Contact stiffness of regularly patterned multi-asperity interfaces

Shen Li , Quanzhou Yao , Qunyang Li , Xi-Qiao Feng , Huajian Gao

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Contact stiffness of regularly patterned multi-asperity interfaces

Shen Li[1,2], Quanzhou Yao[1,2], Qunyang Li[1,2,3,*], Xi-Qiao Feng[3,4], and Huajian Gao[5]

1 AML, Department of Engineering Mechanics, Tsinghua University, Beijing 100084, China
2 Center for Nano and Micro Mechanics, Tsinghua University, Beijing 100084, China
3 State Key Laboratory of Tribology, Tsinghua University, Beijing 100084, China
4 Institute of Biomechanics and Medical Engineering, Department of Engineering Mechanics, Tsinghua University, Beijing 100084, China
5 School of Engineering, Brown University, Providence, Rhode Island 02912, USA

* Corresponding author:
Tel.: +86 10 62772933; Email: qunyang@tsinghua.edu.cn (Q. Li)

Abstract

Contact stiffness is a fundamental mechanical index of solid surfaces and relevant to a wide range of applications. Although the correlation between contact stiffness, contact size and load has long been explored for single-asperity contacts, our understanding of the contact stiffness of rough interfaces is less clear. In this work, the contact stiffness of hexagonally patterned multi-asperity interfaces is studied using a discrete asperity model. We confirm that the elastic interaction among asperities is critical in determining the mechanical behavior of rough contact interfaces. More importantly, in contrast to the common wisdom that the interplay of asperities is solely dictated by the inter-asperity spacing, we show that the number of asperities in contact (or equivalently, the apparent size of contact) also plays an indispensable role. Based on the theoretical analysis, we propose a new parameter for gauging the closeness of asperities. Our theoretical model is validated by a set of experiments. To facilitate the