

Contact mechanics and elements of tribology

Concluding remarks

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What you could learn from the course

Basic notions:

- Continuum contact mechanics
- Flaman's solution
- Roughness
- Friction models
- Lubrication
- Wear at micro/meso-scale
- Finite element analysis of contact

New notions:

- Fractals
- Power spectral density (PSD)
- Nayak's parameter
- Augmented Lagrangian method
- Multi-asperity models
- Fluid-structure interaction FE framework
- Elastodynamic friction
- Stick-slip

- Continuum contact mechanics
 - K.L. Johnson. *Contact Mechanics*, 1985.
 - J.R. Barber. *Contact Mechanics*, 2018.
- Computational contact mechanics
 - P. Wriggers. *Computational Contact Mechanics*, 2006.
 - T. Laursen. *Computational contact and impact mechanics*, 2002.
- Roughness
 - T.R. Thomas. *Rough Surfaces*, 1998.
 - P. Meakin. *Fractals, scaling and growth far from equilibrium*, 1998.
- Lubrication & Sealing
 - B.J. Hamrock et al. *Fundamentals of fluid film lubrication* (2004)
 - H.K. Müller, *Fluid Sealing Technology: Principles and Applications* (1998)
- Micromechanical contact and tribology
 - F.P. Bowden, D. Tabor. *The Friction and Lubrication of solids*, 1954.
 - E. Rabinowicz. *Friction and Lubrication of Materials*, 1964.

Conclusion

- “Practice is the father/mother of learning”
- “Devil/God is in the detail”
- Contact mechanics and tribology are very broad domain and crucial for engineering
- Friction is a rare mechanical phenomenon on which you can hope to publish in Nature/Science

Few recent examples:

[1] I. Svetlizky, J. Fineberg, Classical shear cracks drive the onset of dry frictional motion, **Nature** 509 (2014)

[2] M. Yifei, K.T. Turner, I. Szułufarska. Friction laws at the nanoscale. **Nature** 457 (2009)

[3] F. Yamashita et al., Scale dependence of rock friction at high work rate. **Nature** 528 (2015)

- Many interesting questions are to be addressed in the future
- Fine experiments are crucial for advancement
- Computational mechanics is important for understanding the complex interplay of different physics in the interface

What's next?

- For those who are interested in checking themselves and/or who are interested in getting a certificate of attendance

EXAM!

- **Final survey** to give us your feedback on the course so that we improve/adjust it for future editions. I'll send it to you by email in the afternoon.



Thank you for your attendance and
participation!