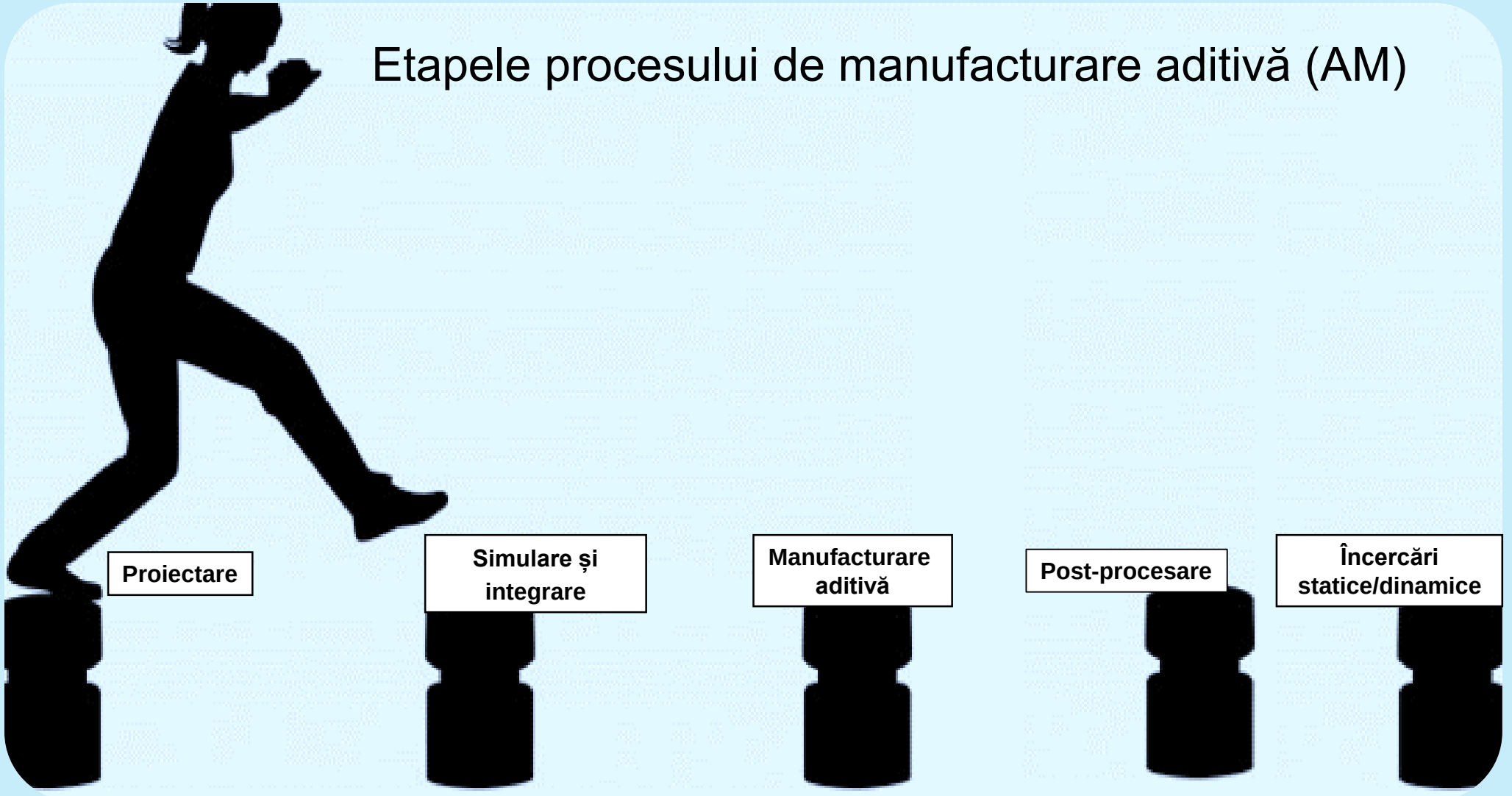
DigiTech 2019

Integrarea structurilor lattice în dispozitive medicale fabricate aditiv prin tehnologia de sinterizare selectivă cu laser

Institutul Național de Cercetare Dezvoltare în Mecatronică și Tehnica Măsurării (INCDMTM)
Șoseaua Pantelimon nr. 6-8, sector 2, 021631, București

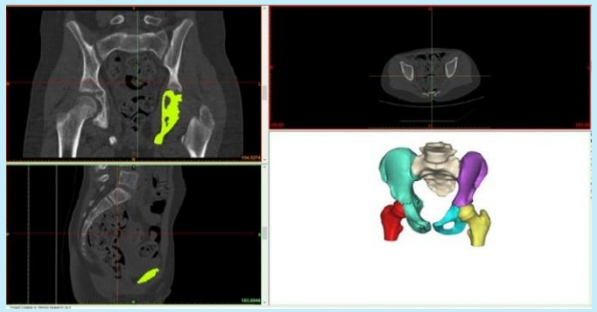
Etapele procesului de manufacturare aditivă (AM)

