Preface

The processes of deformation of natural and artificial working media have a prominent place in many technological processes of construction, which in the vast majority are dispersed systems. Such processes include the development of soils and rocks, mining, production of construction materials, their processing, as well as the processes of compaction of soil and concrete mixtures and other materials. The most effective ways to carry out such work are those that are based on a dynamic principle of action. Despite the obvious advantages of dynamic deformation, its use is still quite limited. This is primarily due to the lack of theoretical studies of the joint movement of machine units and processing media as a single synergistic system. As a result, in practice, theoretical provisions are applied that do not take into account the features of the dynamic nature of the load and the mutual influence of the subsystems on the general movement. The existing provisions are based on the principles of force deformation, characterized by assumptions that are far from reality: linearization, representation in models of a static application of the deformation force, an assessment of the properties of the medium by empirical coefficients, which are determined without taking into account the load speed and changes in the properties of the medium when changing external loads and propagation conditions in the wave medium deformations and stresses. This approach does not allow taking into account the real physical processes occurring in the working medium with an increase in the intensity of its load.

In this study, a new approach and methodology is proposed for the development of machine systems with dynamic effects on processing media, taking into account the influence of energy fields of physical and mechanical effects, the transformation and inversion of types of energy exposure. Given the versatility of the tasks, criteria have been developed for analyzing combinations and their influence on the intensity of physical and mechanical processes. The intensification of physical and mechanical processes, methods and means of their creation is achieved by the formulated idea: the systematization and complexity of approaches through a joint consideration of the mutual influence of the internal properties of the subsystems will reveal the general laws of their changes and take into account in the work process.

Based on the analysis of literary sources, the main directions of theoretical and experimental studies of the development of processing materials are identified.

A justified model for considering the structural nature of dispersed media in a wide range of all components of the process of destruction, grinding and compaction. The revealed changes in the parameters of the subsystems (working medium, technical systems, processes of interaction of working bodies of primary machinery and machines for grinding and compacting concrete mixtures), taking into account their stress-strain state, is a complex superposition of waves arising in media in disperse systems under the action of dynamic loads. The parameters of the system of soil destruction, grinding and compaction of the media are analyzed and quantitative and qualitative changes of all significant characteristics of the subsystems are revealed.

The dependences for describing the process of compaction of mixtures with a discrete and continuum model and for determining the parameters of resonant vibration systems with directional and spatial vibrations are obtained. The joint movement of the working media during high-speed and impact destruction with differentiation of the working area, structuring of the impact process, the formation of entropy destruction, the use of self-organization and evolution of geometric shapes are described.

A set of experimental studies is carried out according to the developed program at specialized experimental facilities.

The experiments allow to evaluate the results of theoretical studies.

As a result of the studies, new properties of the behavior of discrete-continuous systems under conditions of power vibrations are disclosed.

The obtained laws of changing the state of dispersed media under the influence of power loads by technical systems during the implementation of various technological processes have allowed to propose new load processes, including multi-mode implementation with minimized energy costs and increased efficiency of work processes.