

Multiplier Event on the Experiencing of e-Learning Platform for Biomechatronics,

hosted by Bizzcom s.r.o. company, in
Bucany, Slovakia
13th September 2023

Iceland
Liechtenstein
Norway grants

EMERALD PROJECT - EUROPEAN NETWORK FOR 3D
PRINTING OF BIOMIMETIC MECHATRONIC SYSTEMS **bizzcom**
Working together for a green, competitive and inclusive Europe

EMERALD MULTIPLIER EVENT
ON THE EXPERIENCING
OF E-LEARNING
PLATFORM FOR
BIOMECHATRONICS

WHO CAN APPLY?
STUDENTS, PROFESSORS
RESEARCHERS
COMPANIES

SCAN TO APPLY

WWW.PROJECT-EMERALD.EU

13TH SEPTEMBER 2023
BUCANY, SLOVAKIA

TECHNICAL UNIVERSITY OF CLUJ-NAPOCA ROMANIA
POLITEHNICA TIMISOARA
POLITEHNICA POSARANSKA UNIVERSITY OF TECHNOLOGY
Uia University of Agder
bizzcom

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EUROPEAN NETWORK FOR 3D PRINTING OF BIOMIMETIC MECHATRONIC SYSTEMS - EMERALD



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EMERALD: European network for 3D printing of biomimetic mechatronic systems
EEA & Norway Grant - Contract No. 21-COP-0019

MULTIPLIER EVENT on Experiencing of e-learning platform for bio-mechatronics
organized by BIZZCOM s.r.o. company, Slovakia
– Event agenda- 13th of September 2023

| Session 1 – EMERALD e-learning platform for bio-mechatronics | |
|--|--|
| 8:30 | Registration of participants to the Multiplier Event |
| 9:00 | Opening and Welcome ceremony: Branislav Rabara – Director of BIZZCOM s.r.o. company (Slovakia) |
| 9:15 | EMERALD project overall presentation – progress, actions, KPIs, perspectives / details about the event – Associate Prof. Răzvan Păcurar (Technical University of Cluj-Napoca, Romania) |
| 9:30 | EMERALD main concept of the EMERALD e-learning platform for bio-mechatronics - Associate Prof. Răzvan Păcurar (Technical University of Cluj-Napoca, Romania) |
| 9:45 | EMERALD – e-learning platform for bio-mechatronics – presenting of CAD / CAE virtual laboratory room e-learning facilities - (Associate Prof. Răzvan Păcurar – Technical University of Cluj-Napoca - Romania) |
| 10:15 | EMERALD – e-learning platform for bio-mechatronics – presenting of 3D scanning and 3D printing virtual laboratory rooms e-learning facilities - (Associate Prof. Filip Gorski – Poznan University of Technology - Poland) |
| 10:30 | EMERALD – e-learning platform for bio-mechatronics – presenting of Testing and Materials characteristics virtual laboratory room e-learning facilities - (Associate Prof. Diana Băilă – University Politehnica Bucharest - Romania) |
| 10:45 | EMERALD – e-learning platform for bio-mechatronics – presenting of Sensoring, Programming and Assembling virtual laboratory rooms e-learning facilities - (Prof. Filippo Sanfilippo – University of Agder - Norway) |
| 11:00 | EMERALD – e-learning platform for bio-mechatronics – presenting of VR / AR virtual laboratory room e-learning facilities - (Martin Zelenay – BIZZCOM - Slovakia) |
| 11:15 | Conclusions about the content and future perspectives on improving the use of the EMERALD – e-learning platform for bio-mechatronics/ realizing of bio-mechatronics systems to support people with special needs (amputated arms) (Technical University of Cluj-Napoca, Romania) |
| 11:30 | Coffee break / Press conference |

AGENDA



| Session 2 – Experiencing the – EMERALD e-learning platform for bio-mechatronics / VR / AR / MR experience | |
|---|---|
| 12:00 | Opening of the session and organizing aspects related to the EMERALD e-learning platform for bio-mechatronics experiencing / dividing in groups (Martin Zelenay – BIZZCOM (Slovakia)) |
| 12:15 | Experiencing the virtual rooms of the EMERALD e-learning platform for bio-mechatronics (testing on the computer) / Experiencing of VR applications using VR googles / Experiencing AR applications using tablets /collection of feedbacks (all partners + participants to the Multiplier Event) |
| 13:15 | Conclusions about the experiencing of the EMERALD e-learning platform for bio-mechatronics and discussions related to feedbacks /aspects that are still necessary to be improved in the e-learning platform / round table discussions (Martin Zelenay – BIZZCOM (Slovakia)) |
| 13:45 | Comments and discussions on the possibility of joining different projects / consortium / EU Networks - Branislav Rabara – Director of BIZZCOM s.r.o. company (Slovakia) |
| 14:15 | Closing words / ending of Multiplier Event |
| 14:30 | Lunch break |

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EMERALD – e-learning platform for bio-mechatronics – presenting of CAD / CAE virtual laboratory room e-learning facilities

