Literature

Detailed information about the different topics addressed in the seminar can be found in the following publications:

- B.N.J. Persson, Springer Verlag Berlin, 1998, ISBN: 3540671927 – *Sliding Friction: Physical Principles and Applications*
- B.N.J. Persson, J. Chem. Phys. **115**, 3840 (2001) – *Theory of rubber friction and contact mechanics*
- B.N.J. Persson, Sur. Sci. Rep. **61**, 201 (2006) – *Contact mechanics for randomly rough surfaces*
- B.N.J. Persson, O. Albohr, U. Tartaglino, A.I. Volokitin, E. Tosatti, J. Phys.: Condens. Matter **17**, R1 (2005) – *On the nature of surface roughness with application to contact mechanics, sealing, rubber friction and adhesion*
- B.N.J. Persson, J. Phys.: Condens. Matter **23**, 015003 (2011) – *Rubber friction and tire dynamics*
- B.N.J. Persson, U. Tartaglino, O. Albohr, E. Tosatti, Nature Materials **3**, 882 (2004) – *Sealing is at the origin of rubber slipping on wet roads*
- B.N.J. Persson, B. Lorenz, A.I. Volokitin, Eur. Phys. J. E **31**, 3-24 (2010) – *Heat transfer between elastic solids with randomly rough surfaces*
- B. Lorenz, B.N.J. Persson, Eur. Phys. J. E **31**, 159-167 (2010) – *Leak rate of seals: Effective-medium theory and comparison with experiment*
- B. Lorenz, B.N.J. Persson, J. Phys.: Condens. Matter **21** (2009) 015003 – *Interfacial separation between elastic solids with randomly rough surfaces: comparison of experiment with theory*

These publications can be downloaded from our homepage www.MultiscaleConsulting.com/Publications. Additional Information can be found there as well.

Cologne

Cologne is situated on the river Rhein in North Rhine-Westphalia. It is one Germanys most historic cities founded in 50 AD by the Romans.
Cologne is the fourth-largest city in Germany and a major cultural centre of the Rhineland with a vibrant arts scene, endless sightseeing and magnificent buildings such as the Cologne Cathedral, the city's most famous monument and a World Heritage site of UNESCO.

Historically, Cologne has always been an important trade city with important land, sea and air connections. The economy is primarily based on insurance and media industries but there are also corporate headquarters of civil airline company or automotive industries.

In addition Cologne kept its charm of a medieval old town centre, which finds expressions in hospitality and in pleasure in living and working.

Administration

Conference Site

Maritim Hotel Cologne
Heumarkt 20
50667 Cologne, Germany

Seminar Fee

1800 EUR
1500 EUR (booking discount - valid until 31.01.2012)
250 EUR (students)

Payment is due only after having received the invoice.

Organisation and Registration

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Scope of Services

- Seminar Documentation
- Boards (Soft Drinks, Lunch, Dinner on the first Day)
- Certificate of Attendance

Registration

Please register by email or fax. You will then receive an email confirming your registration and an invoice.

Participants

The number of Participants is limited.

Cancellation

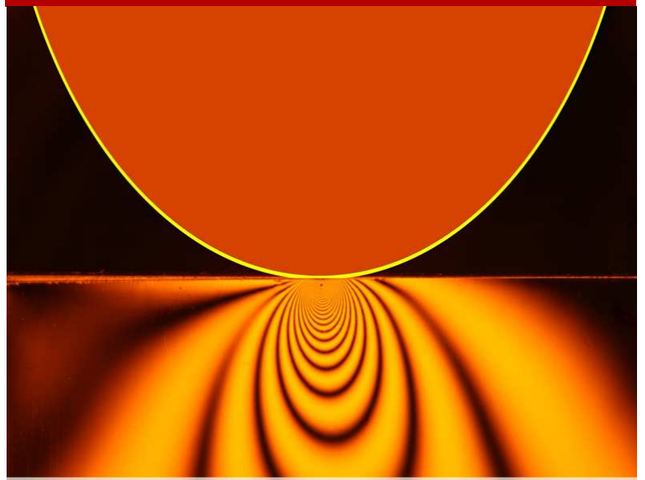
Cancellation of applicants is possible until 4 weeks before the seminar. In case of a later resignation the seminar fee cannot be paid back.
In case of cancellation by the organizers due to unforeseeable circumstances, the participants are to be informed immediately. Registration fees that have already been paid will be refunded. Any further claims shall be excluded.

MultiscaleConsulting
Contact Mechanics & Friction

Your Partner on Contact Mechanics

Seminar

Contact Mechanics with Applications: New Approaches and Software Tools



02. AND 03. April 2012

MARITIM HOTEL
COLOGNE

Content

Contact Mechanics is the central subject for many engineering applications and it is involved in many matters 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 model experiments to test the theory. The seminar will be held in English and a compendium of lecture notes will be handed out.

Intended audience

- Engineers and constructors from research and development who need an introduction to this field or who want to learn about the latest progress
- Managers who want to provide a decision basis for investments
- Scientists who work in the context of Tribology and Contact Mechanics
- Students as well as doctoral students from Mechanical Engineering and Physics

Intended branches

- Automotive- and supply industry
- System and machine construction
- MEMS manufacturer
- Tyre manufacturer
- Motorsport companies
- Seal manufacturer
- Medical industry
- Universities
- Research facilities
- etc.

Program

Monday, 2nd April 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, 3rd April 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