



## SURFACES, FRICTION, VIBRATIONS

### MECHANICAL SYSTEMS AND CONTACTS

Lecturers: Joël PERRET LIAUDET, Denis MAZUYER

| Lecturers : 12.0 | TC : 12.0 | PW : 0.0 | Autonomy : 0.0 | Study : 8.0 | Project : 0.0 | Language : MI

#### Objectives

In many mechanical systems and mechanisms, contact dynamics are often of prior importance in ensuring integrity, energy efficiency and environmental respect. Designing these systems remains complex due to the couplings between the dynamic response of the system and local tribological behavior at the surface scale.

The objective of this course is to give a multidisciplinary approach on these issues. In particular, the main phenomena involved will be provided (description of the lubricated, dry contacts, in normal and tangential stresses, friction laws). The resulting vibroacoustic problems will be put into perspective: vibroimpact, squealing, global dynamic behavior induced by local interactions.

**Keywords :** Contacts, mechanical systems, tribology, dynamics of systems, advanced design

#### Programme

The following topics will be addressed with courses, TD and BE:

- Kinematic aspect of contact drive systems
- Contact theory, dry and lubricated
- Normal contact dynamics
- Friction instabilities

#### Learning outcomes

- Understand the main concepts of contact dynamics
- Understand the basics of lubrication
- To be able to predict the performance of mechanisms
- To be able to build an advanced design methodology of dynamic systems

#### Independent study

**Objectifs :** The courses are completed by a group activity based on solving a problem that will deepen the concepts seen in class. This activity will concern in particular the study of screeching in the context of a windshield wiper.

**Méthodes :** Problem-based learning method

#### Core texts

K.L. Johnson, *CONTACT MECHANICS*, Cambridge University Press, 2001  
V. L. Popov *CONTACT MECHANICS AND FRICTION*, Springer, 2010  
A. Cameron *THE PRINCIPLES OF LUBRICATION*, John Wiley & Sons Inc, 1981

#### Assessment

Final mark = 25% Knowledge + 75% Know-how  
Knowledge N1 = 100% final exam  
Know-how N2 = 100% continuous assessment