15th INTERNATIONAL CONFERENCE
Dynamical Systems — Theory and Applications
December 2-5, 2019. Lodz, POLAND.

DSTA 2019

paper id: ENG298

Vibrations of flexible beam NEMS elements in a temperature field taking into account Coulomb forces

Irina V. Papkova, Vadim A. Krysko, Jan Awrejcewicz, Alena A. Zakharova, Anton V. Krysko

Abstract: A mathematical model of nonlinear vibrations of flexible beam NEMS elements located in a stationary temperature field and under the action of electrostatic forces (Coulomb force) was constructed. Nanobeams are considered as a Cosserat continuum with constrained particle rotation (pseudo-continuum). The governing PDEs of the beam element, the boundary and initial conditions are obtained based on the Hamilton's principle, and the Euler-Bernoulli hypotheses and geometric nonlinearity by the T. von Karman model are taken into account. The system of nonlinear partial differential equations (PDEs) is reduced to the Cauchy problem by the second-order finite difference method. The Cauchy problem is also solved by the fourth-order Runge-Kutta method. The effect of the Coulomb force on the nonlinear dynamics of the structural members of the NEMS in the form of beams located in the temperature field is illustrated and discussed.

[1)] Irina V. Papkova, Associate Professor: Department of Mathematics and Modeling, Saratov State Technical University, Politehnicheskaya 77, 410054 Saratov, Russia (RU), ikravzova@mail.ru.

[2)] Vadim A. Krysko, Professor: Department of Mathematics and Modeling, Saratov State Technical University, Politehnicheskaya 77, 410054 Saratov, Russia (RU), tak@san.ru.

[3)] Jan Awrejcewicz, Professor: Lodz University of Technology, Department of Automation, Biomechanics and Mechatronics, 1/15 Stefanowskiego Str., 90-924 Lodz, Poland (PL), jan.awrejcewicz@p.lodz.pl.

[4)] Alena A. Zakharova, Professor: Department of Informatics and Software Engineering, Bryansk State Technical University, Boulevard 50 years of October 7, 241035 Bryansk, Russia (RU), zaa@tu-bryansk.ru.

[5)] Anton V. Krysko, Professor: Department of Applied Mathematics and Systems Analysis, Saratov State Technical University, Politehnicheskaya 77, 410054 Saratov, Russia (RU), anton.krysko@gmail.com.