

The theory of travelling deformation waves and its applications in biomechanics, engineering, and geophysics

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Our theoretical and experimental researches of the *travelling waves of deformation* in solid, liquid, and gaseous bodies have resulted in an establishment of some unknown before wave phenomena and effects. With help of natural examples from biomechanics, engineering mechanics, and geophysics this report introduces these widespread different wavelike phenomena. On descriptive and mathematical levels the different in physical state, dimensions, and shapes travelling deformation waves are presented. Developed mathematical expressions which give main kinematics and mass transfer parameters of the travelling deformation waves are presented and explained. The travelling deformation wave is defined as a size limited deformed region which is moving along some lengthy deformable body. It was established, that the travelling waves of deformation play an important role both in living organisms and in inanimate nature and act in various physical matter in micro- and macrocosm. The created theory of travelling waves of deformation and wave mass transfer has allowed to receive new scientific results and to make inventions in such areas as the theoretical mechanics, the theory of mechanisms and machines, the biomechanics and medicine, the Earth's and planets' sciences. These results were recognized as fundamental by various experts in our republic and abroad. Our results on a competitive basis were awarded with grants of Fund of basic researches of Belarus, the American Physical Society, the International Soros scientific fund.

New scientific results were received:

- ***In the field of the biomechanics and medicine:***

- From positions of the theory of travelling waves of deformation and wave mass transfer the non-conventional explanation of locomotion of such living creatures as garden caterpillar, earthworm, snake, and snail was received and mathematical model of these phenomena was created. From the same mathematical model positions the non-conventional explanations of such medical and biologic mechanisms as peristaltic in digestive system, work of urethra, biomechanics of labour were given.

- ***In engineering area:***

- Wave mechanisms and machines of new type, which use a biomechanical wave principle of movement (wave reducers of continuous and step-by-step rotation, linear and rotational step-by-step electric motors), which are characterized by simplicity of structure, the technical and economic advantages in comparing to traditional analogous mechanisms.
- The transport and transport-tractive machines which use new biomechanical wheel-stepping method of movement possess such advantages as simplicity of design and high tractive force in comparison with traditional machines of the same purpose. The wheel-stepping machines are perspective for use in such areas as an agriculture, machines for work in mines, building of roads and tunnels, a forestry works etc. Now the International Science and Technology Centre has examined our submitted project "Design and production of the experimental pattern of transport device which uses biomechanical wheel-stepping principles of motion" which was submitted by UIIP together with the Minsk tractor plant.

- ***In the field of the Earth's sciences:***

It was supposed and proved that the travelling tidal waves which are continually arising in all layers of the Earth play role main generators of global geophysical processes in all geospheres. From positions of the theory of travelling tidal waves and wave mass transfer the non-conventional scientific explanations of following global geophysical processes were given:

- Tectonics of lithosphere plates;
- The tidal mechanism of generation and accumulation of strains in the Earth's crust as a driving mechanism of the "earthquake machine";
- Generation of the large-scale ocean currents;
- Superrotation of the top layers of an atmosphere of the Earth and planets;
- Superrotation of photosphere of the equatorial belt (zone) of the Sun;
- The mechanism of formation and maintenance of the magnetic field of the Earth and planets.

The mentioned results were approved at native and international scientific seminars and conferences, published in the special literature and were recognized as new in these areas of science. Mechanical and hydraulic models and visual computer models and animations for demonstration of the laws of wave processes and wave mass transfer in solid, liquid, and gaseous environments were developed. The patents for some wave mechanisms and machines and physical devices are received.

We hope, that these report will promote establishment of scientific communications in joint International scientific projects. With the same purpose the specialists from UIIP are ready to read before the interested audience the lectures in Russian or English "The travelling waves of deformation in nature, engineering, and medicine", concerning the above theme on mechanics, biology, medicine, physics, and sciences about the Earth. Lectures will be accompanied by demonstration of new wave models and mechanisms, physical demonstration devices, video and computer films.

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In the web site Dobrolyubov A.I., Kolesnik A.A. Travelling Deformation Waves. Website, <http://pages.sbcglobal.net/akolesnik/> there are animations and pictures related to the report.