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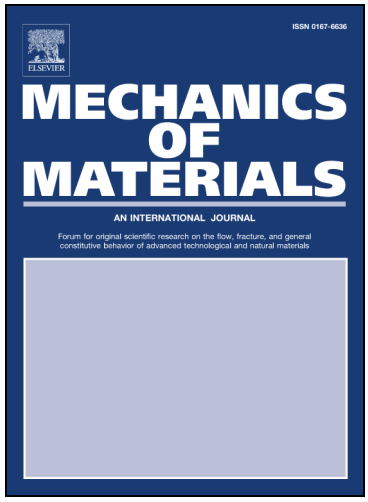

On the contact mechanics of a rolling cylinder on a graded coating. Part 2: Numerical results

M.A. Guler, Y. Alinia, S. Adibnazari

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On the contact mechanics of a rolling cylinder on a graded coating. Part 2: Numerical results

M.A. Guler[a,*], Y. Alinia[b,c], S. Adibnazari[b]

[a] *Department of Mechanical Engineering, TOBB University of Economics and Technology, Ankara, 06560, Turkey*
[b] *Department of Aerospace Engineering, Sharif University of Technology, Azadi Street, Tehran, Iran*
[c] *Department of Mechanical Engineering, Hakim Sabzevari University, Sabzevar, Iran*

Abstract

The analytical formulation of the fully coupled and the uncoupled rolling contact mechanics problems for all possible stick/slip regimes are derived in Part I (Alinia et al. 2013). In this part, we focus on the numerical algorithm, the iteration procedure and the numerical results. The coupled and the uncoupled solutions corresponding to each of the assumed stick/slip regimes are provided. The uncoupled solution provides an acceptable approximation to the problem for small coefficient of friction values. However, for high values of the coefficient of friction the problem should be solved in fully coupled form. In addition, the effect of several parameters such as the stiffness ratio, the coefficient of friction and the thickness of the coating on the surface normal, shear and in-plane stresses as well as the creep ratio that may have a bearing on the fatigue life and the vibrations of the components are investigated. The results indicate that there is a strong effect of the material property grading on the tensile peak of the surface in-plane stress.

Keywords: Rolling contact, Contact stresses, Convergence criteria, Coupled solution

*Corresponding author. Tel.+90 312 292 4088
Email address: mguler@etu.edu.tr (M.A. Guler)

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