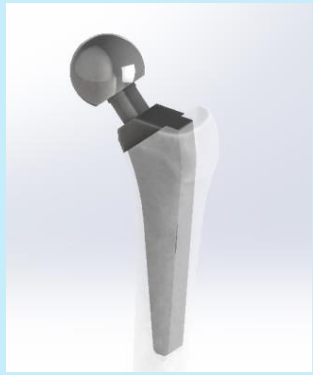


This work was supported by a grant of the Romanian Ministry of Research and Innovation, CCCDI – UEFISCDI, project number PN-III-P1-1.2-PCCDI-2017-0224, Ctr. No. 77PCCDI/2018 – Digi Tech, within PNCDI III

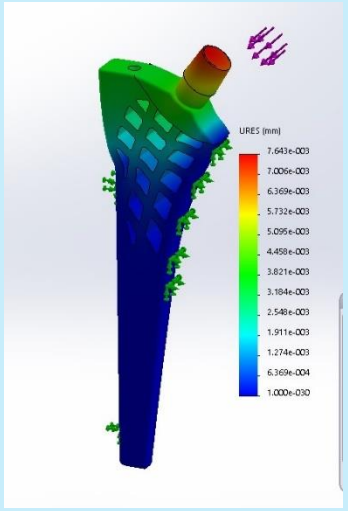
Reconstrucția unui implant specific pacientului: Proces

Pacient → CT/RMN → DICOM → Modelare medicală → Model CAD pe baza datelor anatomice →





Proiectare → Integrare structuri specifice implantului → Simulare FEA



STL

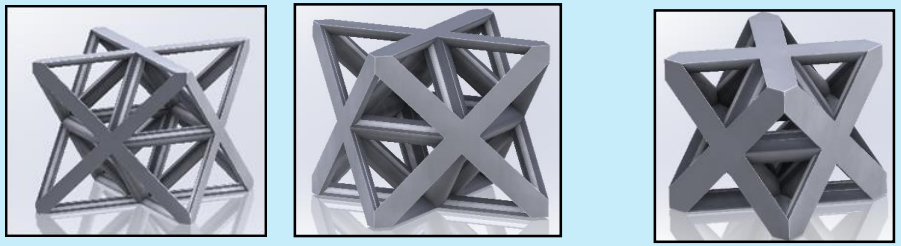
Manufacturare aditivă

Pentru un implantul specific pacientului, proprietățile anatomice trebuie să fie consecvente în timpul achiziționării și procesării imaginilor

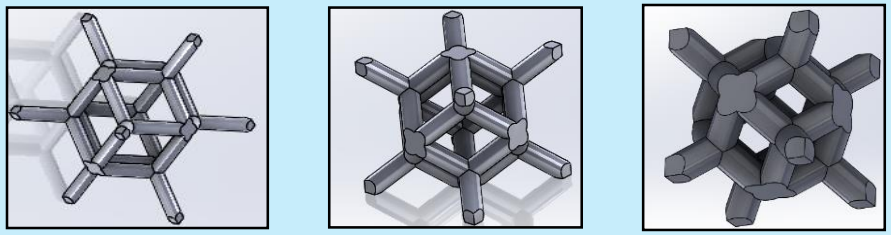
This work was supported by a grant of the Romanian Ministry of Research and Innovation, CCCDI – UEFISCDI, project number PN-III-P1-1.2-PCCDI-2017-0224, Ctr. No. 77PCCDI/2018 – Digi Tech, within PNCDI III

Structuri lattice pentru implanturi medicale: Design

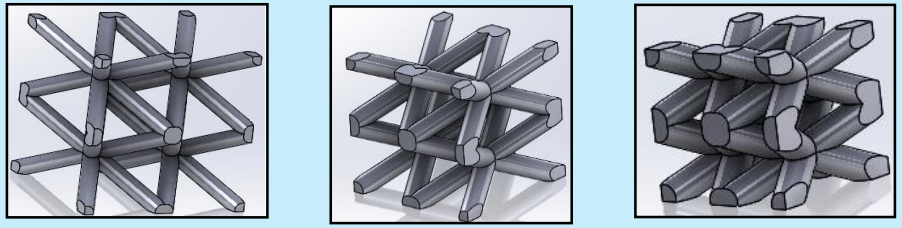
Structură lattice **octetică** cu ștrutul de 0.36, 0.5 și 1 mm



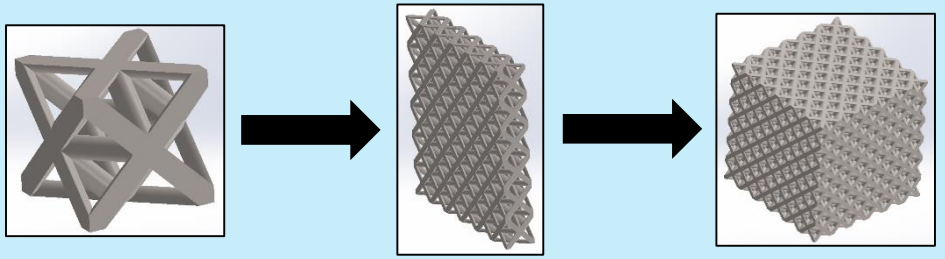
Structură lattice **diamant** cu ștrutul de 0.36, 0.5 și 1 mm