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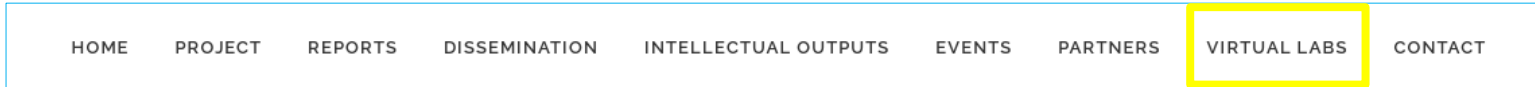
HOME PROJECT REPORTS DISSEMINATION INTELLECTUAL OUTPUTS EVENTS PARTNERS **VIRTUAL LABS** CONTACT

EMERALD E-LEARNING VIRTUAL LABORATORY PLATFORM

TUCN

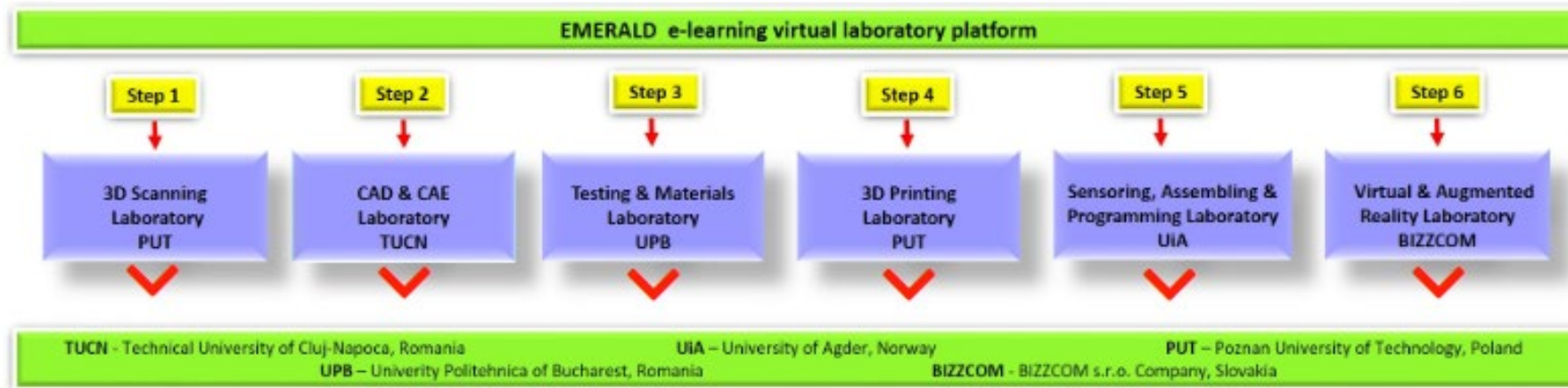
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Please click on the tooltips on the diagram below to virtually visit our laboratories.

