报告题目： **新型边界元方法分析先进材料的弹性力学问题**

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摘要： 近些年，为了应对工程和科技的多种需求，越来越多的先进材料横空出世。这些材料通常具有非均匀和各向异性的材料性质。它们复杂的材料性质会对其力学行为具有重要影响。这项研究应用新型边界元方法来解决一系列先进材料的弹性力学问题。将四种基本解分别引入边界元方法，并用不同种类的边界单元用于满足离散边界面的不同需求。采用多种数值积分方法解决离散的边界积分方程中的一般奇异积分、近乎奇异积分和奇异积分。最后，应用发展的新型边界元方法，分析了各向同性层状材料和横观各向同性层状材料的复杂弹性力学问题。相关的应用包括分析和求解非水平层状和梯度材料的三维弹性力学问题、以及层状和梯度材料的轴对称问题和裂纹问题。数值结果表明，该新型边界元方法具有极高的计算效率和精度，且先进材料的材料性质对于其弹性场具有重要影响。

New Boundary Element Methods for Group of Elastostatic Problems in Advanced Materials

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Abstract: Nowadays, more and more advanced materials emerge to meet the needs of various requirements in engineering and science. These materials are generally characterized by graded inhomogeneity and anisotropy. Their complex material properties have significant influence on the mechanical behaviours. This research aims to develop new Boundary Element Methods (BEMs) to solve groups of elastostatic problems in advanced materials. Four fundamental solutions are incorporated to the BEMs and different types of boundary elements are used to discretizing the boundary surfaces to satisfy different requirements. Many types of numerical integral methods are applied to solve the regular, nearly singular and singular integrals in the discretized boundary integral equations. Finally, the new BEMs are used to analyze some complicated elastic problems in isotropic and transversely isotropic layered halfspaces. They include the analyses of the three-dimensional problems of non-horizontally layered and graded materials, the axisymmetric problems and crack problems of layered and graded materials. Numerical results show that the proposed BEMs have high efficiency and accuracy and the influence of material properties on elastic fields are remarkable.

Reference： Xiao S. (2021). New boundary element methods for group of elastostatic problems in advanced materials. PhD thesis, The University of Hong Kong.