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Exact and approximate solutions of the infinite integrals of the asperity height distribution for the Greenwood-Williamson and the Greenwood-Tripp asperity contact models

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Abstract

The main contribution of this paper is in providing the closed-form solutions for F_2 and $F_{5/2}$ integrals. They appear in problems of contact mechanics described by the Greenwood-Tripp model for the contact of two nominally flat rough surfaces. It is evident that exact solutions as proposed are better than the existing approximate solutions because they could significantly improve the results in comparison to the solutions which are obtained via existing approximants. Relatively simple approximation formulas for those who do not choose to use closed-forms are also proposed. Two kinds of rational approximants which differ in complexity and accuracy are provided. The maximum relative error of more accurate approximations is about $10^{-8}\%$, while for the simpler approximants is about $10^{-4}\%$.

Keywords: Greenwood–Williamson theory, Greenwood–Tripp theory, Contact mechanics, Roughness, Real contact area, Statistical model

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