Solving the pressure jump in conforming contact problems

***Xiaomin Shu, †Jianming Zhang**

State Key Laboratory of Advanced Design and Manufacturing for Vehicle Body, Hunan University, Changsha, 410082 China

*Presenting author: shu_xmin@hnu.edu.cn
†Corresponding author: zhangjianm@gmail.com

Abstract

In boundary element computation for conforming contact problems, a sudden jump in pressure is often observed near the edge of the contact zone. Although some explanations have been given, they are contradictory to some studies. To this end, we give a new explanation. According to the explanation, a strategy to deal with the jump is proposed.

The core of the explanation is to satisfy the force equilibrium condition. Since Lagrange elements are used in this paper, the explanation can be described that the force obtained from Lagrange interpolation should be equal to the actual contact force. In the explanation, all nodal pressure values are assumed to be located on the curve of the exact pressure solution (convex function), and then the force obtained from Lagrange interpolation is compared with the actual contact force. If the force obtained from Lagrange interpolation is greater than the actual contact force, for satisfying the force equilibrium, a jump will appear; else if the force obtained from Lagrange interpolation is less than the actual contact force, then no jump will occur.

To test the explanation, several numerical examples are given and the results are in full agreement with the prediction, which supports the explanation. Thus, the strategy to deal with the jump is obvious, that is, the force obtained from Lagrange interpolation should be less than the actual contact force.

Keywords: contact problem; boundary element method; force equilibrium; convex function.