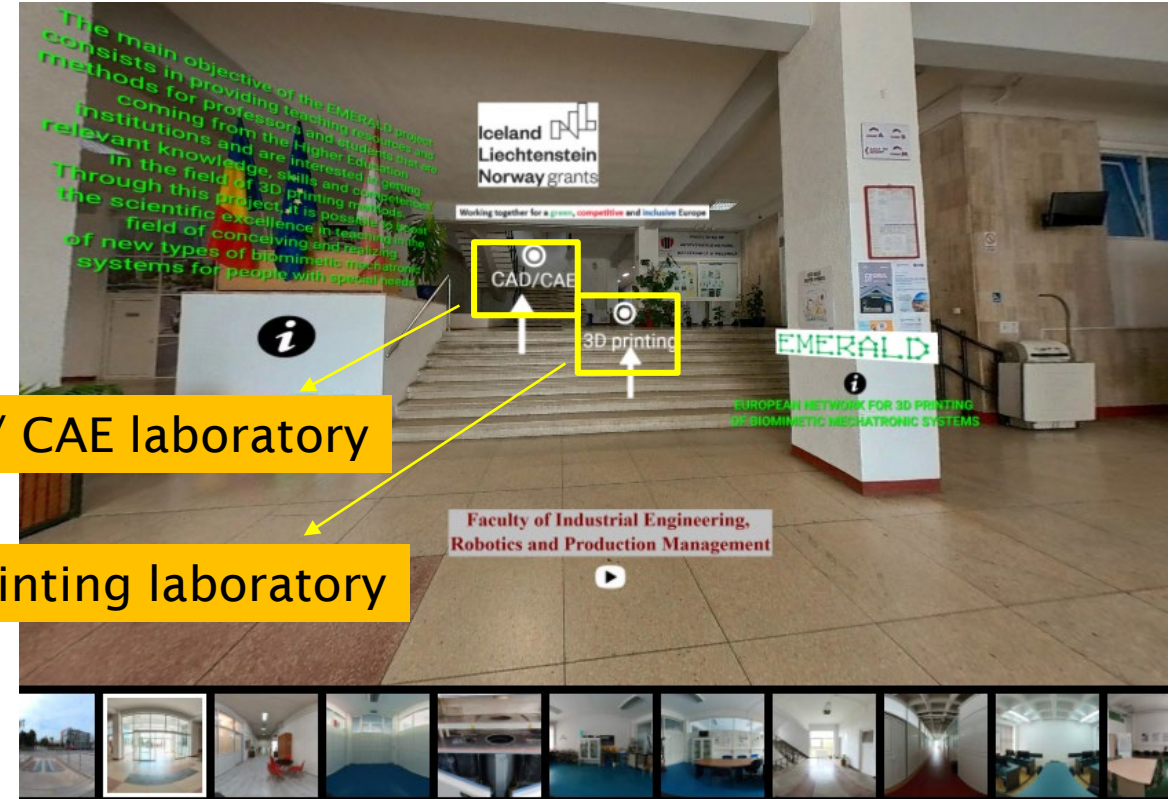
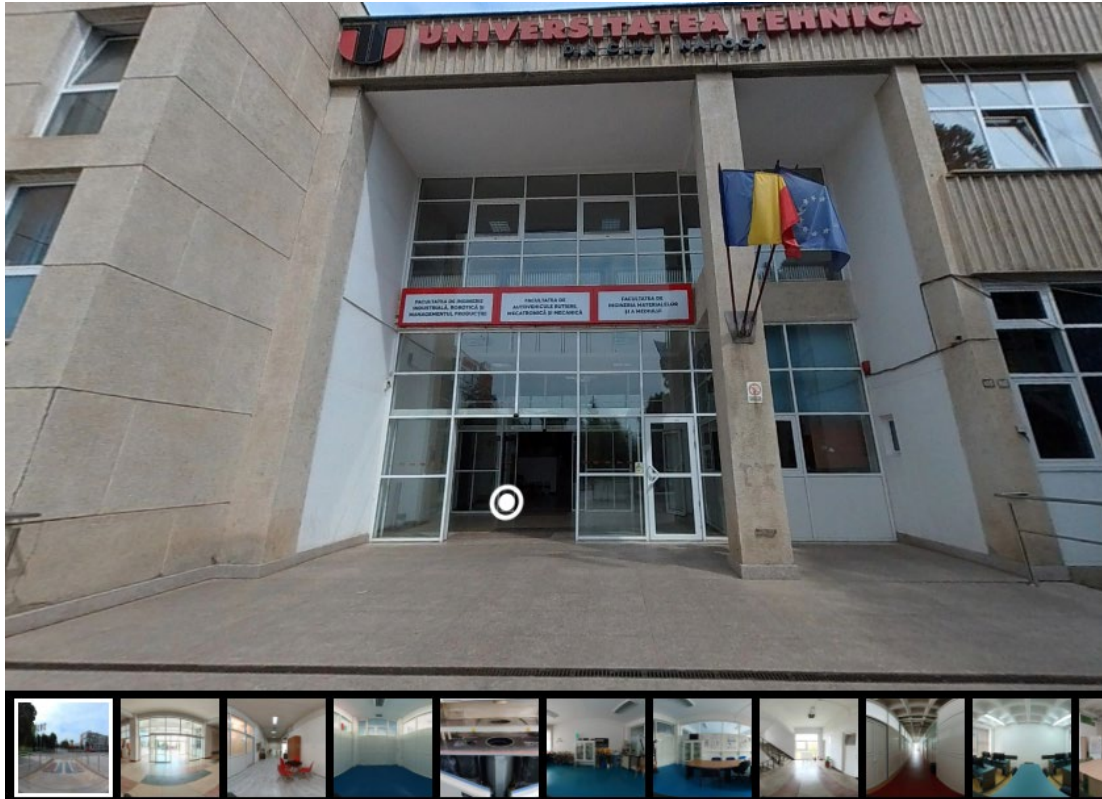
For a better understanding of the EMERALD e-learning virtual laboratory platform, which includes 3D scanning, CAD, CAE, testing and material characterization, 3D printing, sensorizing, assembly, programming, AR & VR, it is advisable to access the virtual laboratories by following the steps that are outlined in the diagram given below. By following the steps in the indicated order, this will lead to a more comprehensive understanding of the logical process involved in conceiving and developing of new biomimetic mechatronic systems to be realized utilizing 3D printing technologies.



