Computational Optimization for Biomechanics and Biomedical Engineering

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Abstract

Computational methods and advanced numerical techniques have been extensively used in biomechanics and biomedical engineering which enables to promote computer aided surgical design and plan for enhancing therapeutic outcomes. Nowadays, numerous prosthetic devices are employed to replace damaged/lost tissues in human body to restore proper functionality. Such artificial structures are required to withstand various mechanical loading over a desired service duration without failure. Further, implantable prostheses need to play a role in engaging the surrounding tissue for osseo-integration and bone remodeling, thereby strengthening the entire system of prosthesis - tissues. These issues have drawn significant attention over the past two decades, where computational biomechanics has been seen extensive applications from fundamental science to clinical therapy. Nevertheless, one problem remains, which needs substantial studies, is structural optimization in biomedical engineering field. As a well-established engineering method, structural optimization has been mature through development of rigorous computational methods for general engineering problems. This paper aims to introduce its specific features and potential in biomedical fields through a series of typical design optimization case scenarios in dentistry [1,2], cardiology [3], orthopedics [4,5], tissue engineering [6] and biofabrication.

References

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