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A Novel Just-In-Time Concept

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An Innovative Combination of the Power of Additive Manufacturing and the Integrity of Mimics Innovation Suite

Researchers from RMIT University's Center for Additive Manufacturing in Melbourne, Australia, are proposing a new concept called just-in-time, that applies to additive manufacturing (AM) prosthesis design. This particular approach adopted by the Australian research converts raw CT scan data directly into 3D printable porous calcaneal prostheses.

(a) DICOM contours obtained from the disease free bone showing loading zone and articular surfaces, (b) use of fine density lattice structures in the loading zone and (c) near the solid suture holes to ensure adequate bonding between solid and lattice structures.

The proposed workflow maximizes the combined use of CT imaging and 3D Printing, and shortens the time it takes to design and produce a patient-specific implant. In this research, real-time customization of a patient-specific implant was made possible for the entire process of design and additive manufacturing.

AM presents notable design possibilities. However, creating patient-specific anatomical structures requires unique expertise due to the variety of optimization platforms. Additionally, the design and manufacturing process for complex anatomical structures is computationally demanding. How can these practical obstacles be overcome?

(left) Initial design (280 g), (middle) proposed design (89.4 g) and (right) as-manufactured Calcaneal Prosthesis at optimal orientation.

DICOM-to-lattice design methodology

A novel DICOM-to-lattice structure method was introduced in which 2D DICOM cross-sections were converted into periodic lattice structures. Hence, there was no need for 3D reconstruction, manual intervention, data conditioning or smoothing operations. This resulted in highly geometrically accurate and conformal lattice structures produced in less time.

Although these results show a lot of promise, further work needs to be done before the methodology reaches a broad clinical use.

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