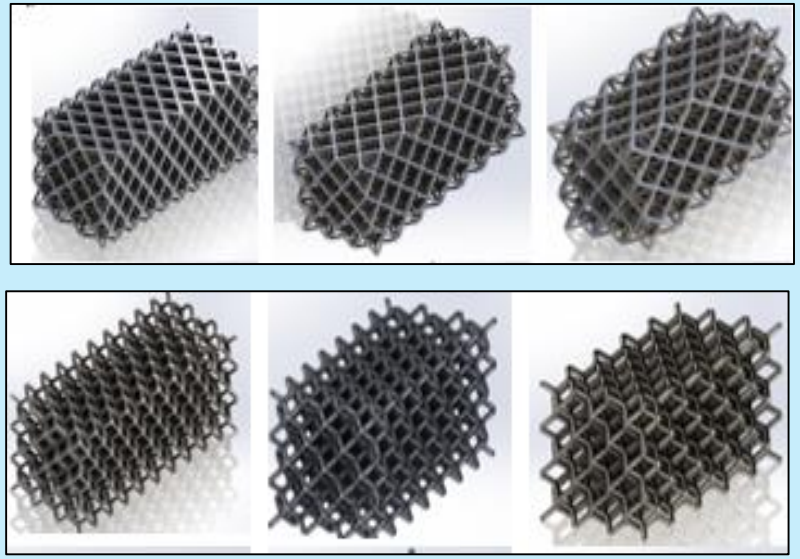
Structură lattice **rombică** cu ștrutul de 0.36, 0.5 și 1 mm



Strategia de design: de la celulă unitară
la implant lattice pentru o structură octetică



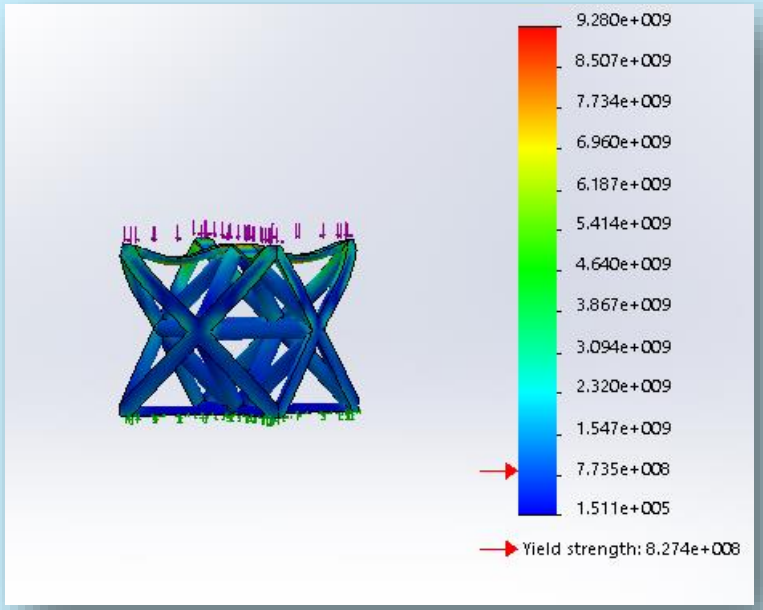
Strategia de design: varierea dimensională a celulelor (3x3x2, 3x3x3 și 3x3x4) la ștruț 0.5 pentru structuri octetice și diamant



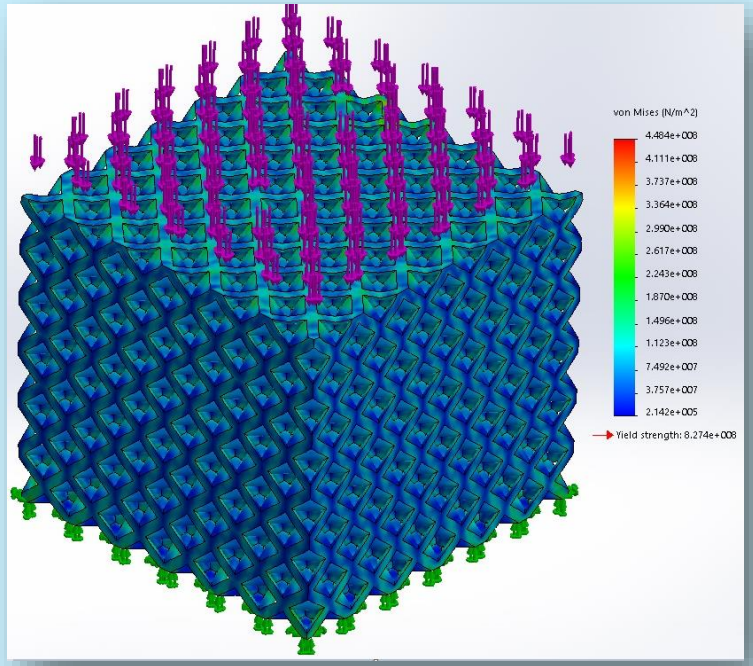
This work was supported by a grant of the Romanian Ministry of Research and Innovation, CCCDI – UEFISCDI, project number PN-III-P1-1.2-PCCDI-2017-0224, Ctr. No. 77PCCDI/2018 – Digi Tech, within PNCDI III

