TRANSVERSELY ISOTROPIC FUNDAMENTAL SOLUTION APPLIED TO BIOENGINEERING PROBLEMS

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This work is proposed to show the implementation of the transversely isotropic fundamental solution, first proposed by Pan & Chou [1] and revised and extended by Loloi [2], in a boundary element program, called E-Con3D, developed for biomechanics analysis. Biomechanics applications are more complex than conventional solid mechanics applications mostly due to the complexity of the involved biological materials [3]. Bones are the most important components of human biomechanical structure. Bone materials have different responses for each external load direction. Moreover, bone materials are capable to adapt themselves [4] in order to offer the best resistance for the most common loadings. Just these two characteristics are sufficient to propose an anisotropic material model for the bone instead of the conventional isotropic model used for engineering materials, like metals. Then, in order to improve the capabilities of a basic biomechanical analysis program, it is necessary to implement more complex material models. In this case, the transversely isotropic material model is an obligatory step. E-Con3D is a boundary element environment, developed with research purposes, used to test new implementations. The transversely isotropic fundamental solution was implemented and tested in order to validate its results. The validation was made through comparison of the results of a standard problem analysed with isotropic model and transversely isotropic model with quasi-isotropic material properties. Finally, some biomechanical models were analysed in order to assure the biomechanical capabilities of the implemented solution.

References

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