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EMERALD VIRTUAL E-LEARNING PLATFORM – TUCN UNIVERSITY LABORATORIES



CAD / CAE laboratory

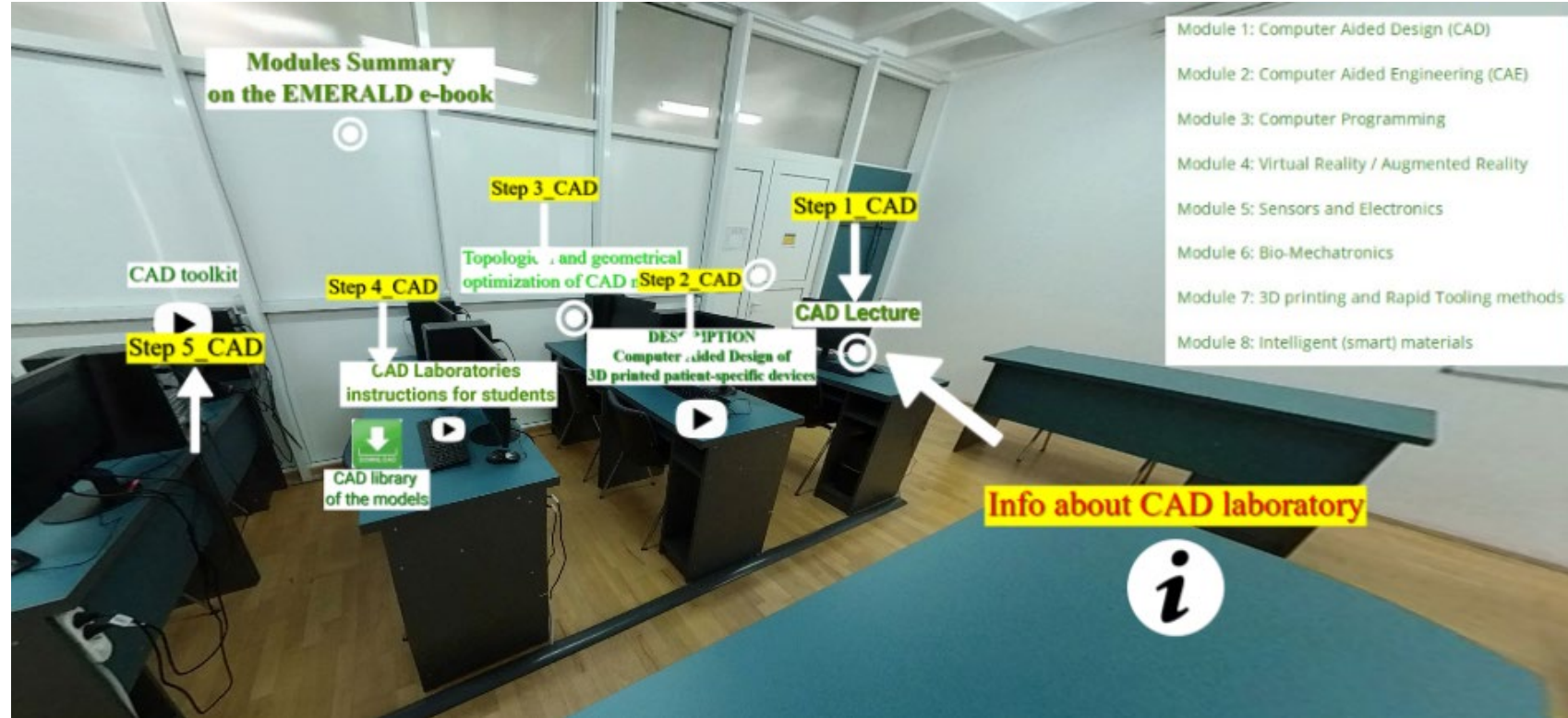
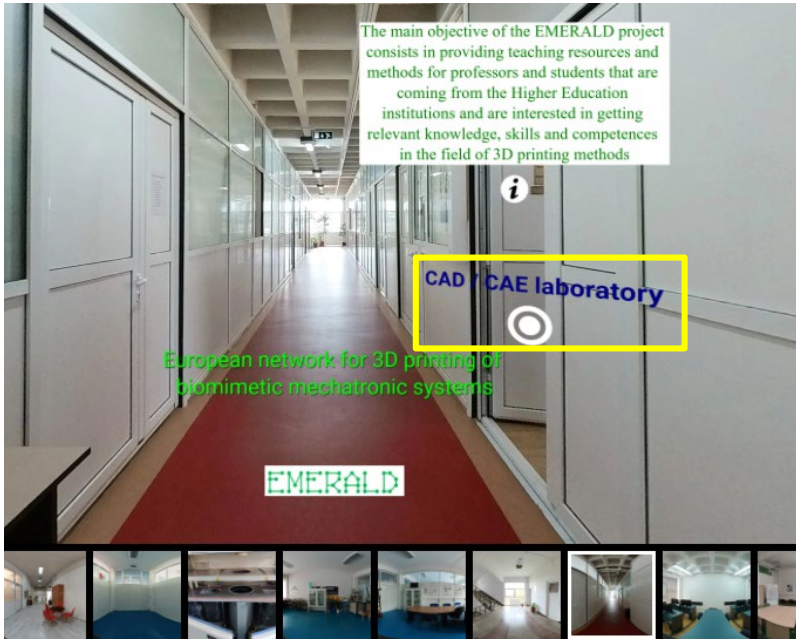
3D printing laboratory

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CAD / CAE LABORATORY

CAD STEPS



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CAD STEPS

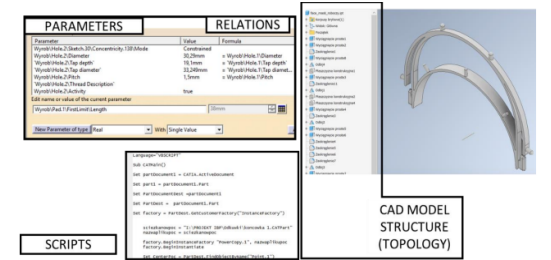
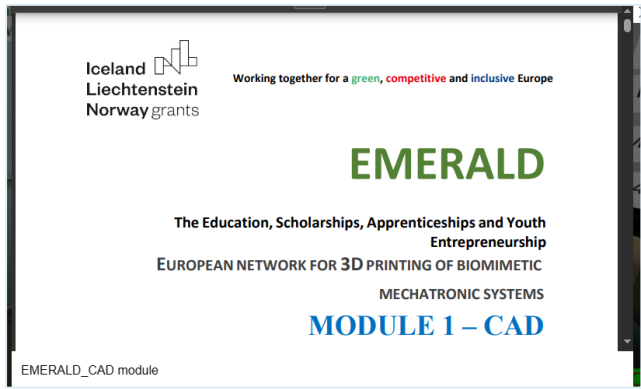
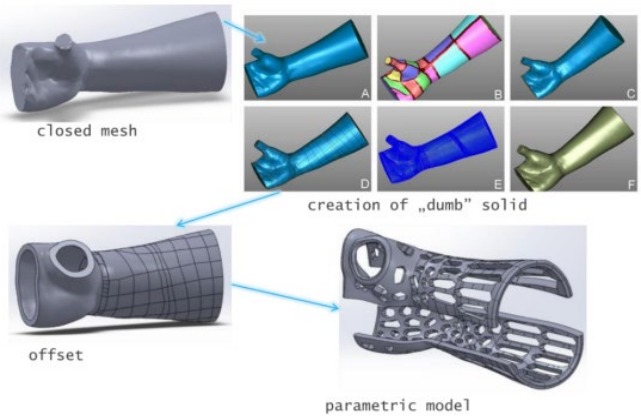
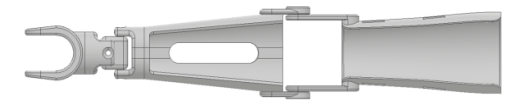