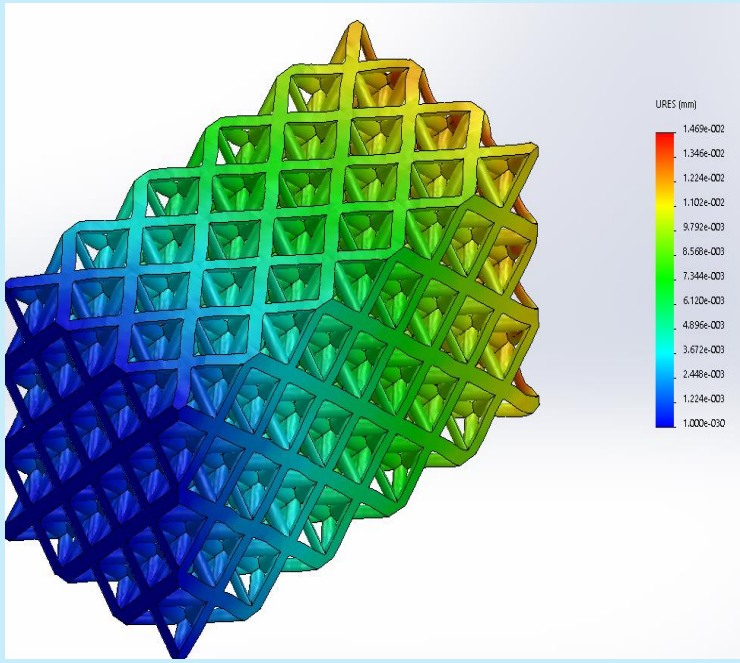
Structuri lattice pentru implanturi medicale: Simulare

