

Introduction

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ALMA MATER STUDIORUM – University of Bologna

The University of Bologna takes part into more than 100 research projects, considering only those connected with Horizon 2020, promoting scientific research in different fields.

Italy

DIN – Department of Industrial Engineering

The Department of Industrial Engineering is active in Aerospace, Biomechanics, Design and Methods, Flight mechanics, Fluid dynamics, Industrial application for plasmas, Mechanical plants, Mechanics of Machines, Machine design and construction, Technologies and manufacturing systems.

The group of Design and Methods is involved in Optimization Algorithms for solid modeling, Artificial Intelligence techniques in the mechanical and aerospace field, Design of mechanical and aerospace systems, Virtual Reality, Modeling and Simulation, Rapid Prototyping and 3D Printing.

Web url: <http://137.204.97.212/dview2/index.html>

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ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

CHING

RESEARCH

INTERNATIONAL

SERVICES AND OPPORTUNITIES

Information for

yes

IT EN

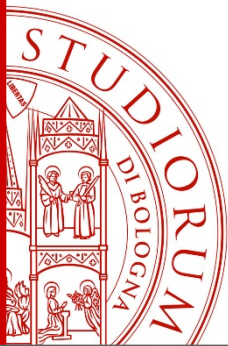
Projects and Initiatives

For the Alma Mater, research is a central pillar and a fundamental lever for competition and employment, as demonstrated by its widespread commitment to a range of initiatives and activities. Within Europe, the University of Bologna stands out for the wealth of skills and its systematic policies of services supporting researchers and their achievement of important goals. Here below is a list of some of the projects and initiatives involving the University of Bologna.

Projects

- Research Projects - Horizon 2020
- Unibo Projects under 7th Framework Programme
- Unibo Projects POR FESR 2014-2020 (in Italian)
- Tecnopoli Project
- Unibo Projects - Other International Programmes
- Unibo research funded by Telethon





Project Idea

Advanced technologies assessment for optimized Train body components

TOPICS

- Hybrid composite material: best performance assessment between different materials (2 fibers - 1 matrix).
- Non conventional modelling optimization.
- Hybrid 3D manufacturing: additive and subtractive adaptive combination for optimised manufacturing.
- Anthropomorphic arm to best orient fiber deposition.
- Large dimension pieces' manufacturing.

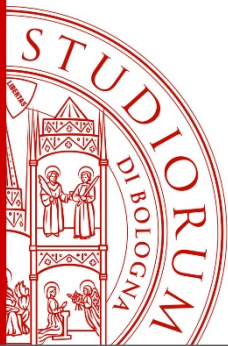
Brief Project Description

The proposal will be centered on the design and development of innovative train components by means of optimized modelling and enhanced composite materials. High performance train body configurations will be simulated and tested.

PARTNERS SOUGHT

- Composite technology experts
- Train body manufacturers
- Railway transport system operators





Expertise 1.

Advanced hybrid composite materials

✓ **Carbon:** The thickness of such element is reduced. The fibers of carbon are assisted from the Flax fibers.



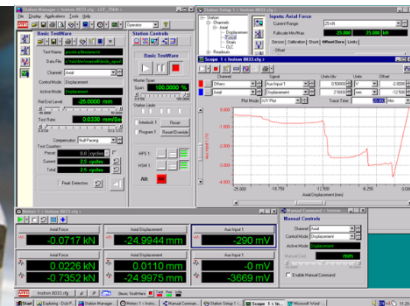
✓ **Flax:** It increases notably the moment of inertia of the laminate increasing its stiffness. Its elongation allows the fibers nobles to answer to the best to the actions of load static and not.

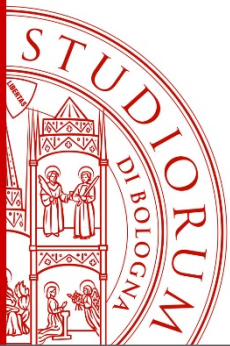


✓ **Basalt:** This material acts as link for the two others. The basalt perfectly fits the matrix. It has a strong performance of resistance to the usury and to aggressive environments. Overall, its introduction has been thought for the high fireproof performance.

