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CONSIDERING FORCED VIBRATIONS OF THE DOUBLE DNA HELIX MAIN CHAINS VIA TWO MODELS WITH ELASTIC AND FRACTIONAL ORDER PROPERTIES

Andjelka N. Hedrih[1], Katica R. (Stevanović) Hedrih[2]

[1] Department for bio-hemichal and medical science, State University of Novi Pazar, Novi Pazar, Serbia, 18 000 – Niš, ul. Trg učitelj Tase br. 3/9, Serbia
e-mail: sandjelka@bankerinter.net, andjelka@hm.co.rs
[2]Mathematical Institute SANU Belgrade, Department for Mechanics
11 000-Belgrade, ul. Knez Mihailova 36/II, and Faculty of Mechanical Engineering, University of Niš. Priv. address: 18000-Niš, ul Vojvode Tankosića 3/22, Serbia, e-mail: khedrih@eunet.rs

ABSTRACT. By using as a basic approach to DNA mathematical models published by N.Kovaleva, L.Manevich in 2005 and 2007, we consider the linearized model to obtain main chain subsystems of the double DNA helix as well as a fractional order model. Analytical expressions of the eigen circular frequencies for the homogeneous model of the double DNA chain helix and corresponding characteristic numbers for fractional order model are obtained, as well as corresponding eigen vibration modes as well as eigen fractional order modes.

Two sets of eigen normal coordinates of the double DNA chain helix for separation of the system into two uncoupled chains are identified. This may correspond to base pair order in complementary chains of DNA double helix in a living cell. In this paper analytical expressions of the forced oscillations of the double DNA (dDNA) helix chains are presented for the both introduced models, ideally elastic as well as fractional order. On the basis of the previous listed results and new results analysis of the forced vibrations is done. Different cases of the resonant state in one of the main chains appear, and no interactions between main chains.

The possibilities of the appearance of resonant regimes only in one of the two main chains is proved, as well as dynamical absorption under the external one frequency forced excitations is considered.

Keywords: Double DNA helix chain, forced vibrations, eigen main chains, resonant state, dynamical absorption, fractional order model.

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