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Summary: An axisymmetric problem for a frictionless contact of a rigid stamp with a semi-space in the presence of surface energy in the Steigmann-Ogden form is studied. The method of Boussinesq potentials is used to obtain integral representations of the stresses and the displacements. Using the Hankel transform, the problem is reduced to a single integral equation of the first kind on a contact interval with an additional condition. The integral equation is studied for solvability. It is shown that for the classic problem in the absence of surface effects and for the problem with the Gurtin-Murdoch surface energy without surface tension, the obtained equation represents a Cauchy singular integral equation. At the same time, for the Gurtin-Murdoch model with a non-zero surface tension and for the general Steigmann-Ogden model, the problem results in the integral equation of the first kind with a weakly singular or a continuous kernel, correspondingly. Hence, the contact problem is ill-posed in these cases. The integral equation of the first kind with an additional condition is solved approximately by using Gauss-Chebyshev quadrature for evaluation of the integrals. Numerical results for various values of the parameters are reported.

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frictionless contact; axisymmetric; Steigmann-Ogden surface energy; Gurtin-murdoch surface energy; singular integral equation; Fredholm equation of first kind

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