Analiză FEA pentru o unitate celulară



Analiză FEA pentru structură octetică: analiză von Mises și de Deplasare

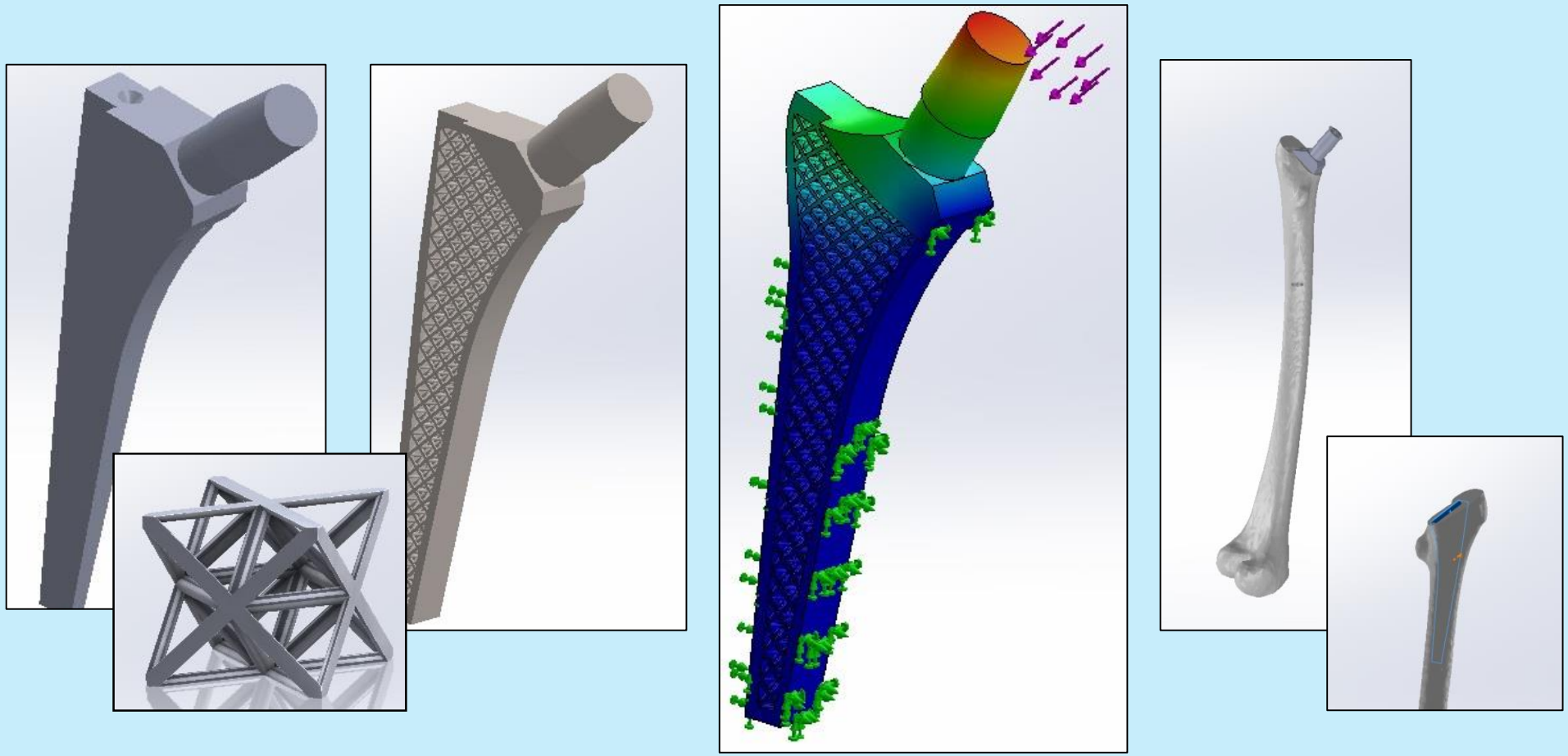




Simularea FEA este un instrument de analiză relevant pentru încărcările la care sunt supuse unitățile celulare și structurile lattice

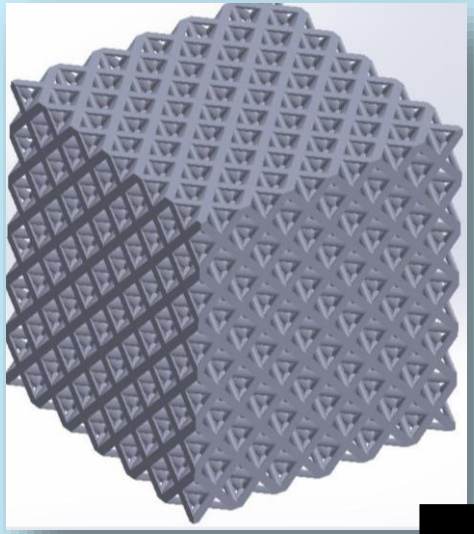
This work was supported by a grant of the Romanian Ministry of Research and Innovation, CCCDI – UEFISCDI, project number PN-III-P1-1.2-PCCDI-2017-0224, Ctr. No. 77PCCDI/2018 – Digi Tech, within PNCDI III

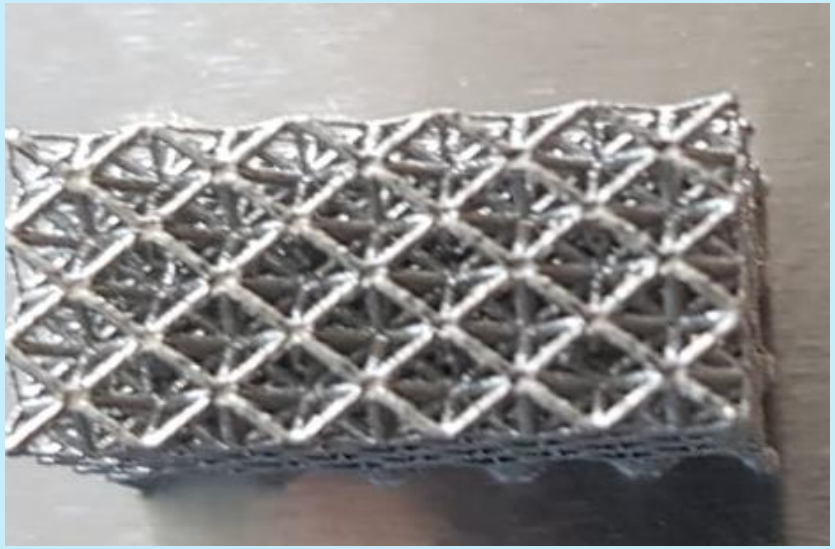
Structuri lattice pentru implanturi medicale: Integrare



This work was supported by a grant of the Romanian Ministry of Research and Innovation, CCCDI – UEFISCDI, project number PN-III-P1-1.2-PCCDI-2017-0224, Ctr. No. 77PCCDI/2018 – Digi Tech, within PNCDI III

