

# DEPARTMENT OF MECHANICAL ENGINEERING



## **Federal University of Santa Catarina**

Dean: Prof. Ubaldo Balthazar

### **School of Technology**

Director: Prof. Edson Roberto De Pieri

### **Department of Mechanical Engineering**

Head: Prof. Sergio Gargioni

#### **In 2019:**

45.006 Students

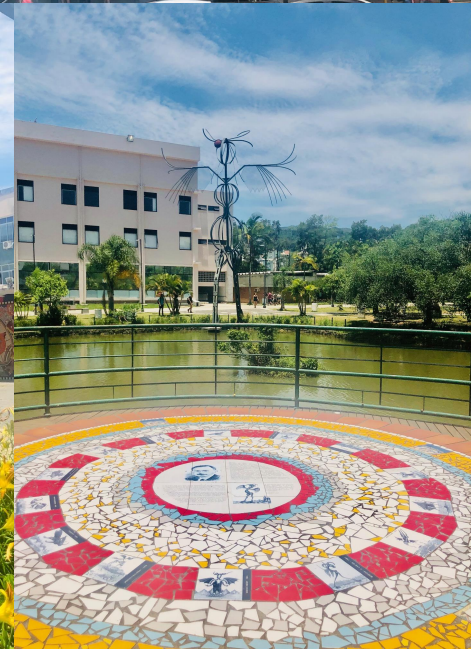
2.551 Professors

3.242 Collaborators

119 Undergraduate Courses

64 Masters Programs

55 Doctoral's Programs



# Department of Mechanical Engineering

## In 2019:

- About 1.000 Undergraduate students
- 600 Graduate students
- 66 Professors, 95% of them PhDs
- 24 Laboratories/Research Groups
- About 20.000m<sup>2</sup> of constructed area



## Mechanical Engineering Undergraduate Course

- Created in 1962, it was the first in the country to implement mandatory curricular internship
- The course attracts many students from other states and countries
- Recognized as one of the best in Brazil
- Approximately 3,110 diplomas awarded until 2019.1
- 55 students / semester
- 10 semesters

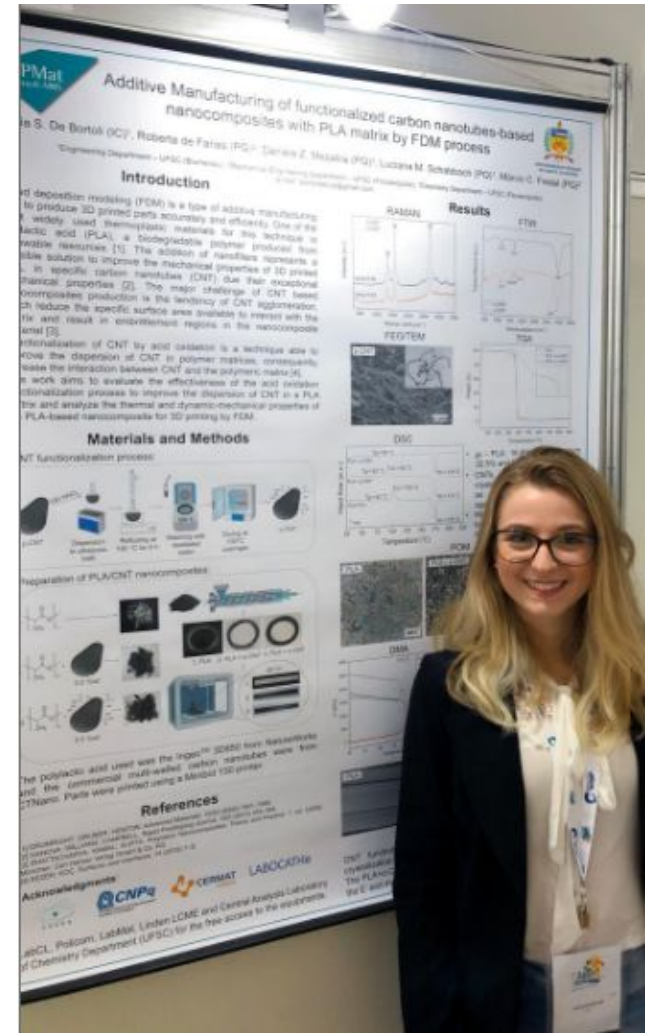
Almost 60% of students get involved in laboratory research, in competition teams or in extracurricular activities



# Materials Engineering Undergraduate Course

- Created in 1999, nowadays the course has 2 mandatory internships and 1 optional internship
- 733 graduates by 2019.1
- 35 students/semester
- 10 semesters

