

Contact Mechanics and Elements of Tribology

Foreword to the 8th edition

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@ Centre des Matériaux (& virtually)
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- Acquaintance
- Questionnaire
- Teaching team
- Course content
- Complexity of contact physics
- Notations

Teaching team



- **Henry Proudhon** (@CNRS, France) - Fretting and Wear
- **Ramin Aghababaei** (@Aarhus University, The Netherlands) - Nanoscopic wear
- **Pierre Arnaud** (@MINES, France) - Fretting wear, 3rd body & oxygenation
- **Antoine Perriot & Philippe Bussetta** (@Michelin, France) - Tribology of tyres
- **Vladislav Yastrebov** (@CNRS, France)

Please introduce yourself

Nominally 41 participants from 19 different countries



Welcome questionnaire



Zoom and operational mode

- We give this course in a hybrid mode, so please be patient with technical problems ☺.
- In case of such problems, please write in Zoom chat, we'll try to solve them asap.
- Please do not record the course, one day, I'll do it on my own ☺
- Please don't share zoom links neither. If someone would like to attend, please write me an email.
- During lectures, I'll accept oral question only from people in the classroom.
- For all Zoom participants, please write your questions in Google.Sheet, I'll try to address them later.
- All slides are available on www.yastrebov.fr/teaching.html
- All links will be provided in Google.Sheet of the course (please be careful with this online document).
- You can use all my figures and my slides (CC BY license) if you simply mention the author.

Monday

- Lecture: Industrial Applications
- Lecture: Continuum Contact Mechanics
- Blackboard: Flamant's problem

Tuesday

- Lecture: Contact mechanics and material behavior
- Lecture: Contact at small scales: roughness & contact
- Practical work: Integration of Flamant's solution

Wednesday

- Lecture: Fretting and wear (*H. Proudhon*)
- Lecture: Computational Contact Mechanics
- Practical work: Contact algorithms (FEM)

Thursday

- Lecture: Lubrication and Sealing
- Lecture: Contact at Small Scales: transport
- Practical work: some contact problems (analytical and numerical solutions)

Friday

- Seminar: *Elastodynamic friction*
- Seminar: *Tribology of tyres* (P. Bussetta & A. Perriot, Michelin)
- Seminar: *Third body and oxygenation in fretting wear* (P. Arnaud, MINES)
- Seminar: *Nano-/micro-scale wear* (R. Aghababaei)
- Exam for all

Exam, certificates & notes

- On Friday, February 10th at 13h30.
- 20-25 questions on lectures of the first four days (Monday-Thursday)
- Duration: 3 hours
- Type of questions: technical questions which generally require some calculations
- Please take notes during the class, I give extra information on the blackboard
- You will be allowed to use whatever source of information you need, but not be helped by others or ChatGPT ☺
- The exam is “mandatory” for all the participants:
 - If you need a certificate of attendance. By the way to get it, you'll need to attend 13/16 of lectures and practical sessions...
 - If you would like to try to get a certificate of excellence
- Final notes are essential for DMS participants to validate the course

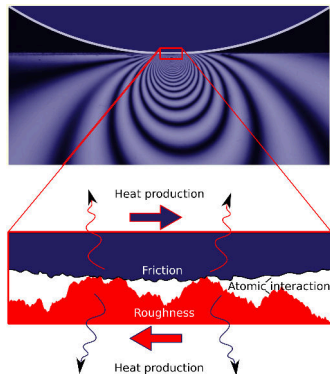


2022, I signed seven such certificates out of 35 participants who followed almost all lectures and passed the exam, in total you were 80 registered participants. ☺

Contact complexity: physics and mathematics

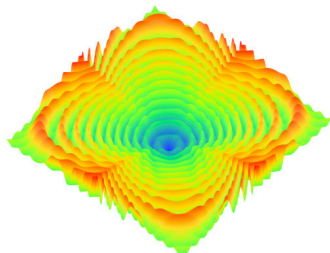
Particular difficulties related to contact problems:
multiphysical aspects, mathematical aspects

- Fractality of surfaces
- Interface chemistry
- Hardly accessible contact interface for measurements
- Generation and diffusion of heat
- Multiscale and multiphysical nature of friction



Particular difficulties related to contact problems: multiphysical aspects, **mathematical aspects**

- One of the most hard problems in mechanics
- Lack of standard optimization problem
- Non-convexity and non-differentiability
- Non-continuous character
- Bad scalability





Welcome to the CMET course!
