# GROUP TRANSFORMATION SYMMETRY INVARIANTS ON NATURAL DEVELOPMENT TRAJECTORY OF BIOMECHANIC SYSTEMS

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The nature perfection, harmony forms of flora and fauna are conventionely assume to connect and explain by means of the projective and conformal symmetries regularieties. Such approach are clousely connected with the row of Fibonacci numbers,with the golden section and with double quotient or wurf and are good verified by direct nature measerement. In the time of implementation of these investigations there is possible a problem connected with the assessment of the role and the influence on the harmony of the biological skeleton bodies of two fundamental factors: the natural selection in the evolution process and the general morphogenetical roots, their forms and structures. It is necessary for its solution the attraction of some new ideas and methods. In this work there is developed a conception of the primary nature of the latent dynamical symmetry of biological systems over the visible geometrical symmetry, which is consecvence of the first one. Naturally, as far as the base of the life is the variety of the whole moving forms, than, evidently, the general base of the observed harmony forms and biological bodies properties is the space and time symmetry. According to the E.Noether theorem the consequences of the symmetry are the whole conservation laws of energy, impuls and impuls angular momentum. The important conclusion is followed from this theorem that as a source of the partial regularities of conservation and of appearence of nonvaiable quantities named invariants may be regarded the symmetry of every physical nature, for example, the dynamical symmetry relatively one or another group of transformations. The aims of this work were the study of construction principles of dynamical models of biological sceleton bodies (by a man example) with the predicted eigen properties, the investigation of trajectories of their possible variations "from simple to complex one" and investigation of interconnections between the dynamical and dimension symmetries. The eigen properties of ever system consists in its inherent wonderful and in alienable inner possibility created by the nature organization the components of which are the spectrum of the resonance (natural) frequensies and the corresponding to them vibrations forms, i.e. the relative amplitudes along each of coordinates. These system properties are good prognosed by mechanics and are showing by its possibility to vibrational interaction with the other systems practically only by the resonance frequencies. Eigen properties are inherent to the whole variety of micro-, macro- and cosmic systems and, therefore, they reflects their most general inner peculiarities. The modern investigations

marks the eigen properties basic role in the biological systems and in the problem of all living forms self-generation. From the mechanical point of view to set the eigen properties of a system with a known model means the same as to show the sqvire table or the matrix of the resonance (natural) frequecies B and corresponding to them so colled modal matrix C, definding the vibration forms. The physical system parameters connekted with the dynamical matrix A. For solution the stated problems there were worked out the analytical methods of A synthesis by the known B and C. The peculiarity of these invariant-group methods consists in the fact, that the definable matrix A depend only on the degree of freedom number and is correct for the every systems structures. In such a manner, the general requlatities were studied over the variety field of the arbitrary systems, the structure peculiareties of which effects only the numerical value of its parameters. There were stayed that the matrix A of every structure systems from the point of view of synthesis formalitues,controlled by matrix C elements,by top geometrical symmetry relatatively to the diagonals, rows and colums and,hence, by unification of their elements variety. The system in this state has the obligatery equality of the all masses (inertia moments), of rigidities and their complexes, the minimum of the total (eigen) energy and maximal sensitively to the outside influences. It corresponds to the C orthogonality. Successive comming together by parts of natural frequencies lead to additional symmetrization of A (equality of group of its elements and diagonalization of A under equality of all frequences. In this case a change of phase state by a system takes place as a result of disintegration on a group of the simplest oscillators. Breaking of orthogonality C as a result of changes of magnitudes of its element or part of elements under invariability of matrix B. This lead to symmetry breaking of A and growth of variety among magnitudes of elements and, therefore, amang parameters of a system. Theoretically considering a suquence of states by matrix A and parametirs of a system as a result of controling effects, one can tell about a trajectory of natural "development" (TND) in a direction from simplicity to complexity. This trajectory TND, predicting by mechanics, one may consider as approximate "mechanical" projektion of vector universal idea of development which undoubtedly is inherent to nature. Adhering a formal analogy with basic stages of biological development sceleton body let us select three phases in a trajectory of a system: "pre-embrional", "embrional" and development. A comparison of matrix A on two last phases of its transformation shows that this matrix has invariants from combinations of elements. These invarians can be also expressed througt resonance frequences and its combinations. There are two types of invariants. The first type does not depend on changes of elements C. The second type can exist only under certain restrictions to changable elements and these restrictions begin more stronger in the direction from higher vabration form to lower one. The first form of vibration consists only of equal amplitudes and does not changable. Physically it defines exclusion on relative moving of

masses. In order to provide thise exclusion every mass should have elastic connections with common base. Structurally it is represented in models and in nature by means of skeleton. Matrix A of a system with three degree of freedom has the greatest number of invariants (more than ten). This result shows the correctness of well known and well proved threenomial structure principle to build of biological skeleton bodies from conformally symmetrical blocks. Discussed above type of transformation of A, providing the existence of invariants on trajectory TND of a systems, is referred to a transformation of symmetry, and its collection is called "group of symmetry". It needs to be underlined that the narrow class of model matrixes C exists which provides the continuity of a trajectory TND. A deadlock or a gap of the trajectory may be regarded as example of a defective development which is connect with the the appearance of an unrealizable zero values system parameters. The possibility of the defects is described as a consequence of appearance of two equal elements in some row of A matrix during its synthesis. It is shown that the trajectory gap is possible if A matrix set of invariants really exists. It is provided by the type of C matrix, which play the role of mechanical-genetic code od a system development, and by the change of matrix elements which have no prohibition functions. It is well known that frequencies spectrum of a human body does not dependent practically on a human age and human body systems parameters: the invariants constants, the constancy of dynamic and geometric symmetry proportions, and the cyclic time factor also. The first resonance frequency approximately equals six Herz, and is connected with the eigen frequency of the ionsphere through the world constanssuch such as light velocity and the Earth diameter. If it is known that the ration between the two lowest frequences of a human body equals oktava then the invariants set of matrix A is determined by the golden proportion in every point of TND, and between the points of the system limit states in the simplest cases. The result described are the examples of the system golden proportion, which are habitual properties of the models elaborated, and suit the human body proportions. The investigation of the wurf value shows that model masses and rigidities are nearly equel the ratious, which are known from the human, animals and birds measuring results. The conclusion is followed from above mentioned text that morphogenetical factors of biological skeleton body are the consequences of the constantly acting the physical lows ofnature. The laws determine the processes of structures formation (creation), the basic properties and the rational TND. Obviously the functional motives play the roles of second adaptation factors and provide the survival in stochasic external enviroment. The results described above are generalised on nonconservative systems case.