NUMERICAL SIMULATION OF FINITE LENGTH LINE CONTACTS

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Abstract: Finite length line contact is investigated numerically using both classic inversion of influence coefficient matrix and a modern CG-DCFFT algorithm. Various profiling techniques of roller generatrix, including partial crowning and three and five circle arcs rounding are investigated and their influence on pressure distribution assessed. The positive influence of roller profiling in diminishing axial ends pressure risers was evidenced. Program validation is performed either against numerical results published by Hartnett and by J. de Mul or against experimental data obtained by Glovnea et al. [5] using laser profilometry.

The use of influence coefficients method, coupled with the CG-DCFFT [6], removes the classic methods resolution limitations. This very efficient approach consists in employing the Conjugate Gradient Method (CGM) with the resolution of the linear system in pressure, while convolutions arising during residual minimization are computed in the frequency domain via Discrete Convolution and Fast Fourier Transform (DCFFT). With this algorithm, grids of 10^6 nodes can be solved on a personal computer in minutes. A typical result is shown in Fig. 1.

Results for the k ratio corresponding to loading levels in the elastic domain (up to 1660N) followed the same trend as the experimental data [5], Fig. 2.

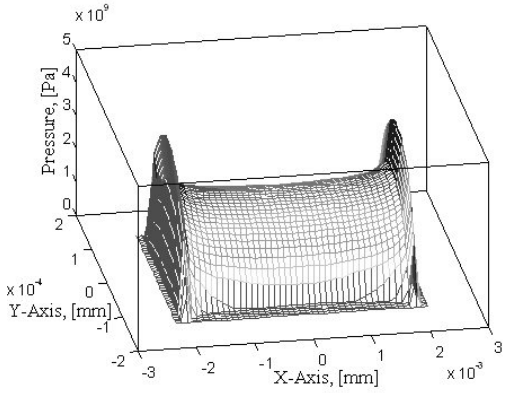

Fig. 1. High resolution grid solved by CG-DCFFT

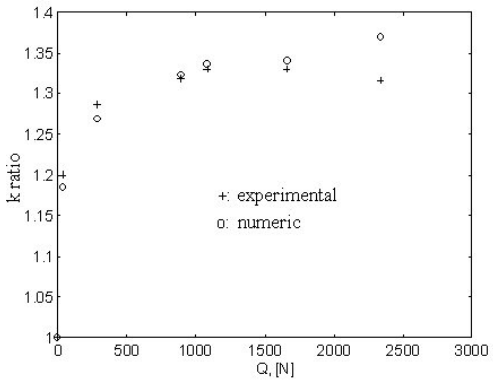

Fig. 2. k ratio, numeric and experimental

REFERENCES

[1] Lundberg, G., (1939), *Elastiche Beruhrung zweier Halbraume*. Forch Geb. Ingen, Bd. 10, 201-211.
[2] Gradinaru, D., Spinu, S., Marchitan, M., (2005), *Numerical Resolution of Elastic Contact Problem by Influence Coefficients Matrix Inversion*. Acta Tribologica, Volume 13, 2005.
[3] Hartnett, M.J., (1979), *The Analysis of Contact Stresses in Rolling Element Bearings*. ASME, Journal of Lubrication Technology, vol. 101, 1, pp. 105-109.
[4] de Mul, J.M., Kalker, J.J., Fredriksson, B., (1986), *The Contact Between Arbitrary Curved Bodies of Finite Dimensions*. ASME, Journal of Tribology.vol. 108, 1, pp.140-148.
[5] Glovnea, M., Diaconescu, E.N., (2004), *New Investigations of Finite Length Line Contact*. Proceedings of TRIB 2004 ASME/STLE International Joint Tribology Conference Long Beach, California USA, October 24 – 27.
[6] Crețu, S., Antaluca, E., Crețu, O., (2003), *The Study of Non-Hertzian Concentrated Contacts by a GC-DFFT Technique*. Rotrib'03 National Tribology Conference, Galați, Romania.