Effect of material elastic properties and surface roughness on the grip performances of ski boot soles

Supplementary information

Matteo Moncalero[a], Stefano Signetti[b], Barbara Mazzanti[c], Piero Bruzzi[c], Nicola M. Pugno[b,d,e,*], Martino Colonna[a,**]

[a]*Department of Civil, Chemistry, Environmental and Materials Engineering, University of Bologna, via Terracini 28, I-40122 Bologna, Italy*

[b]*Laboratory of Bio-Inspired and Graphene Nanomechanics, Department of Civil, Environmental and Mechanical Engineering, University of Trento, via Mesiano 77, I-38123 Trento, Italy*

[c]*Centro Ceramico Bologna, via Martelli 26, I-40122 Bologna, Italy.*

[d]*School of Engineering and Materials Science, Queen Mary University of London, Mile End Road, E1 4NS London, UK*

[e]*Ket-Lab, Italian Space Agency, via del Politecnico snc, I-00133 Roma, Italy*

[*]Corresponding author at: Laboratory of Bio-Inspired and Graphene Nanomechanics, University of Trento.
E-mail: nicola.pugno@unitn.it

[**]Corresponding author at: Dept. of Civil, Chemistry, Environmental and Materials Engineering, University of Bologna.
E-mail: martino.colonna@unibo.it

(a) **(b)**

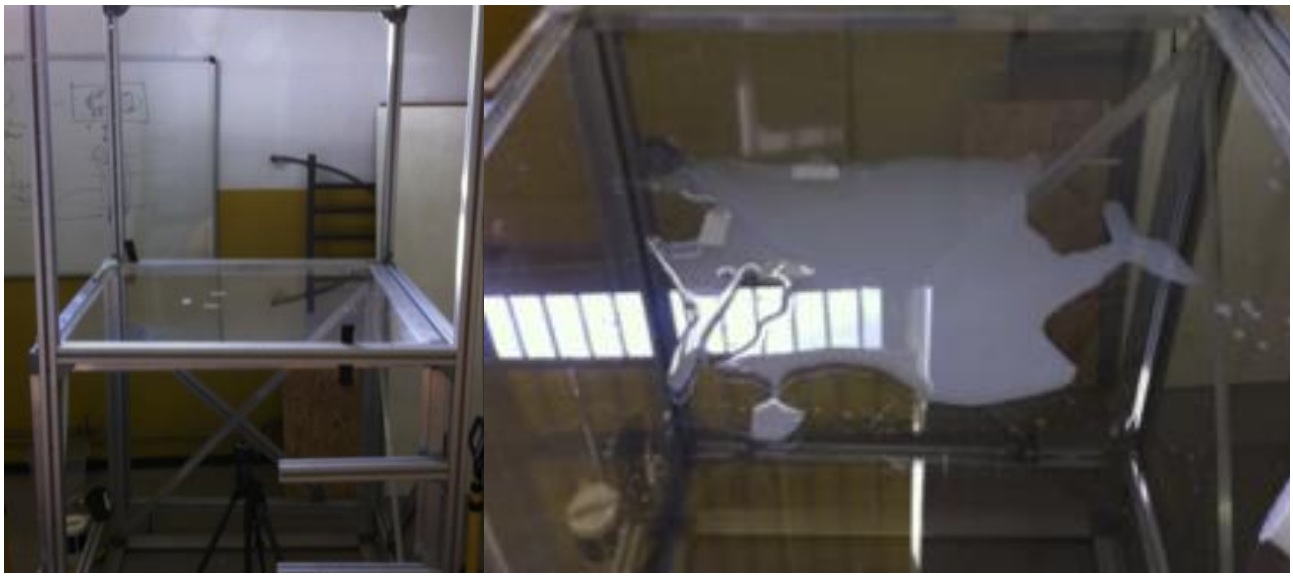

Figure 1. (a) Transparent PMMA testing platform (108x108 cm^2, thickness 10 mm) for the determination of the sole area of contact with the ground and **(b)** contrast liquid.