Figure 3.5 Basic ideas of intelligent CAD models [Górski 2021]



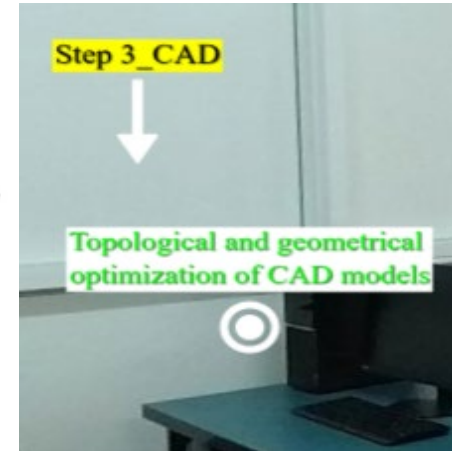
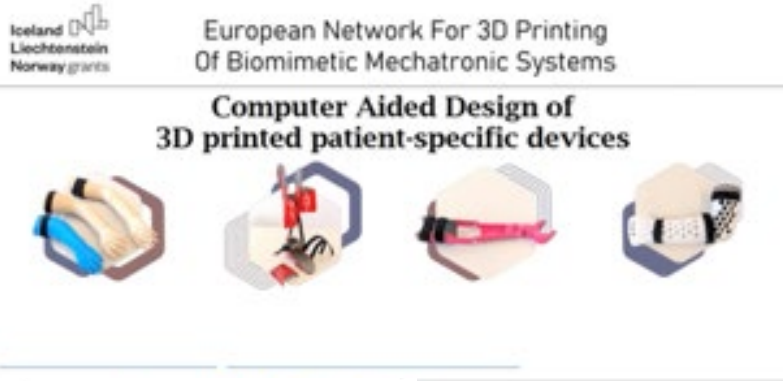
| name | dimension | unit | |
|--------------|-----------|------|-------------------------------|
| X1 | 140 | mm | hand length "a" |
| X2 | 110 | mm | don't change |
| X3 | 70 | mm | don't change |
| X4 | 70 | mm | don't change |
| param_west_C | 100 | mm | hand radius, don't change |
| wymar_b | 100 | mm | forearm length (healthy limb) |
| wymar_c | 100 | mm | arm length (elurup) |
| wymar_d1 | 60 | mm | arm section 1 - bbox size y |
| wymar_d2 | 60 | mm | arm section 1 - bbox size x |
| wymar_e1 | 60 | mm | arm section 2 - bbox size y |
| wymar_e2 | 60 | mm | arm section 2 - bbox size x |
| wymar_f1 | 60 | mm | arm section 3 - bbox size y |
| wymar_f2 | 60 | mm | arm section 3 - bbox size x |
| odslunacje | 40 | mm | offset value at the elbow |



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CAD STEPS



In completion to the Computer Aided Design (CAD), but inter-correlated to this topic it is important to comprise that through the Topological optimization, a topic that is in trend nowadays, there are some benefits in relation to the designing of bio-mechatronic systems (like robotic arms, orthoses, prostheses, etc.).

Topology optimization is a structural optimization technique that it is utilized in various medical applications, particularly in the realm of bio-mechatronic systems. It involves optimizing the distribution of material within a product to meet specific performance requirements, ensuring that it efficiently withstands loads and deformations under defined boundary conditions. CAD (Computer-Aided Design) is employed to create an initial product model, while the primary objective of topology optimization is to eliminate material in areas of the product that do not significantly bear loads or deformations, optimizing its functionality.

Few of the most used programs: Next-generation Design & Engineering Software (nptology.com/topology-optimization-software/), Altair OptiStruct™ (www.altair.com/optistruct/).

DESIGN TABLES - EXAMPLES



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CAD STEPS



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The image shows a presentation slide with two posters on the left and a group photo on the right. The posters are for the EMERALD International Summer School, one for 2023 (Virtual e-learning platform) and one for 2022 (3D printing in bio-mechatronics). The group photo shows a large group of people standing in front of a modern building with the Uia logo. Below the posters are labels: 'EMERALD International Summer School 2023_info' and 'EMERALD International Summer School 2022_info students applications (selection)'. Below the photo is a caption: 'Presentations of students applications during the Summers Schools from 2022 and 2023' with a Google Drive link.

