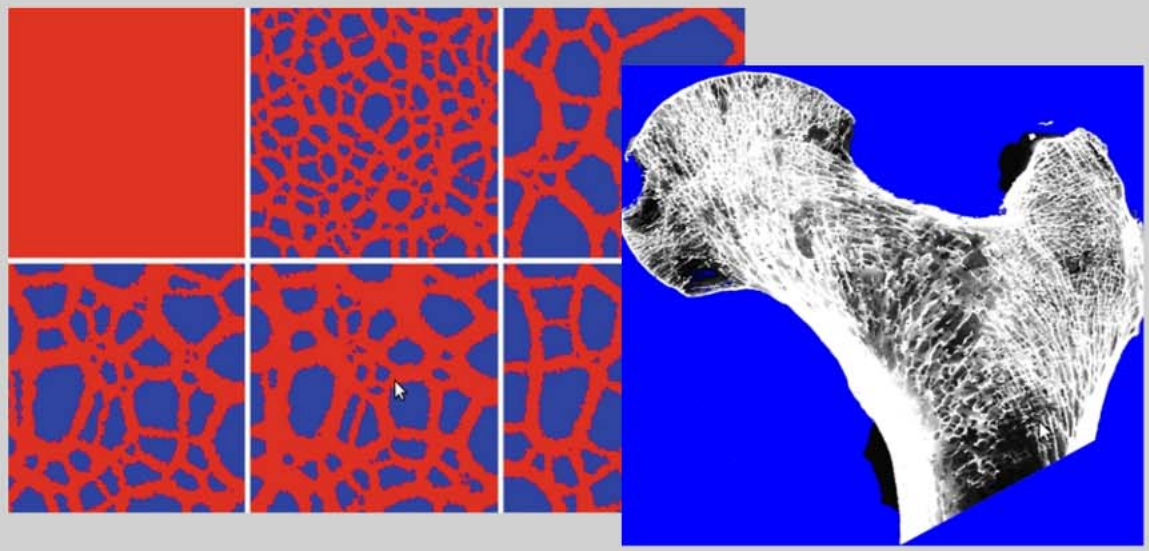
seminarios máster estructuras

SEMINARIO INTERUNIVERSITARIO DE MECANICA Y MATERIALES

MÁSTER DE ESTRUCTURAS

BIOMECHANICS OF BONE STRUCTURE AND STRENGTH: FROM IN-VIVO TO IN-SILICO ANALYSIS



Bert van RIETBERGEN

Department of Biomedical Engineering, Eindhoven University of Technology, The Netherlands.

Día: Lunes 7 de noviembre 2011 a las 12:00h
Lugar: Salon de Grados de
E.T.S. Ingeniería de Caminos, C y P, Campus Fuentenueva

Universidad de Granada

http://www.ugr.es/~iestructuras http://w3.mecanica.upm.es/seminarios

SEMINARIO INTERUNIVERSITARIO DE MECANICA Y MATERIALES

MÁSTER DE ESTRUCTURAS

BIOMECHANICS OF BONE STRUCTURE AND STRENGTH: FROM IN-VIVO TO IN-SILICO ANALYSIS

Bert van RIETBERGEN

Given their load-carrying function, the quality of our bones is best described by their strength. Bone strength can be affected by bone diseases, of which osteoporosis is the most common one. A direct measurement of bone strength, however, is not possible for bone in-vivo. For this reason, the diagnosis of osteoporosis presently is based only on bone density measurements, even though it was found that bone density is not a good predictor of bone strength.

In order to improve the diagnosis of bone strength in-vivo, three-dimensional information about the bone external and internal morphology as well as accurate mechanical analysis techniques are needed. Over the last decade, new high-resolution imaging techniques have been developed that make it possible to image bone micro-architecture in vivo in great detail and computer models based on the finite element method have been developed to calculate in-vivo bone mechanical properties based on such images. In the first part of this presentation the state-of-the-art in this field as well as some clinical applications and results will be discussed.

While an accurate diagnosis is needed to decide that treatment is needed, an accurate prognosis of the progression of the disease and the effect of drugs or other treatment is needed to decide which treatment strategy is the most effective. Also during the last decade, computer models have been developed that can simulate the progression of osteoporosis and the effects of different treatment strategies. These models are based on the hypothesis that bone remodeling is regulated by bone cells that can measure local loading conditions and can stimulate bone resorption or apposition locally. In the second part of this presentation it will be demonstrated that such models can explain the formation of typical bone micro-architectures, the adaptation of bone structures to changes in loading conditions, and the development of osteoporosis as a result of changes in cell activity. An outlook for the clinical application of such models will be given as well.

Universidad de Granada

http://www.ugr.es/~iestructuras http://w3.mecanica.upm.es/seminarios