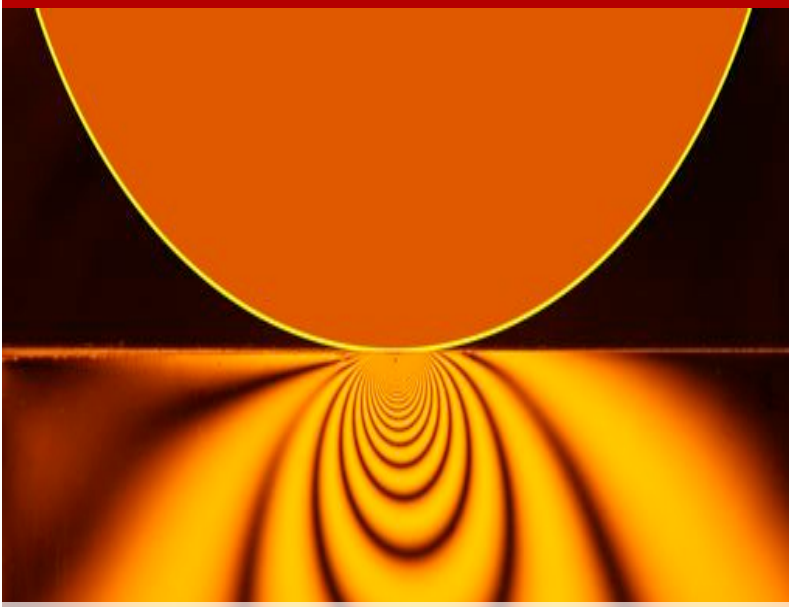
MultiscaleConsulting
Contact Mechanics & Friction

Your Partner on Contact Mechanics

Seminar

Contact Mechanics with Applications: New Approaches and Software Tools



18. AND 19. June 2012

MARITIM HOTEL
COLOGNE

Content

Contact Mechanics is the central topic for many engineering applications. This involves such as contact stiffness, heat and electric contact resistance, leakage of static and dynamic seals, rubber friction, adhesion, and mixed lubrication.
The influence of surface roughness on Contact Mechanics is usually described either by over-simplified analytical models, which are known to fail even qualitatively, or by numerical approaches such as the Finite Element Method (FEM), which can handle roughness on just two or at most three decades in length scales. Real surfaces of engineering interest, however, may have roughness over many decades in length scale starting from cm and going down to nm. It is not possible to handle these surfaces using purely numerical approaches such as FEM.

Recently a new multi-scale approach to Contact Mechanics has been developed taking accurately into account all relevant length scales. This approach is very flexible and general and it can be applied to describe the Contact Mechanics of elastic, viscoelastic, elastoplastic as well as layered materials. The theory predicts the area of real contact (and how it depends on the resolution of the instrument used to detect it) and the distribution of contact stresses and interfacial separations (in the non-contact region). This approach gives a new and very powerful way of how to understand problems in Contact Mechanics involving surface roughness on many length scales, and it informs the user about the most important scales involved in a particular application.

The lectures will be given by Dr. B.N.J. Persson, who has developed the multi-scale approach to Contact Mechanics, and by Dr. B. Lorenz who has performed many simple model experiments to test the theory. The seminar will be held in English and a compendium of lecture notes will be handed out.

Program

Monday, 18th June 2012
09:00 till 18:00

Contact Mechancis

09:00 — **Registration**

09:15 to 09:30 — **1 Welcome**

Introduction - Scope of the Seminar

09:30 to 10:30 — **2 Surface Roughness**

Surface Roughness Power Spectra, Top and Bottom Power Spectra, Characterization of Surface Anisotropy, Generation of Randomly Rough Surfaces, Experimental Methods and Limitations

10:30 to 11:00 — Coffee Break

11:00 to 13:00 — **3 Contact Mechanics: Stress Distribution**

Hertz Theory, Multi-Asperity Contact Theories, Multi-Scale Theory by Persson, Stress Probability Distribution, Elastoplastic contact, Contact Mechanics for Layered Materials and for Viscoelastic Materials, Experimental Validation

13:00 to 14:00 — Lunch

14:00 to 15:00 — **4 Contact Mechanics: Interfacial Separation**

Average Interfacial Separation, Probability Distribution of Interfacial Separation, Experimental Validation

15:00 to 16:00 — **5 Contact Mechanics with Adhesion**

Dry Adhesion, Capillary Adhesion, Bioadhesion

16:00 to 16:30 — Coffee Break

16:30 to 17:00 — **6 Contact Stiffness**

Normal Stiffness, Tangential Stiffness, Ultrasound Wave Interaction

17:00 to 18:00 — **7 Heat and Electric Contact Resistance**

Heat Transfer via the Area of Real Contact and the Area of Non-Contact, Experimental Validation

20:00 — Dinner at Peters Brauhaus

Program

Tuesday, 19th June 2012
09:00 till 15:30

Rubber Friction

09:00 to 10:00 — **1 Leak Rate of Seals**

Critical Junction Theory, Effective Medium Theory, Experimental Validation

10:00 to 10:30 — **2 Squeezing Out of Fluids**

Relation between Squeeze-Out and Friction, Role of Contact Area Percolation, Application to Tires, Syringes and Bio Applications

10:30 to 11:00 — Coffee Break

11:00 to 12:00 — **3 Mixed Lubrication and Fluid Flow Factors**

Effective Fluid Flow Equation, Fluid Flow Factors, Friction Factors, Numerical Illustrations, Experimental Verification

12:00 to 13:00 — **4 Rubber Friction**

Different Contribution to Rubber Friction, The Role of Different Length Scales, Flash Temperature

13:00 to 14:00 — Lunch

14:00 to 14:45 — **5 Tyre Dynamics**

Simple Tire Model with Realistic Description of the Rubber Friction, μ-Slip and Slip-Angle Curves, Self Aligning Moment and ABS Breaking Simulations

14:45 to 15:30 — **6 Contact Mechanics Software**

Introduction and Overview of Different Software Tools, Surface Generator, Power Spectrum, Contact Mechanics, Rubber Friction and Tire Dynamics, etc.

15:30 to 16:00 — Coffee Break / End of Seminar