EMERALD International Summer School
2023_info

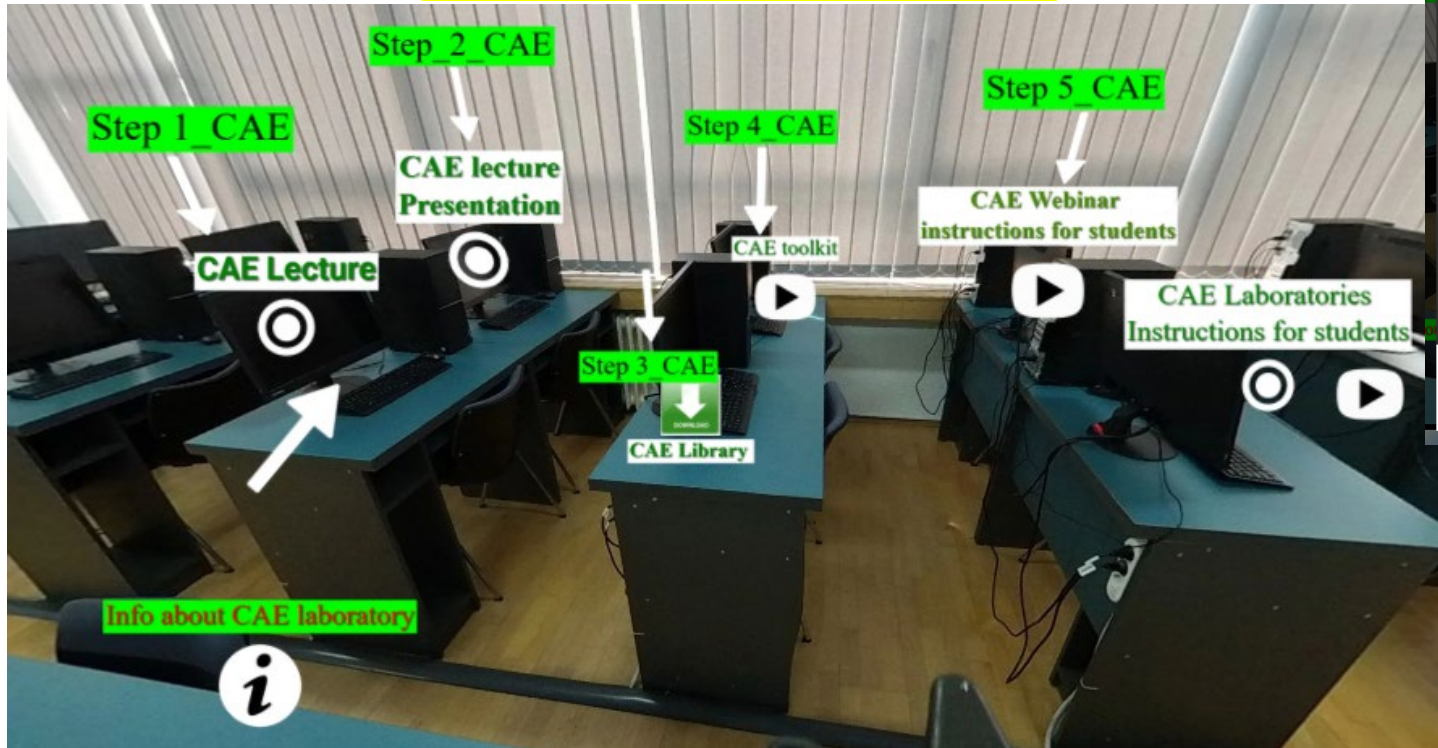
EMERALD International Summer School
2022_info
students applications
(selection)

Presentations of students applications during the Summers Schools from 2022 and 2023
drive.google.com/drive/folders...

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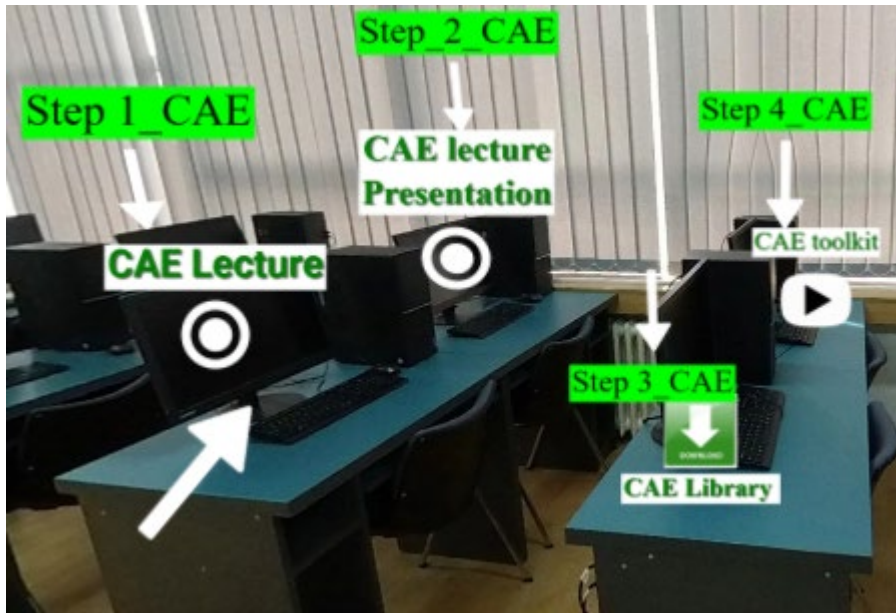
CAE STEPS



