



Master-Thesis

Finite-Element Method, Biomechanics

Contact Mechanical and Wear Simulation of Primary and Secondary Articulating Surfaces of Hip Joints

Goal: FEA should be applied to contact mechanical calculations within the primary and secondary articulating surfaces.

Project Description: The contact mechanics of hip joints is well investigated by means of laboratory and computer simulation. What is missing is the implementation of two features. The first is the increasing importance of the secondary contact regions. Since the wear rates of the primary contact areas have become very small by recent developments the wear of the secondary contact areas has become a substantial contribution to the entire wear behaviour. This should be made assessable by implementing the Archard wear equation to the different contact areas. The second aspect stems from the fact that a hip surface under steady-state conditions consists of several layers of organic and inorganic materials, which have different properties. These do not just alter the topography and chemistry but also the mechanical properties of the contact areas and, therefore, the distribution and time sequence of the mechanical stresses. The latter should be the focus of this thesis. It is important to notice that such simulations always must incorporate the state of lubrication, which should be incorporated by the existing derivatives of the Reynolds equation.

Procedure:

- Literature research
- Implementation of contact stress and lubrication models to hip joint and hip replacement
- Comparison of contact load cycles for primary and secondary articulating surfaces on the basis of standard and measured gait cycles.
- Assessment of wear by a mechanism dependant application of the Archard wear equation
- Documentation

Prerequisites:

- Experience with FEA

Supervisor and Contact: Prof. Dr.-Ing. habil Alfons Fischer

Email: alfons.fischer@uni-due.de

Tel.: 0203/379-4372

Fax.: 0203/379-4374

