49th Leeds-Lyon Symposium on Tribology – September 2-4, 2024, Lyon, France
50 years of Leeds-Lyon

Metainterfaces: how to design rough contacts with specified friction laws?

A. Aymard [a], E. Delplanque [a], D. Dalmas [b], J. Scheibert [a*]
*julien.scheibert@cnrs.fr
[a] 1CNRS, Ecole Centrale de Lyon, ENTPE, LTDS, UMR5513, 69134 Ecully, France

KEYWORDS
Contact and adhesion; Texturation; Friction; Elastomer contacts

ABSTRACT
Many devices, including touchscreens and robotic hands, involve frictional contacts. Optimizing those devices requires fine control of the interface's friction law. We lack systematic methods to create dry contact interfaces whose frictional behaviour satisfies preset specifications. In this talk, we will present a generic surface design strategy to prepare dry rough interfaces that have predefined relationships between normal and friction forces [1]. Such metainterfaces circumvent the usual multiscale challenge of tribology [2], by considering simplified surface topographies as assemblies of spherical asperities. Optimizing the individual asperities' heights enables specific friction laws to be targeted. Through various centimeter-scaled elastomer-glass metainterfaces, we will illustrate different types of achievable friction laws, including linear laws with a specified friction coefficient and unusual non-linear laws. This design strategy represents a scale- and material-independent, chemical-free pathway toward energy-saving and adaptable smart interfaces.

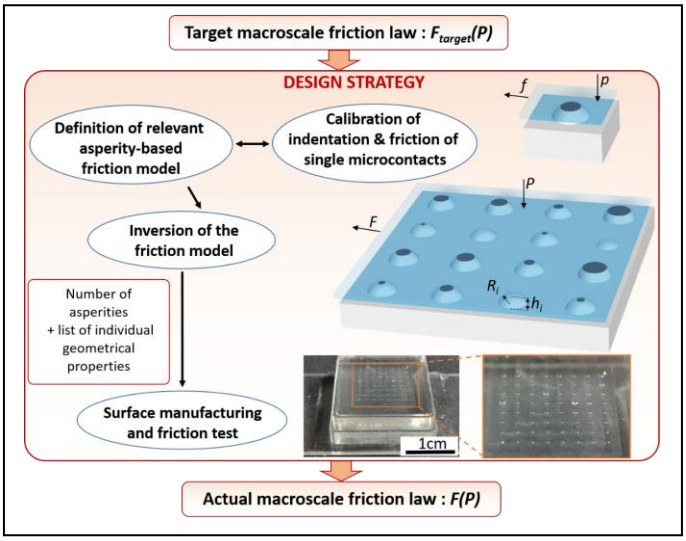

Fig.1: Flowchart of the design strategy for metainterfaces with specified friction laws (from [1]).

ACKNOWLEDGMENTS

This work was funded by LABEX iMUST (grant ANR-10-LABX-0064) of the Université de Lyon within the program "Investissements d'Avenir" (grant ANR-11-IDEX-0007) operated by the French National Research Agency (ANR), the ANR through grant ANR-18-CE08-0011 (PROMETAF project), and the Institut Carnot Ingénierie@Lyon (PREGLISS project).

REFERENCES

[1] A. Aymard, E. Delplanque, D. Dalmas, J. Scheibert, "Designing metainterfaces with specified friction laws", Science, 383, 2024, 200-204.
[2] A. I. Vakis, et al., "Modeling and Simulation in Tribology Across Scales: an Overview", Tribol. Int., 125, 2018, 169-199.