CAE module_EMERALD
By attending the CAE lecture, the method in the design of medical de

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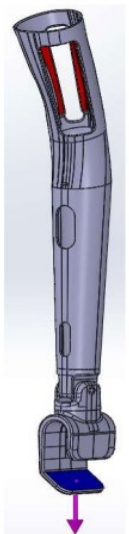
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CAE STEPS

EMERALD
The Education, Scholarships, Apprenticeships and Youth Entrepreneurship
EUROPEAN NETWORK FOR 3D PRINTING OF BIOMIMETIC MECHATRONIC SYSTEMS
E-toolkit – Computer Aided Engineering (CAE)

| | |
|------------------|---|
| Project Title | European network for 3D printing of biomimetic mechatronic systems 21 COP-0019 |
| Output | IO2 - E-toolkit for teaching purposes, basic knowledge about realizing biomimetic mechatronic systems |
| Module | Computer Aided Engineering (CAE) |
| Date of Delivery | July 2022 |
| Authors | Dan-Sorin COȘAȘA, TUCN |
| Version | Final (January 16, 2023) |



EMERALD CAE_toolkit
The provided description in the toolkit manual concerning the computer-aided engineering (CAE) analysis, specifically using SolidWorks Simulation was oriented on the analysis of upper-limb prosthesis that has been

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CAE STEPS

European network for 3D printing of biomimetic mechatronic systems

CAE laboratory instructions

Steps for CAE simulation

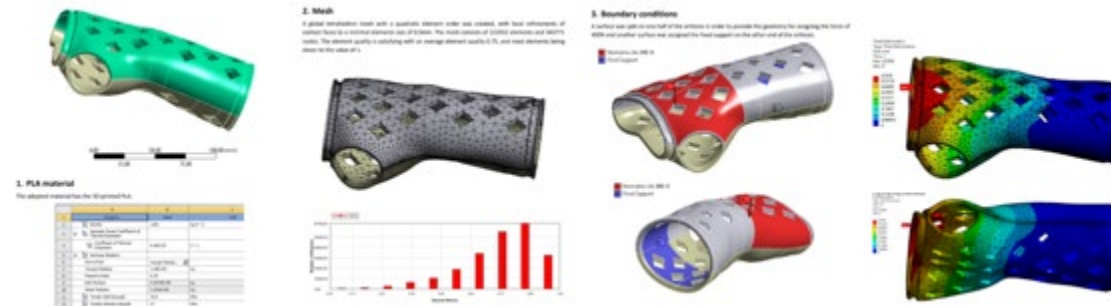
Practical Laboratory – calculations of hand prosthesis using Inventor and finite element analysis

1.1 Aim of the exercise

Your task is to realize a simple Finite Element Method calculation of the bicycle prosthesis you designed in part A. It will be a static load on a part constrained in the internal surface of the open prosthetic socket, as shown in the illustration below. The load will simulate leaning on a bicycle handlebar while riding.



By default, it is assumed that the calculations will be realized in Autodesk Inventor Professional and the detailed instructions are suited to that software. However, any FEA software may be used here – Solidworks Simulation, CATIA GSE module, ANSYS, COMSOL,



Example of report that can be found on the library of work done by students

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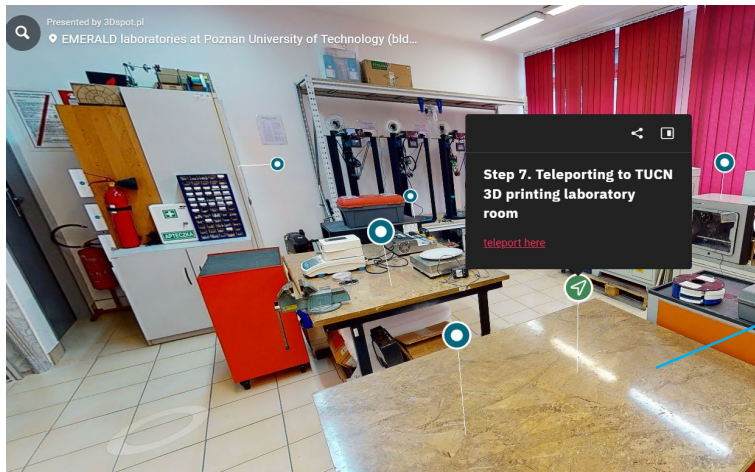
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ADDITIONAL RESOURCES ON 3D PRINTING PROVIDED BY TUCN



