

## 双材料应力分析中的镜像点方法

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**摘要** 提出一种分析各类双材料中任一点受集中力作用问题的方法. 通过将结合界面或其自由表面看作镜面, 将应力函数或位移函数设定成固定于受载点及其镜像点上的局部坐标系下的形式, 利用界面连续条件和Dirichlet的单值性原理, 所有应力函数或位移函数就可由无限体中集中力的解或半无限体表面集中力的解的应力函数求得. 这种方法不仅可适用于单一界面的情况, 也可适用于多个界面并存的情况, 并且也可适用于具有自由表面的结合材料. 这一方法可应用于各类结合材料、涂层薄膜材料、板材等.

**关键词** [双材料](#), [界面](#), [Dirichlet单值性原理](#), [理论解](#), [格林函数](#)

分类号

## MIRROR POINT METHOD FOR STRESS ANALYSIS OF BONDED DISSIMILAR MATERIALS

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### Abstract

To analyze the fundamental solution of bonded dissimilar material structures, this paper has proposed an effective theoretical analysis method, based on the Dirichlet's uniqueness theorem and the mirror point technology. This method can be used to solve the problems of concentrated forces acting at the inside or at the free surface of infinite bonded dissimilar materials, by regarding the interface and the free surface as the reflection planes to the loading point. By introducing the mirror points, it is found that the whole stress function can be given as the summation of that defined under the local coordinate system fixed to each mirror point. From the interfacial condition of continuity and the free boundary condition, by adopting the Dirichlet's uniqueness theorem, then all the stress functions can be determined from that for concentrated forces acting at the inside of a infinite homogeneous media or at the free surface of a semi-infinite space. Therefore, the corresponding theoretical solution can be deduced in the closed series form of stress functions corresponding to each mirror point. If there are infinite mirror points, it is found that only the stress functions corresponding to the first several mirror points have effects on the accuracy of the solution, by the comparison of numerical and theoretical results. Such a theoretical solution can be used as the Green function to deal with the problem of distributed force, and also as the fundamental solution for boundary element method, so that it has extensive applications in engineering. Though the proposed method has been illustrated by only two examples of plane problem in this paper, it can also be used to deal with three dimensional problems. Moreover, this method can be applied not only for the case of single reflection plane, but also for the case of multiple reflection planes, which generally leads to infinite mirror points, due to the reflection after reflection.

**Key words** [bonded dissimilar materials](#) [interface](#) [Dirichlet's uniqueness theorem](#) [theoretical solution](#)

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