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Application of the homotopy analysis method to nonlinear characteristics of a piezoelectric semiconductor fiber. (Application of the homopoty analysis method to nonlinear characteristics of a piezoelectric semiconductor fiber.) (English) Zbl 1480.74075

AMM, Appl. Math. Mech., Engl. Ed. 42, No. 5, 665-676 (2021).

Summary: Based on the nonlinear constitutive equation, a piezoelectric semiconductor (PSC) fiber under axial loads and Ohmic contact boundary conditions is investigated. The analytical solutions of electromechanical fields are derived by the homopoty analysis method (HAM), indicating that the HAM is efficient for the nonlinear analysis of PSC fibers, along with a rapid rate of convergence. Furthermore, the nonlinear characteristics of electromechanical fields are discussed through numerical results. It is shown that the asymmetrical distribution of electromechanical fields is obvious under a symmetrical load, and the piezoelectric effect is weakened by an applied electric field. With the increase in the initial carrier concentration, the electric potential decreases, and owing to the screening effect of electrons, the distribution of electromechanical fields tends to be symmetrical.

MSC:

74F15 Electromagnetic effects in solid mechanics
74G10 Analytic approximation of solutions (perturbation methods, asymptotic methods, series, etc.) of equilibrium problems in solid mechanics
78A55 Technical applications of optics and electromagnetic theory

Keywords:

piezoelectric semiconductor fiber; homotopy analysis method; elastic displacement; series solution; screening effect; electric field effect

Full Text: DOI

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