machinery and equipment, taking into account the quality of their performance to determine the optimal values of structural and kinematic parameters of working machines and equipment and carry out their comparative assessment at the stage of research and development work.

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Obosnovano Choice Criteria for determining parameters for optimization assets mechanization and equipment in tehnolohycheskyh protsessah selskohozyaystvennoho production.

Optimization, Options machinery and equipment, Criteria.

The choice of criterion for optimization is grounded for determination of parameters of facilities of mechanization and equipment in the technological processes of agricultural production.

Optimization, parameters of machines and equipment, criteria's.

UDC 620.1

INNOVATIVE MECHANICS MODEL Percolation-fractal MEDIA

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It is shown that the results obtained from the position of continuum mechanics are not satisfied for a number of problems of modern mechanics of materials. To improve the reliability of the results proposed to use the model of mechanics, percolation fractal environments. Shows the number of solutions to actual problems from MPFS.

Mechanics percolation-fractal environments percolation threshold, the model final measure, fractal dimension.

Formulation of the problem. Mechanics percolation-fractal environments (MPFS), unlike the continuum mechanics (MCC), a highly innovative branch of science which is born in the early 21 th century.

The innovative nature of society confronts the world scientific community unprecedented involvement in the production rate of scientific innovation. Increasing modes of process parameters, increase efforts temperatures and their gradients, steady growth requirements for functionality and quality products require constant increase in requirements for materials, among the most urgent tasks are: composites, ceramics, nanomaterials and materials with predetermined properties. And for most of the tasks necessary to attract models MPFS as the MCC model is too coarse.

The beginning of the 21st century is marked by important scientific achievements at the intersection of modern materials, nonlinear dynamics, physics of critical phenomena and synergy in the study of multi-fractal percolation systems [1-10], which gives a powerful impetus to the technologies of tomorrow, namely, the production and use of materials with predetermined properties; supersensitive new classes of materials for sensors and sensors; new classes of materials given structure; fractal-percolation conductive material with any law changes the electrical properties of space and time (for configuration required field); new classes percolation-fractal systems for phase separation, filtration and purification of gases and liquids in micro dispersed mixtures etc. design and manufacture of new biocompatible porous coating the surface of the soil to regulate gas exchange and moisture accumulation and more.

Analysis of recent research. Creating a percolation-fractal systems - a key area of modern materials, because they have very unique properties for use as adsorbents (practically unlimited surface area), filters (developed structure channels), sensors and sensors (percolation-fractal mixture "conductor-insulator" with unlimited possibilities sensitivity) biosumisnyn porous ceramics, regulation of moisture in the biodynamic system "plant - soil" [1-10].

Until recently, most of these problems were considered in the Euclidean formulation R^n (N = 1, 2, 3) from the standpoint of continuous media, although in recent years more and more the need to introduce Riemann spaces, as in the latest composites boundaries between the individual components of the fuzzy because a chemical, mechanical, diffuse interactions become complex shapes and often are the ultimate measure - length, area, volume. In this case it is necessary to talk about the fractal nature of such limits. For example, if we map the coastline where the coast is very irregular (fjords in Norway or channel g. Pripyat before the confluence with the Dnieper) and will measure the length of shoreline segments of length d. By varying d, we come to the paradoxical (for Euclidean formulation!) Result - the total length of this line will depend on the "step" d in the exponent law

$$L(d) = A \times d^{1-D},$$

where: A - some constant dimension, D - constant (for the examples 1 <D <2), which called fractal dimension or Hausdorff-Besicovitch dimension. Whence it follows that the fractal dimension can be found from the formula:

$$D = -\ln(N(d)) / \ln d.$$

For example, Cantor set, which is based rejection middle of each segment obtained by dividing the three previous, since the interval [0; 1], D = - ln 2 / ln 3 = 0.6390.

A significant contribution to the theory of fractals made Mandelbrot Feder, Schuster, offices, Haken, Feigenbaum and others. And even though strictly fractal definition does not exist, fractal approaches give very good results in many areas of science, art, and even information theory.

Percolation - a wide field for the development of new algorithms, a simple but powerful tool that allows a single approach to solve a variety of everyday tasks. Percolation theory gives us the key to understanding the various physical processes [5-9, 10-12].

Percolation theory marching alongside and largely intertwined with the theory of fractals, this area of mathematical art when using the simplest of formulas and algorithms created paintings of great beauty and complexity. In circuits constructed images often guessed leaves, trees and flowers. Modern physics and mechanics are just beginning to study the behavior of fractal objects.

The purpose of research. To develop a theoretical framework for creating and implementing models of mechanics percolation-fractal environments algorithms to calculate and obtain summaries of research in the form of engineering design and ratios for calculating articles approximation MPFS.

