σmin are the same, then the cycle is called constant (Pic. 1.5).

In the case when one of the stresses ($\sigma_{\max}$ or $\sigma_{\min}$) is equal to zero, the cycle is called pulsating or zero (pic. 1.6, a and b).

For zero cycle voltages: $\sigma_{\max} = 0$ or $\sigma_{\min} = 0$; $\sigma_m = \sigma_a = \sigma / 2$; R = 0.



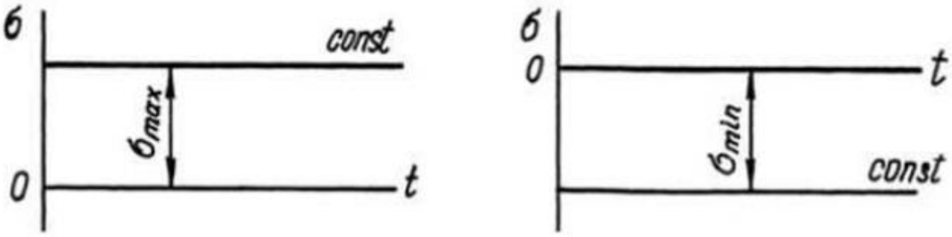
Pic. 1.5. Signs of constant stress cycles



Pic. 1.6 Zero stress cycles

Static loaded is sometimes called a canned cycle (pic. 1.7).

In such a cycle $\sigma_{\max} = \sigma_{\min} = \sigma_m$; $\sigma_a = 0$.



Pic. 1.7. Constant voltage cycle

Any asymmetric cycle of alternating voltages can be represented as the sum of a symmetric cycle with a maximum stress equal to the amplitude of a given cycle σ_a and a constant stress equal to the average stress of the cycle bm (see pic. 1.3), i.e .:

$$\sigma_{\min}^{\max} = \sigma_m \pm \sigma_a \qquad (1.4)$$

In the case of variable shear stresses, all the above terms and relations remain valid with σ replaced by τ [2].

STRENGTH CALCULATION UNDER REGULAR LOADING CONDITIONS

Regular mode loaded is called a mode in which the average voltage σ_m and amplitude of the cycle b_a remain constant over time.

If, with a regular loading mode $\sigma_{\max} = \sigma_m + \sigma_a$, the maximum stress of the operating cycle is less than the endurance limit of the part for a given asymmetry $\sigma_{RД}$ of the cycle, then the calculation for strength and cyclic stresses is performed as a test one. The strength condition for this calculation has the form.

$$K_{adm} \leq K \qquad (1.9)$$

Where: K - is the calculated safety factor for cyclic stresses; K_{adm} — permissible safety factor; assigned from operating experience, depending on the purpose of the part and the conditions of its operation, the accuracy of calculation methods and the reliability of information about the mechanical characteristics of the metal. Usually take K_{adm}= 1,3...3 [2-4].

The calculation for the allowable safety factor is carried out separately only for a uniaxial stress state, i.e., for normal stresses (bending, tension - compression, tension - compression with bending), only for pure shear, i.e., for shear stresses (torsion), and for a plane stress state, i.e. with a combination of normal and shear stresses (bending with torsion, tension - compression with torsion, tension - compression with bending and torsion). If condition is satisfied in the calculation, then it is considered that the part can work indefinitely.

REFERENCES

1) Feodosiev V.I. Strength of materials. - M .: MSTU im. N.E. Bauman, - 2000 - 592s .: ill.
2) Volkov A.N. Strength of materials. - M .: Ko-los, 2004 - 286s.: Ill.
3) Nazarov A.A. Principles of education that develop an innovative approach to engineering professional activities./ European Journal of Research and Reflection in Educational Sciences. Vol. 8 No. 8, 2020 ISSN 2056-5852
4) T Khankelov, S Tursunov, Z Maksudov Domestic Solid Waste Crusher. / International Journal of Psychological Rehabilitation 24 (issue 07), 8090-8096, 2020
5) Nazarov A.A. Role of Discipline “Machine Parts” in Forming Professional Qualifications Engineer. Eastern European Scientific Journal (ISSN: 2199-7977) Ausgabe 3-2018. Pp. 330-333.
6) Nazarov A.A. Fundamental research general professional process disciplines on the basis of general scientific disciplines. European Journal of Research and Reflection in Educational Sciences (ISSN 2056-5852) Vol.7 No. 1, 2019 -p. -38-40