THE MATHEMATICAL BASICS OF INTERRELATED BIOMECHANICS AND MECHATRONICS

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The article presents the mathematical model non-homogenous, isotropic environment, where is possible to create various types of flows (the chemical reaction flow, the diffusion flow, the heat flow, the electromagnetic flow).

Key words: *biomechanics, mechatronics, entropy production, magnetic field, diffusion, chemical potential*

1. Introduction

Various physical fields are often used in the modern medicine. They work on the living organisms parts in order to affect the mass structure inside the area by the chemical reaction induction.

For example acupuncture, acupressure, magnetic field, ionisation and diffusion is used for this purpose. Their application gets mostly out of experiment and maybe also out of intuition.

The using of the unstable thermodynamics principle could give the instructions for this methods expectance.

From this point of view is the Gauss-Ostrogradskij theorem a big inspiration. According to this theorem is possible to use one physical field causing changes on that field boundary or another physical character fields inside the area.

It is assumed, that the V domain is bounded by the surface S and $\mathbf{n}$ is the external normal vector.

We have at one's command the specific physical field $\sigma(x_i, t)$ that depends on the spatial coordination x_i, $i = 1, 2, 3$ and time t. The σ field could be of scalar, vector or tensor character.

According to the above-mentioned theorem it holds:

$$\int_S \sigma \, n_i \, \mathrm{d}S = \int_V \frac{\partial \sigma}{\partial x_i} \, \mathrm{d}V \ . \tag{1.1}$$

The term (1.1) could be interpreted as: The change of some quantity inside the area vent itself on its surface as the functional value.

For example the measuring of the temperature gradient inside the area is possible by values on its outside surface.

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