Results. At this stage of the technology is increasingly a question of increasing the accuracy of the actuators, which in turn requires increased sensitivity control devices, sensors. It is difficult to overestimate the importance of design and research hypersensitive percolation-fractal sensors for industries such as engineering, robotics, medicine, aviation and space technology, etc. Based on theoretical studies conducted MPFS Nature of connecting cluster conductive nanoparticle components in the system "conductor-insulator" on the final measure Cartesian areas LxL size and LxLxL. Fig. 1 shows the results of computer simulation.

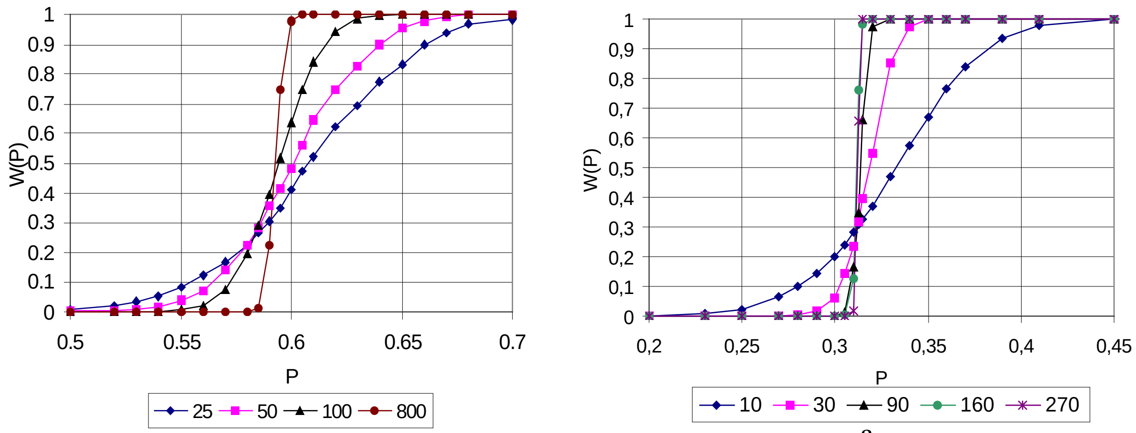

Fig. 1. Results of modeling of cluster connector on final measure Cartesian gridsLxL and LxLxL [11].

The results of computer simulation show, firstly, that the final measure Cartesian grids scale phase transition is blurred and the likelihood of connecting the cluster accurately described by prof. Grabar IG:

$$W(P) = \frac{1}{1+\exp[L(P_* - P]}. \quad (1)$$

Second, as the water from the rice. 1 critical percolation P *, which found the results of the simulation of the conditions: P = P * (W = 0,5), also depends on the size of the lattice, and decreases with increasing the size of the area. By the way, increasing the size of the $L \Rightarrow \infty$ dependence W (P) are increasingly approaching stepwise characteristic of critical phenomena. We conducted a theoretical study of critical percolation P * as a function of the fractal dimension D and space received a relationship:

$$P_* = 1 - \ln\frac{D+1}{2}, \quad (2)$$

which brilliantly confirmed the known experimental data (Fig. 2) for Cartesian grids. A high correlation coefficient of 0.9999 confirms the authenticity of formula (2), which suggests the presence of a functional link between the fractal dimension of space and percolation threshold for this space. The results in Fig. 1 and formulas (1) and (2) obtained: the lattices L * L breakdown of Cartesian percolation threshold value and size of the area with a high distress communications Spividnoshennya describes the following correlation:

$$P_* = 0{,}5927 + \frac{6{,}3966}{L^{1{,}7396}}; r_{1/1}^2 = 0{,}9736. \quad (3)$$

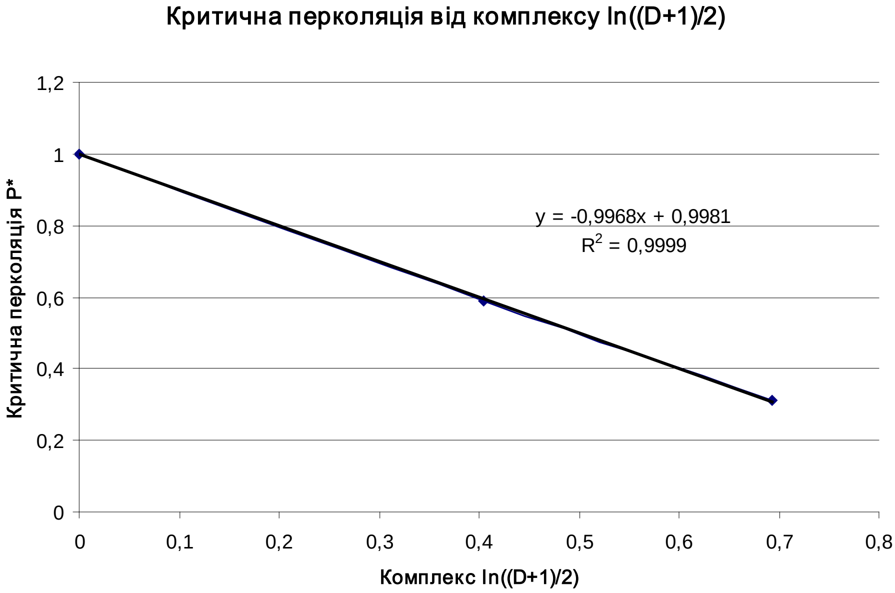

Fig. 2. Results approximation known experimental values of critical percolation space dimension formula (2).

