

Development of a preprocessor for the simulation of human bones

Medical imaging techniques like quantitative computer tomography (qCT) can be used in combination with finite element analyses in order to predict the mechanical response of human bones [1]. Normally, such an endeavor requires extracting the geometry of a bone from its qCT scan with a costly segmentation and meshing procedure. Another approach is the recently developed Finite Cell Method (FCM) which takes advantage of the voxel-based data and thereby decreases the computational effort tremendously without losing accuracy [2]. So far, this method has been used for academic, *in vitro* test cases only and shall now be rolled out for real clinical applications. For this reason a generic preprocessor is needed.

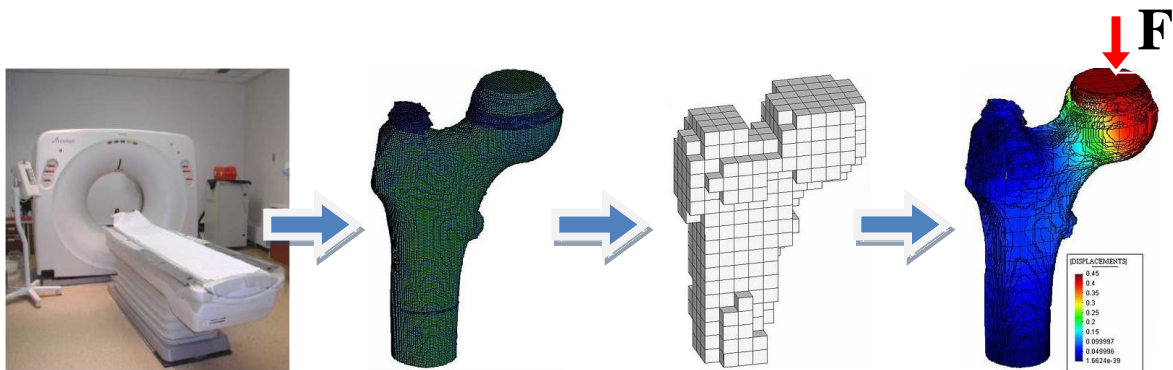


Fig 1: workflow for a human femur, scanned *in vitro* and computed with FCM

In this software lab project, the students will become acquainted with the simulation of human bones using the FCM. The final task will be to develop a generic preprocessor which automatically identifies Neumann and Dirichlet boundary conditions within *in vivo* qCT scans of different human femurs and models them accordingly. Additionally, the predicted mechanical response for *in vivo* and *in vitro* qCT scans of the same bone shall be compared. To this end, an implementation of the FCM and different qCT scans will be provided.

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References

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