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A micro-meso model to predict van der Walls and capillary induced stiction in micro-structures.

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Undesirable stiction in MEMS results from the contact between surfaces and is due to the adhesive van der Waal and/or capillary forces, which become important for micro-structures. In this work, a micro-macro multi-scale approach is developed in order to predict possible stiction in MEMS structures

At the lower scale, the unloading adhesive contact-distance curves of two interacting rough surfaces are established based on Maugis' model extended herein to account simultaneously for the van der Waals and the capillary forces. The resulting unloading adhesive contact-distance curves are dependent on the material and surface properties -such as elastic modulus, surface energy- on the rough surfaces' topography parameters -the standard deviation of asperities heights and the asperities' density- and on the humidity level.

At the higher scale, a beam finite element analysis is considered to determine the residual configuration due to the adhesive forces once contact happened. Toward this end, the adhesive contact-distance curve computed previously is integrated on the surface of the finite elements as a contact law.

Keywords: MEMS, Stiction, Multi-scale, Van der Waals forces, Capillary forces