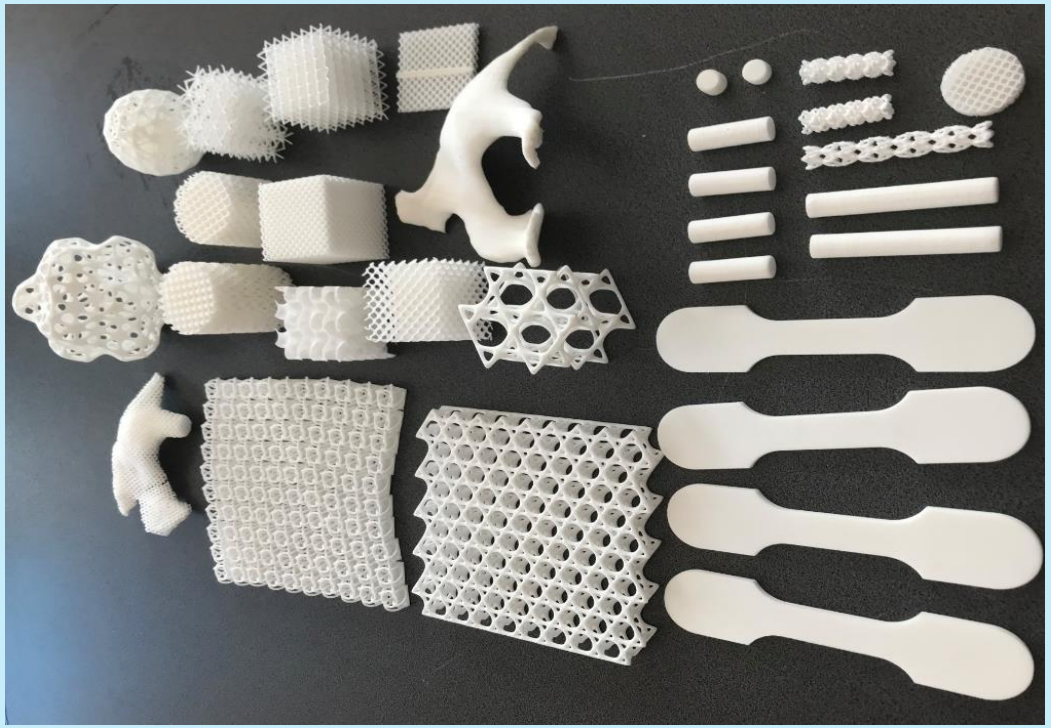
Structuri lattice pentru implanturi medicale: Manufacturare aditivă





