

# **Mechanical Engineering**

### SEMINAR SERIES

### FALL 2018



## *Elastic Adhesive Contact of Rough Surfaces: Non-Dimensional Parameters*

Wednesday, October 31 Mechanical Engineering Building, Room 128 3:30 pm - 4:30 pm Host: Dr. Matthew Brake

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#### Abstract:

Adhesive contact of a rigid flat surface with an elastic substrate having Weierstrass surface profile is numerically analysed using the finite element method. We investigate the relationship between load and contact area spanning the limits of non-adhesive normal contact to adhesive contact for various substrate material properties, surface energy and roughness parameters. In the limit of non-adhesive normal contact, our results are consistent with (Ciavarella et al. 2000 Proc. R. Soc. Lond. A 456, 387-405 and Hyun et al. 2004 Phys. Rev. E 70, 026117) - contact area is linear with load and has a fractal character. For the adhesive contact problem, we employ Lennard-Jones type local contact interaction model with numerical regularization to study the transition from partial to full contact including jump-to-contact instabilities as well as load-depth hysteresis. We have investigated evolution of bonded contact area and pull-off force for various surface roughness parameters to adequately explain experimentally observed adhesion weakening and strengthening phenomena. The roughness parameter is the ratio of root mean square (rms) roughness to range of interaction which quantifies the intimacy of surfaces and the strength parameter which is a function of surface energy, elastic modulus, rms slope and small scale roughness characterizes the bondability of the surfaces.

#### Biography:

Dr. Sreekanth Akarapu obtained his doctorate degree from Washington State University working on 'Dislocation interactions with interfaces" under the guidance of Professor Hussein Zbib and Dr. John Hirth in 2009. After completing his doctoral studies, he worked as a postdoctoral research fellow at Johns Hopkins University investigating the "stiffness of contact between rough surfaces" in collaboration with Professor Mark Robbins. Since 2010, he has gained industrial experience working at Shell Oil Company and, currently, with ANSYS in the application of computational mechanics to solve engineering problems. His research interests include dislocation dynamics, multi-scale model of plasticity, contact mechanics of rough surfaces and polymer process modeling.