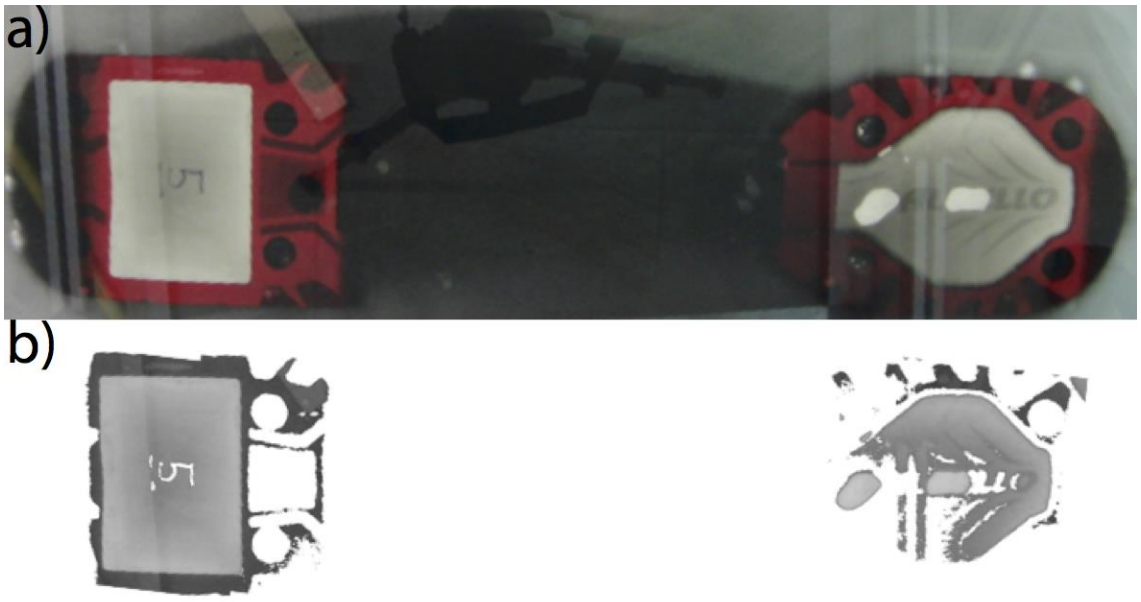

Figure 2. Images of the Sole 1 acquired with a Casio~Exilim~EX-FH25 digital camera with resolution of 3648x2736 pixels. **(a)** Sole with contrast liquid; **(b)** surface in contact.

Table 1. Main profile parameters according to ISO 25178 for the 6 tested soles determined with 3D scan (sample size 1.2x0.9 mm).

Parameter	Description	Sole 1	Sole 2	Sole 3	Sole 4	Sole 5	Sole 6
S_q [µm]	Root mean square height	3.346	3.256	3.440	3.055	4.484	20.906
S_{sk} [-]	Skewness	0.303	0.327	0.132	-0.029	0.049	0.083
S_{ku} [-]	Kurtosis	3.454	4.169	3.178	3.634	3.121	2.803
S_p [µm]	Maximum peak height	14.599	16.712	13.642	11.140	15.697	62.343
S_v [µm]	Maximum pit height	14.260	17.838	13.148	14.727	16.621	65.391
S_z [µm]	Maximum height	28.859	34.550	26.790	25.867	32.318	127.734
S_a [µm]	Arithmetic mean height	2.629	2.493	2.730	2.372	3.522	16.799
S_{mr} [%]	Areal material ratio	0.072	0.008	0.024	0.151	0.056	0.054
S_{mc} [µm]	Inverse areal material ratio	4.385	4.047	4.485	3.882	5.868	27.293
S_{xp} [µm]	Extreme peak height	5.944	5.934	6.393	5.993	8.934	39.282
S_{al} [µm]	Auto-correlation length	36.921	32.212	41.412	38.713	162.626	127.044
S_{dq} [-]	Root mean square gradient	0.483	0.510	0.511	0.495	0.424	3.077
S_{pd} [1/µm^2]	Density of peaks	4.07E-04	4.04E-04	5.59E-04	5.99E-04	2.30E-04	1.97E-04