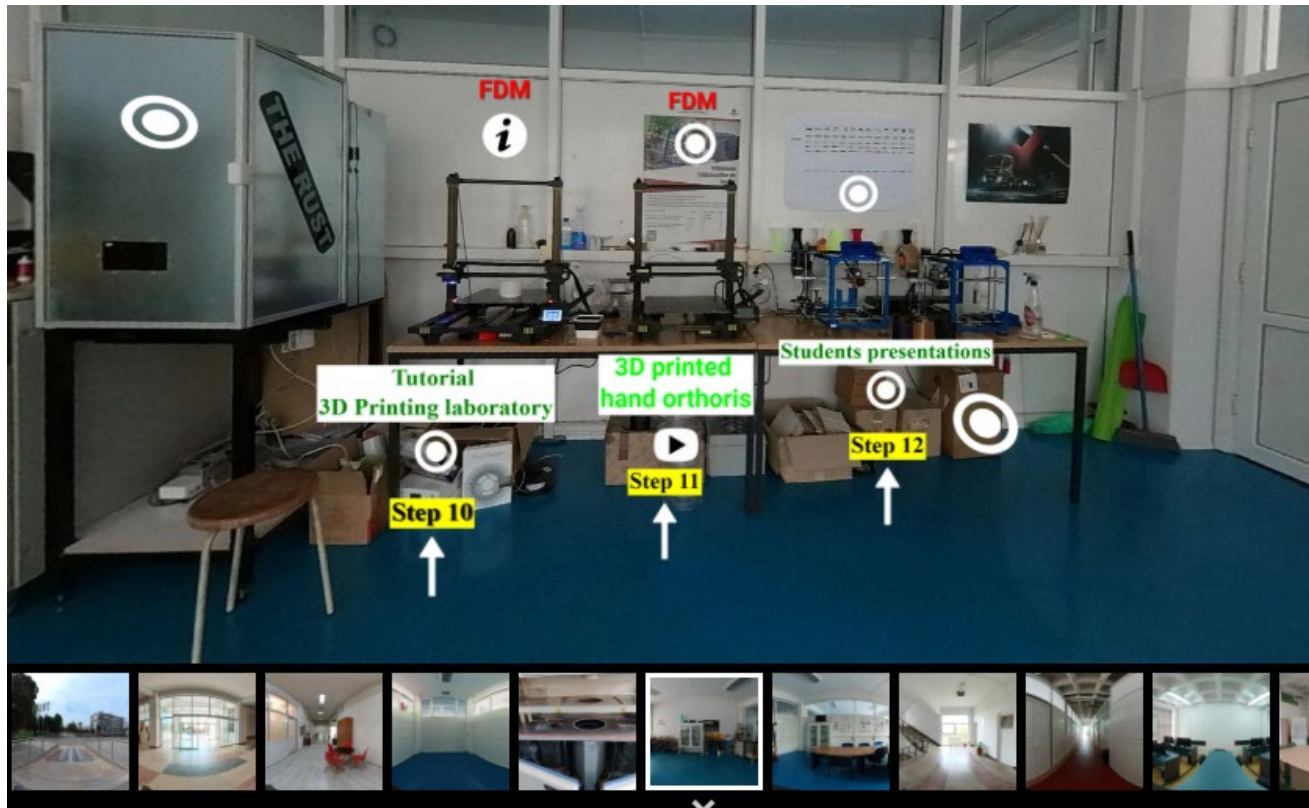

 European Network For 3D Printing
Of Biomimetic Mechatronic Systems
**3D Printing and Rapid Tooling
Methods for Medical Applications**
 Assoc. Prof.dr.eng. Razvan Pacurar
 Department of Manufacturing Engineering,
 Faculty of Industrial Engineering, Robotics & Production
 Management, Technical University of Cluj-Napoca, Romania
 





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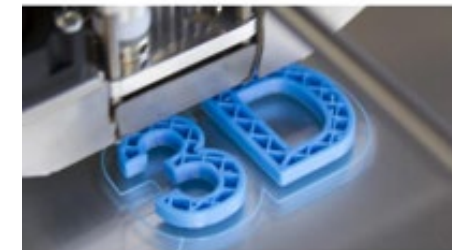
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Good practice examples realized by the students using the EMERALD 3D printing resources of virtual laboratory of the e-learning platform



summer school 2022
3D Printing Laboratory



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Then we tried to put the model in the best position for the printing process in order to decrease the time of printing and the need of support material. The expert helped us to find the best one.

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Innovation for a better life

- Saves time, allows more flexible working
- Saves time and money (especially for repeats)
- Involves the patient in design, improves aesthetics

Customized orthosis made by FDM

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Adaptability

- We cut the orthosis into two symmetrical, vertical parts to be easier to be put on the hand
- The orthosis was made of PLA and has a weight of only 113.6 grams

3D PRINTING

ABOUT US
CAD
CAE
VR/AR
3D PRINTING
TESTING

PRINTER
Strasasys F170

MATERIAL
ABS - ASA (Light Grey)

PARAMETERS
Layer Height: 0.3 mm
Wall Thickness: 132 mm
Infill Density: 10%

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CONCLUSIONS

As one may notice concerning the CAE virtual laboratory of the EMERALD e-learning platform , teaching resources that have been provided by the EMERALD consortium aims not just to provide the users (students) only the basics and theoretical knowledge about CAE analyses following CAD step, but aims to stimulate them through the provided laboratory educational resources (toolkit laboratory, CAE instructions, tutorials, videos, CAE library, etc.) to get practically involved in performing the CAE analyses of specific bio-mechatronic components (like orthoses or prostheses) for people with amputated arms that have been realized in the previous step by CAD, with the main aim of understanding how a CAD variant and one type of material (among more that can be selected) can be validated in the end in concordance with the functionality /mechanical characteristics of the realized parts. Laboratory toolkit and provided tutorials, as well as the instructional videos are highly practical, providing the users step by step information data on how they have to do the CAE analyses of specific bio-mechatronic components for people with amputated arms (like orthoses, prostheses), guiding in this way the users (students) to go through the essential steps of a CAE analysis to be realized for specific models to be made of different types of materials like ABS, PET-G or PLA by 3D printing, building on the knowledge acquired from the introductory courses.

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