3D Elastostatic Boundary Element Analysis of Ultra-Thin Structures with Planar Surfaces

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Over the years, this topic of nearly singular integrals has attracted significant researches in the BEM community. For the BEM analysis, ultra-thin structures with flat or less-curved surfaces can be modeled by assemblage of planar elements. In this subcategory, the present work targets the 3D BEM elastostatic analysis by an approach of "integration by parts". The leading author has applied this technique to analyze the 2D problems; however, no implementation of this technique in 3D cases has been reported in the open literature yet. The present work is to demonstrate how this technique can be applied for 3D ultra-thin bodies with planar surfaces. For numerical tests, the regularized integrals of an example were evaluated using the 8-point Gauss integration and compared with the results obtained by mathematical software. Also, the proposed formulations have been implemented in an existing BEM code. For demonstration of our successful implementation, a few numerical examples are presented.

Keywords: Integral Regularization, 3D Elastostatics, Boundary Element Method