# The Simulation of trabecular bone mechanism

*HoangThi Le*
ELE 482, Biomedical Engineering, University of Rhode Island

Trabecular bone is the bone that we found at all the articulating joint and spine. The porous is one type of the trabecular bone. It is consisting of irregular three the Dimensional array of boney rods and plates. In additional, the bone surface is cover by the bone cell, the bone is a living tissue, which is self-healing and has the ability adjustment. And bone is a composite of minerals and collagens. There was many types that are relate to the trabecular bone: remodel bone, osteoporosis, prosthesis loosening, development of artificial bone substitutes, and design of drugs to combat bone disease, aging, and space flight.

The mechanical properties of the trabecular bone will show us the strength of whole bone and the knowledge of the failure mechanisms is required to understand the pathways by which aging and disease affect bone properties.

First, they combine the result from tension and compression experiment with the analysis theory of cellular solid. This result will tell the failure mechanism of the individual trabecular. Trabecular deformations are dominated by axial extension or compression of the vertical trabeculae; compressive failure occurs primarily by buckling at low density and by axial yielding at high density; and tensile failure occurs by axial yielding for all densities. Second, they used the high revolution finite element to compute compressions and tension of the individual trabecular, and then they used the result to study the maximum of stress and strain of the bone. As we knew that the deformation and failure of trabecular bone could be depend on individual, age, and disease. So the ‘ high-revolution finite element’ wills analysis to analyze the micro-mechanics of trabecular bone, and thereby improve our understanding of the biomechanics of bone at the level of cells.

They developed the capability to convert the three-dimensional images of trabecular bone into finite element models for stress analysis, where each voxel of bone is converted directly into a single 8-noded brick finite element. The resulting finite element model is then analyzed using a code that was developed for computation on a massively parallel computer. Moreover, they analyzed a series of single bovine slices in order to address modeling issues such as the sensitivity of the predicted specimen modulus and trabecular stresses and strains to the element size (10-100 microns); then the result will the development of the location of maximum stress in the trabecular bone and we could be used the information to develop intuition for how the more complex full specimen models will behave.

Finally, The simulation of the trabecular bone mechanical could be the ability to visualize the locations and types of failure, which occur in the bone is one of the strengths of computer modeling. By using appropriate combinations of experiments and computer models, we can gain much more information about trabecular bone mechanics than could be done using either approach alone.

Reference:

http://biomech1.me.berkeley.edu/tbone-fail/
http://www.npaci.edu