11th World Congress on Computational Mechanics (WCCM XI)
5th European Conference on Computational Mechanics (ECCM V)
6th European Conference on Computational Fluid Dynamics (ECFD VI)
July 20 - 25, 2014, Barcelona, Spain

MULTISCALE MODELING OF CHAIN-GUIDE CONTACT BY USING TESTS AND FEM

[*]Mihai T. Lates[1], Radu G. Velicu[2] and Radu Papuc[3]

[1] Department of Product Design, Mechatronics and Environment, Transilvania University of Brasov, Romania, latesmt@unitbv.ro, www.unitbv.ro
[2] Department of Product Design, Mechatronics and Environment, Transilvania University of Brasov, Romania, rvelicu@unitbv.ro, www.unitbv.ro
[3] Department of Product Design, Mechatronics and Environment, Transilvania University of Brasov, Romania, radu.papuc@unitbv.ro, www.unitbv.ro

Key Words: *Contact Mechanics, Chain Drive, Guide, FEM, Test.*

The paper presents the modeling of the contact area between a link of the toothed chain and its guide. The contact's properties are identified by using the multiscale method (using information from different sources); in the case of the guide (made from PA) from the tests, the hardness, the Young's modulus, the static and the dynamic friction coefficients are determined. By using the information from the tests, the contact pressures are determined by modeling with the finite element method.

The Young modulus is determined on a tribometer by using an indentation test. The static and dynamic friction coefficients are determined on the same tribometer by using a rotary device as it is presented in the Figure 1. One link from the chain drive is mounted in a holder which is pushing with a normal force on a disk plate made by the guide's material.

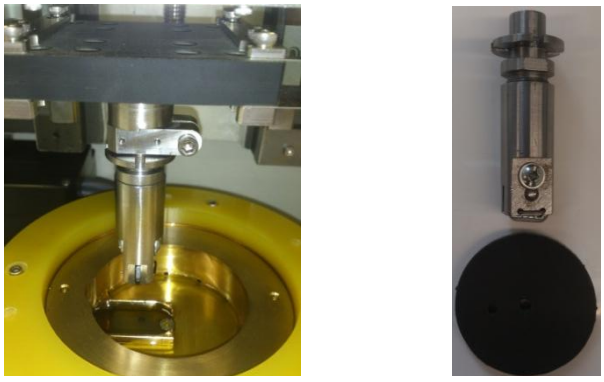

Figure 1. The test equipment

Figure 2 presents the variation of the friction coefficient COF in the case of a 2 way constant rotational speed of the disk plate V2= 500 r pm and a normal force of 5 N, established from the condition of the fluid friction. The values of the static friction coefficient (0.12 - determined when the rotational speed is 0) and of the dynamic friction coefficient (0.11 - determined when the rotational speed is constant but not 0) are comparable with the values from the references. There are made also Stribeck type tests.

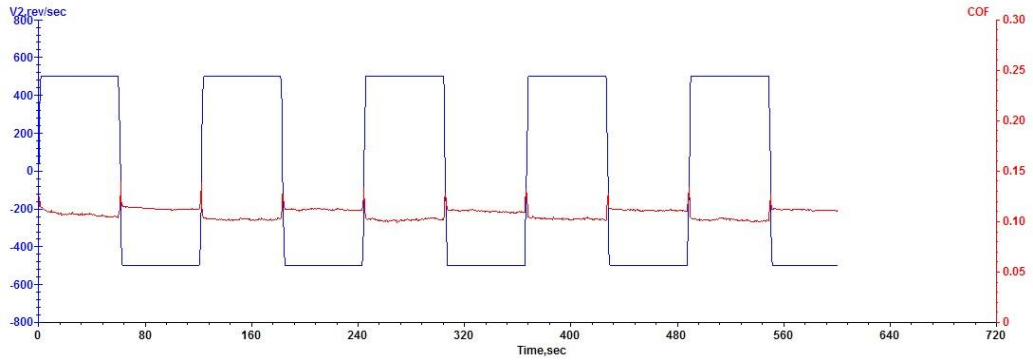

Figure 2. The friction coefficient

The values of the Young modulus and of the friction coefficient are used further in the finite element modeling in order to establish the contact pressures between the ling and the chain's guide.

The contact pressure distribution, determined in the testing conditions, is presented in the Figure 3.

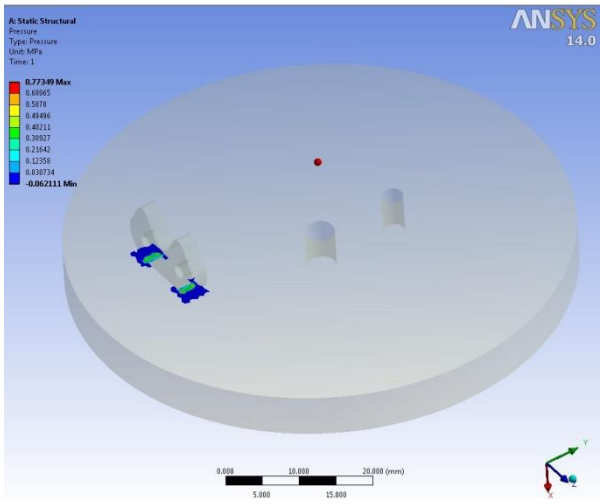

Figure 3. The contact pressure distribution

The test procedure and the finite element modeling presented in the paper can be applied in the case of any chain/guide type contacts with unknown material characteristics of the guide's material (Young modulus and friction coefficients) in order to establish the contact pressures between the guide and the link. The results can be used to optimize the guide/link contact area by using different profiles for the links or/and different materials for the guides.

REFERENCES

[1] T. Hyakutake, M. Inagaki, M. Matsuda, N. Hakamada and Y. Teramaki, Measuring of friction in timing chain. *Society of Automotive Engineers of Japan*, Vol. **22**, pp. 343–347, 2001.

[2] O.C. Zienkiewicz and R.C. Taylor, *The finite element method*, 6th Edition, Elsevier, 2006.