# Modelling inhomogeneous materials by the contribution tensor approach and the boundary element method

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**KEYWORDS:** *effective elastic properties, inhomogeneous materials, contribution tensors, boundary element method, 3-D linear elasticity.*

The work presents an analytical-numerical approach to model composites with arbitrary shapes of inhomogeneities (particles or pores). The approach employs calculating compliance or stiffness contribution tensors. These tensors relate uniform stress or strain boundary conditions to extra strains or stresses caused by a single inhomogeneity [1]. The change in overall compliance or stiffness of the composite depends on the contribution tensors and the volume fraction of the inhomogeneities. Primarily introduced for non-interaction approximation, the approach can be combined with interaction-approximation schemes, e.g., the Mori-Tanaka assumption, to improve its accuracy [2]. The literature shows applications of the finite element method and a meshless method to model the single inhomogeneity problem, which require the discretisation of the domain [3]. Here, to solve the problem and calculate the contribution tensors, we apply the boundary element method (BEM) for 3-D elasticity. The approach requires only the discretisation of boundaries. The BEM employs 8-node boundary elements with quadratic shape functions and an adaptive numerical integration scheme to ensure high accuracy of the calculated stresses and strains [4]. In modelling single-inhomogeneity problems, the BEM eliminates the excessive discretisation of the domain that approximates the matrix, as well as the particle [5]. Numerical examples illustrate the proposed approach.

**ACKNOWLEDGEMENT:** The scientific research was funded from the statutory subsidy of the Faculty of Mechanical Engineering, Silesian University of Technology, Poland.

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