ME 515 CONTACT MECHANICS

Syllabus

Mechanical contact is the principal method of load transfer between engineering components. Stresses in the contact region are generally very high and failure mechanisms associated with these stresses may limit the performance of the component.

The course will start from the classical Hertzian analysis of elastic contact of two bodies, which forms the basis of the design of such components as ball and roller bearings, wheels on rails, gear teeth in contact etc.. The discussion will then be extended to a variety of more recent developments including:-

- The development of plastic deformation in heavily-loaded systems, including the possibility of shakedown under repeated loading.
- Situations involving frictional tractions, e.g. the transmission of a tangential force when accelerating a railroad locomotive, microslip between components in static contact due to machine vibration (leading to fretting corrosion failure), oblique impact of elastic bodies, etc.
- Mechanics considerations in the analysis of surface fatigue failures
- initiation and development of sub-surface defects, effect of loading history, etc.
- Influence of surface roughness on contact stress distributions, friction and on the conduction of heat and electricity across an interface.
- Thermal effects — particularly the effect of thermoelastic distortion on contact stresses in static heat transfer and in frictional sliding.

Throughout the course, the emphasis will be on engineering applications. Rigorous applied mechanics solutions will be used or referred to where appropriate, but the primary focus will be on the results and their relation to experimental evidence, rather than on the mathematical methods. The course is therefore suitable both for mechanical engineers with an interest in design and for solid mechanics students wishing to see additional connections between their studies and practical applications.