Comparison of Sliders for Tactile Friction Measurements

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1. Introduction

An artificial finger has been developed in previous work that has a friction coefficient, softness and low frequency hysteresis similar to a real finger [1]. It is used as a slider in experiments concerning tactile tribology because it produces reliable results, whereas the properties of real fingers can differ and change [2]. Although the slider has been shown to be similar to real fingers [1], it has not been compared with sliders made of other materials. The aim of this research was to compare the performance of the artificial finger with other sliders for measurement of dynamic friction.

2. Method

The testing system consisted of a two-axis load cell (MiniDyn: Multicomponent dynamometer Type 9256C2, Kistler), and an X–Y motion table (Series 1000 Cross Roller, Motion link). The sliders were fixed to the motion table and slid over the surfaces. The surfaces were: aluminium; paperboard; ABS plastic; a moisturizer applied to a soft substrate; and a polycotton fabric. The sliders used were: a 10mm steel ball; 10mm polyethylene ball; an artificial finger; and a silicone hemisphere with a radius of 5mm. The normal loads were between 0.1N and 1.5N, and the sliding speeds were 5, 10 and 15mms^{-1}. The measured friction coefficients were compared with those of the fingers of six volunteers on the same surfaces.

3. Results

It was not possible to set a normal load over 0.5N with the silicone slider as the frictional force arising on most surfaces was too high and could cause it damage.

The results of the sliders against the aluminium surface are shown as Fig. 1. The coefficients of friction were most similar on the moisturizer surface (Fig. 2). These differences can be explained by adhesive effects.

The friction coefficients of the artificial finger were similar to those of the fingers of the human volunteers.

4. Conclusions

The polyethylene and steel balls show a much lower coefficient of friction for all dry samples. On the moisturizer surface, their friction coefficients are similar to those of the artificial finger. They are not practical for most frictional tests because it is difficult to keep the normal load constant and they are likely to damage the test surface. The artificial finger allowed a wide testing range of normal load, whereas the use of the silicone slider is limited due to its fragility.

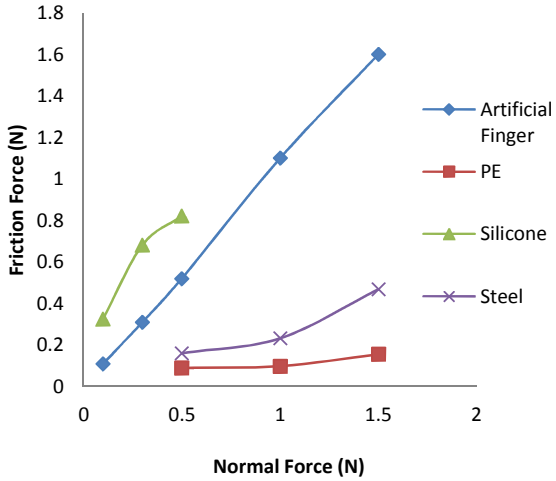

Fig. 1 Friction force against normal force for sliders on aluminium surface at speed of 5mms^{-1}.

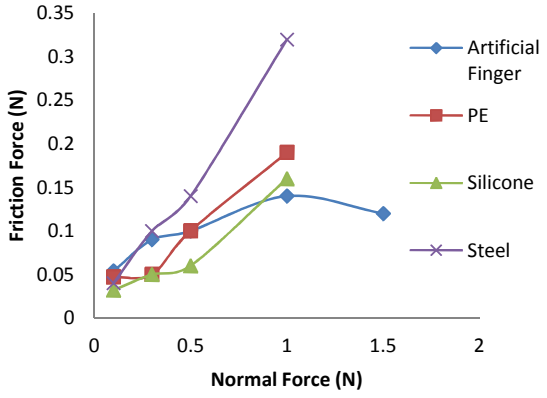

Fig. 2 Friction force against normal force for sliders on moisturizer at speed of 5mms^{-1}.

5. References

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[2] F Shao, X Chen, C J Barnes and B. Henson. (2010) A novel tactile sensation measurement system for qualifying touch perception. Proc. IMechE, Part H, Journal of Engineering in Medicine 224(1):97-105.