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Heterogeneous modeling based prosthesis design with porosity and material variation

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ABSTRACT

The work proposes the development of heterogeneous bio-implants with the aim to minimize stress shielding effect and enhance bone ingrowth. Stress shielding in the implant can be minimized by reducing the overall stiffness of the implant, which is achieved here by varying the material based on stress distribution across the prosthesis. To increase overall stability of the implant by simultaneous enhancing osseointegration and reducing stress shielding, the work proposes the design of heterogeneous prosthesis with graded porosity and material having radial, axial and mixed (simultaneous radial and axial) variations. Static analysis for material variation models and consolidation analysis for graded porosity and material variation models are performed. After comparisons of results among different models, radial variation model was observed to deliver the results.

Graphical abstract

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