According to the lattices L * L * L are:

$$P_* = 0{,}3118 + \frac{0{,}0104}{e^{0{,}0185*L}}; r_{1/1}^2 = 0{,}9656. \quad (4)$$

To construct sensitive elements we have proposed a number of engineering relationships. Thus, the electrical resistance of a two-component mixture percolation "conductor - insulator", attached to the flat deformed substrate can be predicted by formulas prof. Grabar IG:

- For linear stress state:

$$\frac{R_\varepsilon}{R_0} = \left[\frac{1-P^*}{\frac{P}{(1+\varepsilon)(1-\mu\varepsilon)} - P^*}\right]^\nu. \quad (5)$$

- And for plane stress:

$$\frac{R_\varepsilon}{R_0} = \left[\frac{1-P^*}{\frac{P}{(1+\varepsilon-\mu\lambda\varepsilon)(1+\lambda\varepsilon-\mu\varepsilon)} - P^*}\right]^\nu. \quad (6)$$

where: R_ε -elektrychnyy resistance percolation mixture mikrochastyn "conductor - insulator" at the probability P fill components and wiring during deformation ε , R_0 - Electrical wiring resistance components R * - percolation threshold conduction components, λ - Dvovisnosti load factor. Analysis (5) and (6) shows that with proper selection of concentrations conductor components - a few percent more than P * - possibly produce PPS-strain strain gauges that have sensitivity 100-10000, which is 3-4 orders of magnitude better than traditional Strain converters.

Based on the final measure proposed approximation method for estimating the fractal dimension kvazifraktala and shows that nanoparticles of 10 ... 20 interatomic distances are less than three dimensions of space. Although small deviations - in the range of 3-7%, it can significantly affect the deflection processes occurring at the nanoscale, compared to known physical laws obtained for MCC macrosystems approximations and are able to explain many phenomena of nanotechnology.

The authors hope that the proposed objectives of percolation-fractal Materials and their solutions will resonate with stakeholders - scientists, engineers and students of all specialties of mechanical engineering and instrumentation, energy, environment, biomedical areas and more.

Conclusions

1. Based on recent advances in the theory of percolation theory coat metals, synergetic, nonlinear dynamics is possible in a number of tasks MCC to offer more accurate models MPFS.

2. A number of problem solutions for MPFS and received a general view of the potential function for connecting cluster kintsevrmirnyh Cartesian grids, the dependence of the percolation threshold prosotu dimension (Cartesian approach)

3. Based on the equation (2) proposed an alternative methodology for estimation of fractal dimension kvazifraktala the known value of percolation threshold.

4. Comparative analysis approximations MCC and MPFS models are shown in the table below:

№p / p	Characteristic	MCC	MFSS
1	Specific weight	$\rho = m/V$	$\rho \Rightarrow 0$
2	The surface area	$S = 6a^3$	$S \Rightarrow \infty$
3	The sensitivity of strain gauges $\Delta R / R_0$	0.01 ... 0.02	100 ... 1000
4	Critical percolation to the Cartesian approach	0.59	0.59 ... 0.63

		R^2 R^3	0.31	0.31 ... 0.34
5	Fractal dimension nanoparticles		3	2.6 ... 2.9
6	Condensation on the surface		The proportional surface area	

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Shown that results, poluchennыe approximations in models of mechanics sploshnыh environments, not to many tasks udovletvoryayut Modern mehayyky materials. To Increase the Use dostovernosty results predlahetsya model mehayyky perkolyatsyonno-fraktalnыh environment. Pryvedenы solutions rjada actual problems based models MPFS.

Mechanics perkolyatsyonno-fractal environments, percolation threshold, konechnomernыe model, fraktalnaya razmernost, nanomateryalы.

Shown that the results obtained in the approximations of the models of continuum mechanics do not satisfy many tasks of modern materials mechanics. To increase the reliability of results is offered to use model mechanics percolation-fractal environments. Are solutions of

a number of pressing tasks on the basis of models mechanics percolation-fraktalnih environments.

Mechanics percolation-fractal environments, threshold of percolation, finite-dimensional model, fractal dimension, nanomaterials.