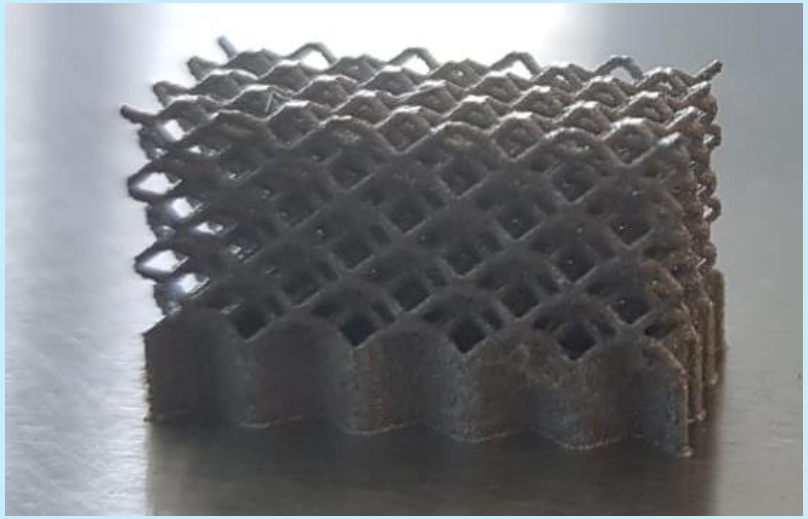
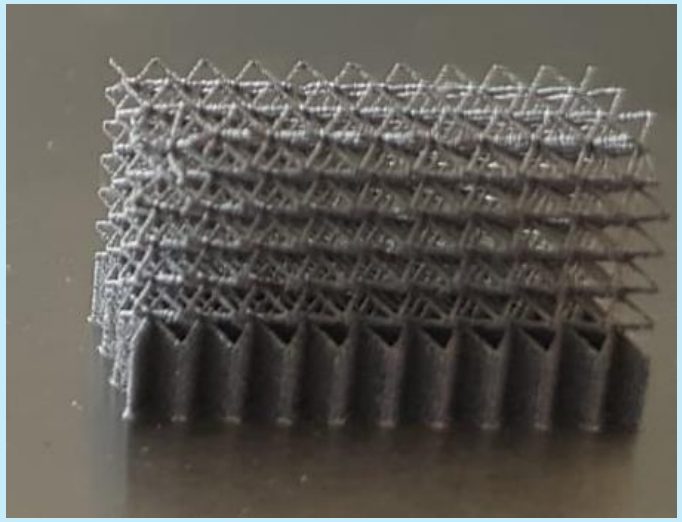
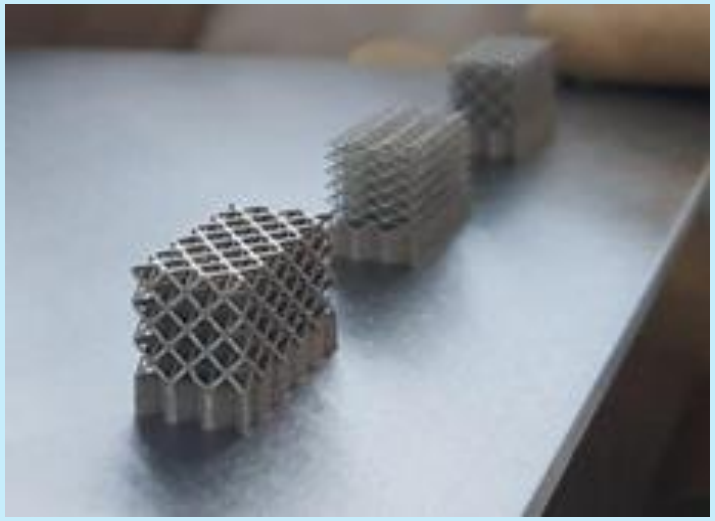
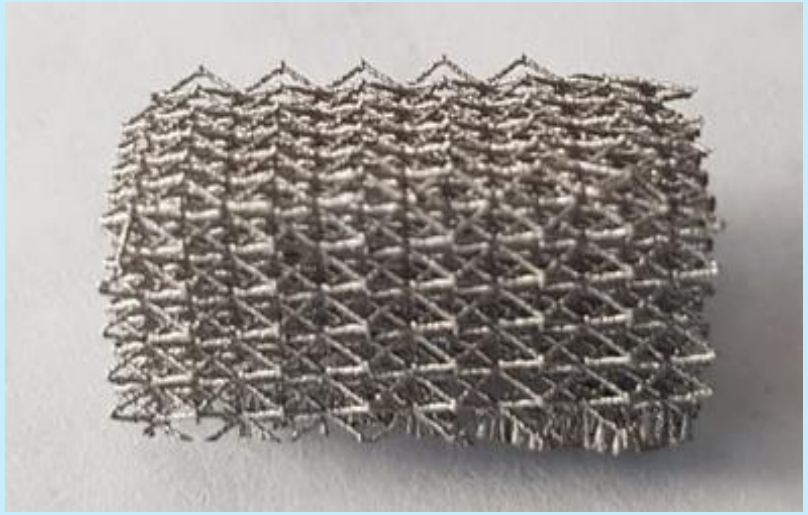
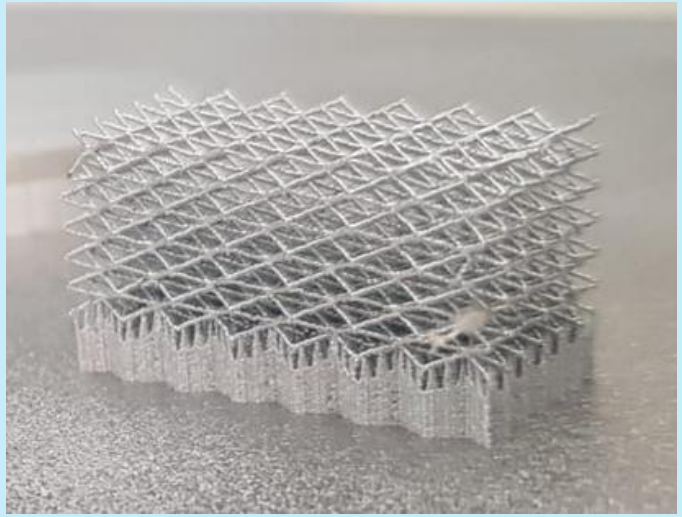
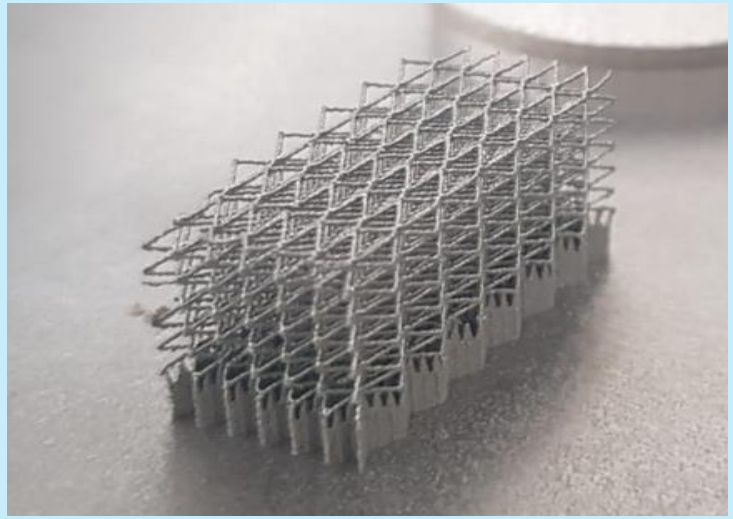
This work was supported by a grant of the Romanian Ministry of Research and Innovation, CCCDI – UEFISCDI, project number PN-III-P1-1.2-PCCDI-2017-0224, Ctr. No. 77PCCDI/2018 – Digi Tech, within PNCDI III

