Isoparametric tube, disk and ring boundary elements and their application in BEM analysis of slender structures

***X.W. Gao, Z.C. Yuan, W.H. Zeng**

State Key Laboratory of Structural Analysis for Industrial Equipment，

Dalian University of Technology，Dalian 116024，China

*xwgao@dlut.edu.cn

Abstract

When using boundary element method (BEM) to solve practical engineering problems with rounded bodies, considerable error comes from the discretization of the geometry and the interpolation of physical quantities. To overcome this problem, an algorithm for using isoparametric tube, disk and ring elements in BEM is proposed in this paper based on the Lagrange interpolation formulation and the closure condition at two ends of an arc. This type of boundary elements can well model geometries with tube, disk and ring shapes and interpolate physical quantities defined over the surfaces of these components. As a result, the discretization error and overall computational model can be reduced considerably. A new technique for eliminating singularities involved in the boundary integrals when using the proposed isoparametric elements in BEM is also presented based on an operation over the intrinsic plane. The proposed boundary elements then are employed to analyze elasticity problems of some slender structures. Numerical examples are given and show that the proposed elements have the advantages of less element discretization and high computational accuracy.

Keywords: isoparametric tube element, disk element, ring element, boundary element method, element sub-division method