A new scaled boundary finite element method using Fourier shape functions

Yiqian He[1], Haitian Yang[1], and *Andrew J. Deeks[2]

[1]Department of Engineering Mechanics, Dalian University of Technology,
Dalian 116024, P.R. China
[2] School of Engineering and Computing Sciences, Durham University,
South Road, Durham, DH1 3LE, UK

*Corresponding author: a.j.deeks@durham.ac.uk

The scaled boundary finite element method (SBFEM) is a semi-analytical method, whose versatility, accuracy and efficiency are not only equal to, but potentially better than the finite element method and the boundary element method for certain problems. This paper investigates the possibility of using Fourier shape functions in the SBFEM to form the approximation in the circumferential direction. The shape functions effectively form a Fourier series expansion in the circumferential direction, and are augmented by additional linear shape functions. The proposed method is evaluated by solving elastostatic and steady-state heat transfer problems. The accuracy and convergence of the proposed method is demonstrated, and the performance is found to be better than using polynomial elements or using an element-free Galerkin approximation for the circumferential approximation.

Key Words: Scaled boundary method; Fourier shape functions; computational accuracy; stress singularities; unbounded domains