Structuri lattice pentru implanturi medicale: Manufacturare aditivă



This work was supported by a grant of the Romanian Ministry of Research and Innovation, CCCDI – UEFISCDI, project number PN-III-P1-1.2-PCCDI-2017-0224, Ctr. No. 77PCCDI/2018 – Digi Tech, within PNCDI III

Structuri lattice pentru implanturi medicale: Manufacturare aditivă

This work was supported by a grant of the Romanian Ministry of Research and Innovation, CCCDI – UEFISCDI, project number PN-III-P1-1.2-PCCDI-2017-0224, Ctr. No. 77PCCDI/2018 – Digi Tech, within PNCDI III

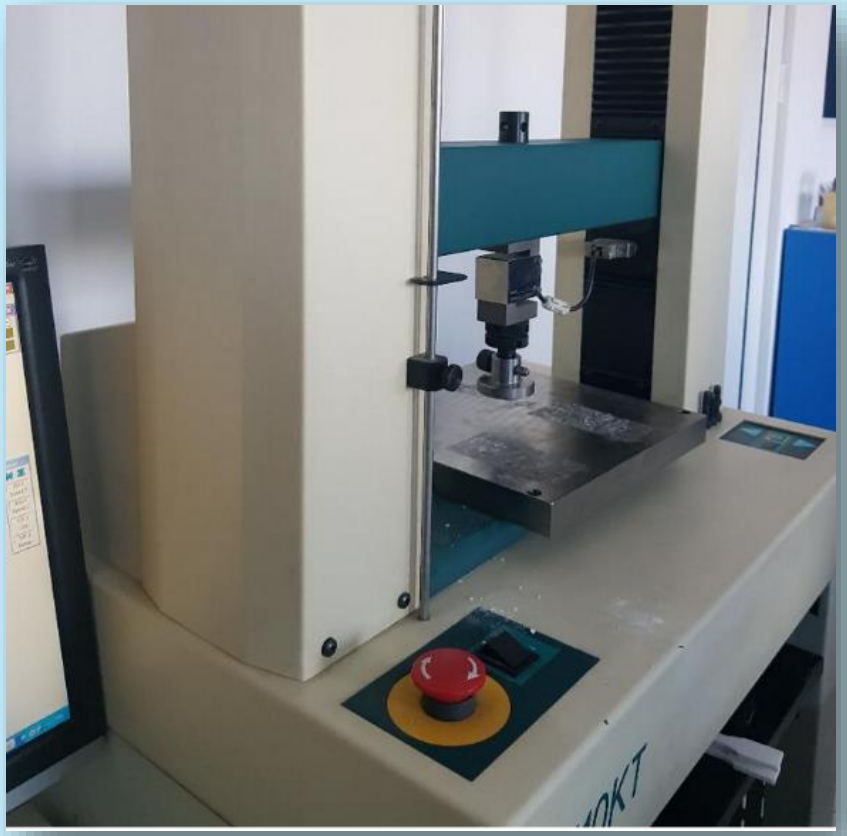
Structuri lattice pentru implanturi medicale: Post-procesare

Post-procesarea include procedee ce îndepărtează pulberea netopită de pe dispozitiv și din interiorul celulelor lattice, tratamente termice pentru eliberarea tensiunilor etc.

Post-procesarea are rolul de a se asigura că specificațiile implantului sunt îndeplinite și coincid cu cele stabilite în timpul proiectării

This work was supported by a grant of the Romanian Ministry of Research and Innovation, CCCDI – UEFISCDI, project number PN-III-P1-1.2-PCCDI-2017-0224, Ctr. No. 77PCCDI/2018 – Digi Tech, within PNCDI III

Structuri lattice pentru implanturi medicale: Testare



Metodele de testare a performanțelor statice și dinamice pentru dispozitive manufacturate aditivă se aseamănă cu cele pentru dispozitive realizate prin tehnologii tradiționale de manufacturare

This work was supported by a grant of the Romanian Ministry of Research and Innovation, CCCDI – UEFISCDI, project number PN-III-P1-1.2-PCCDI-2017-0224, Ctr. No. 77PCCDI/2018 – Digi Tech, within PNCDI III

Structuri lattice pentru implanturi medicale: Beneficii aduse domeniului medical

- Libertate de proiectare
- Avantaje în privința productivității și costurilor de manufacturare pentru implanturi cu forme complexe
- Consum redus de material, performanțe excelente și multifuncționalitate, păstrând distribuția de forțe
- Suprafețe poroase care încurajează osteointegrarea
- Reducerea greutății, energiei și timpului de fabricație
- Reproduce proprietățile osului cu scopul a evita fenomenul de stress-shielding
- Potrivit pentru atașarea și creșterea celulelor pe implant

This work was supported by a grant of the Romanian Ministry of Research and Innovation, CCCDI – UEFISCDI, project number PN-III-P1-1.2-PCCDI-2017-0224, Ctr. No. 77PCCDI/2018 – Digi Tech, within PNCDI III

THANK YOU!!