Elliptic inhomogeneity problem in thermoelectric medium

***H. P. Song, †C.F. Gao**

State Key Laboratory of Mechanics and Control of Mechanical Structures, Nanjing University of Aeronautics and Astronautics, Nanjing 210016, China

*Presenting author:hpsong@nuaa.edu.cn

†Corresponding author:cfgao@nuaa.edu.cn

Abstract

An inhomogeneity embedded in a continuum medium is a classical problem in solids that dates back to Maxwell, and the fields within an ellipsoidal inhomogeneity governed by linear constitutive law are well known to be uniform, rendering them important applications in composite analysis. An inhomogeneity in a nonlinearly coupled thermoelectric medium, on the other hand, is much more difficult to analyze. Using the complex variable method, the problem of a two-dimensional elliptic inhomogeneity embedded in a thermoelectric medium has been analyzed, and the field distributions have been obtained in closed-forms. The analysis shows that the electric current density inside the inhomogeneity is uniform, while the heat flux, temperature, and electric potential are quadratic functions with respect to the coordinates. These results provide a powerful tool to analyze the effective behavior of thermoelectric composites.

Keywords: Elliptic inhomogeneity; nonlinearly constitutive law; Complex variable method; Thermoelectric medium