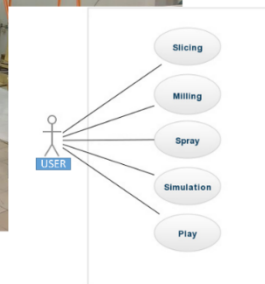
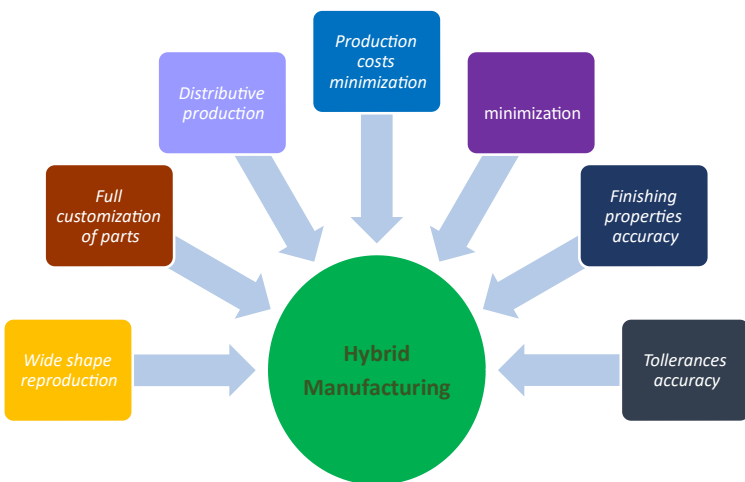


- High percentage of natural material
- High capacity to absorb local damage
- Remarkable flexibility
- Use in aggressive environments
- Excellent response to fatigue loads
- Introduction in aggressive and abrasive environments
- High fireproof
- High stress and strain resistance;
- Low thermal, electrical and acoustic conductivity;
- electromagnetic transparency;
- Low production energy required;
- Fully recyclable.

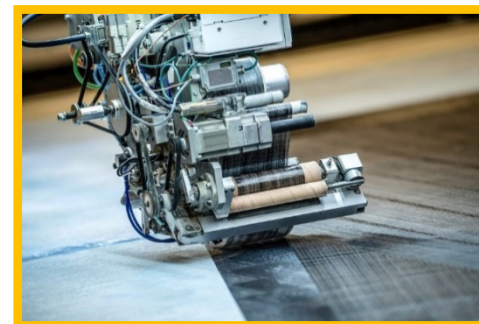


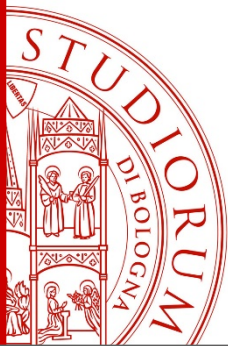


Expertise 2. Enhanced hybrid manufacturing processes



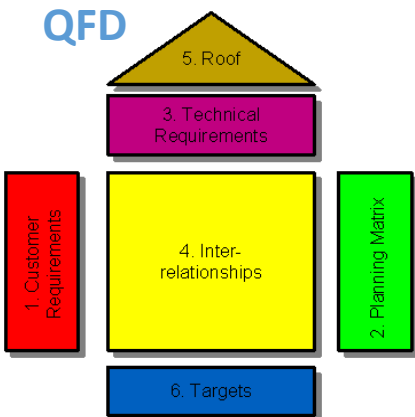
- ✓ Additive and subtractive adaptive manufacturing process
- ✓ Oriented fiber deposition
- ✓ Antropomorph arm
- ✓ Pre-determined layering
- ✓ Component separation for dismantling (sustainability)





Expertise 3. Non conventional optimization methods

QFD



- ✓ Innovative System Design and Development
- ✓ Multiobjective optimization
- ✓ Very high variables number analysis
- ✓ Minimized computational time

TRIZ

Trend	1	2	3	4	5	6
Flexibility of form	Rigid	One joint	Multiple joints	Elastic	Fluid	Field
Flexibility of structure	One piece	Two layers	Multi-layer	Porosity	Molecule	Atom
Flexibility of operating state	One state	Two states	Multi states	Continuous variables	Adaptive	
One-to-many	One	Two same	Two different	Multi	Additional	Opposite
Levels of merging	Separate	Externally combined	Partial	Complex		
Energy flow	Over four steps	Four step	Three step	Two step	One step	Direct
Automation	No system	Human provides control, energy & transmission	Human provides control and energy	Human provides control	No human involvement	

Particle Swarm



Genetic algorithm



Cellular Automata