In 2019, Leticia Silva De Bortoli, a graduate of the Materials Engineering course and a master's student in the same area, won an award for the best poster at the XVIII Brazil Materials Research Society Meeting



# Mechanical Engineering Graduate Program

## Master's Degree (since 1969)

More than 1,530 dissertations

## Doctorate Degree (since 1981)

More than 500 theses

**Coordinator:** Prof. Jonny Carlos da Silva  
jonny.silva@ufsc.br

**Site:** <http://ppgmec.posgrad.ufsc.br/>



6 ÁREAS DE ATUAÇÃO 20 LABORATÓRIOS



Several laboratories maintain cooperation agreements and contracts with national and international industries and research centers,

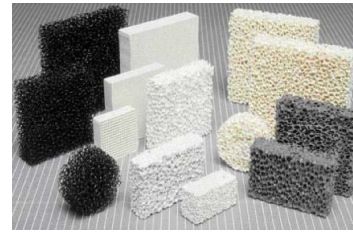
# Materials Engineering Graduate Program

**Master's Degree** (since 1994)  
Completed dissertations: 362

**Doctorate Degree** (since 1994)  
Completed theses: 174

**Coordinator:** Prof. Guilherme M.O. Barra  
g.barra@ufsc.br

**Site:** <http://ppgmat.posgrad.ufsc.br/>



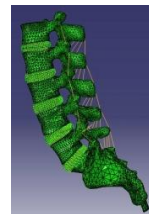
Ceramic and Polymeric Materials



Powder Metallurgy, Plasma Processing and Nanotechnology



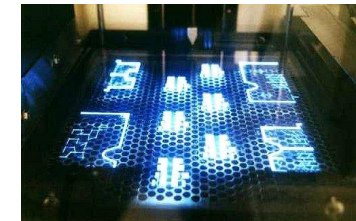
Top score  
in the last CAPES / MEC  
assessment



Biomechanics

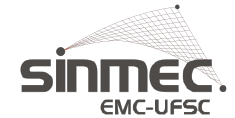


Microstructural  
Characterization



Additive  
Manufacturing

# Laboratories and Research Groups







## Research Laboratories for Emerging Technologies in Cooling and Thermophysics

### Research Focus:

- Refrigeration RD&I focused on developing creative and sustainable solutions for the sector

### Supervisor:

Prof. Alvaro Prata

polo@polo.ufsc.br

Site: <http://www.polo.ufsc.br/>

### Partnerships:

EMBRAPII, INCT, CNPq, CAPES, FAPESC Embraco, Whirlpool, Embraer, Petrobras, FANEM (SP), Panasonic, Danfoss, VMG AIRES, Coca-Cola, Electrolux, Liebherr, Haced B/S/H, Bundy Refrigeration, Federal Polytechnic School of Lausanne Univ. from Texas, Univ. from Michigan, Univ. Autonomous from Nuevo León, Univ. Technician from Denmark, Univ. de Lille, Univ. Delft Technician, London Imperial College, Karlsruhe Institute of Technology, Univ. of Twente.



POLO is the only research center in Brazil to have air-conditioned chambers for testing refrigeration systems, built according to ISO, ASHRAE, NBR and PrEN specifications

## Research Focus:

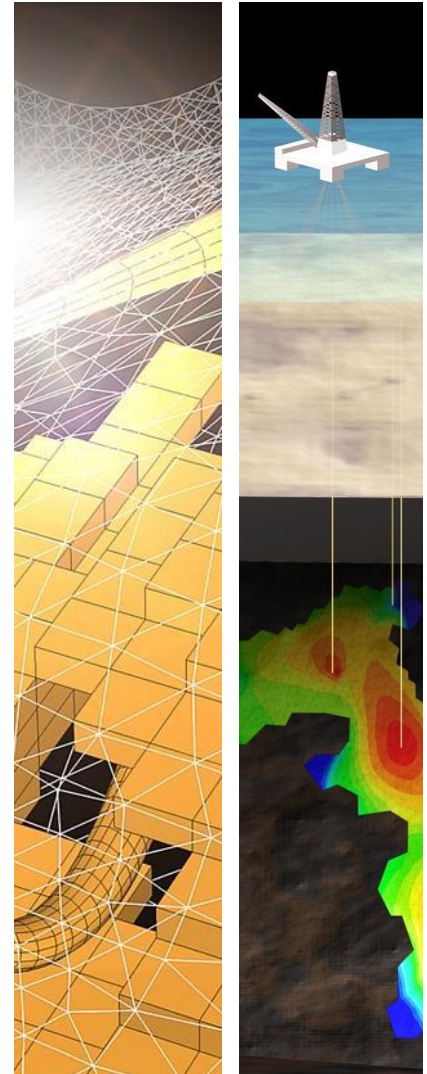
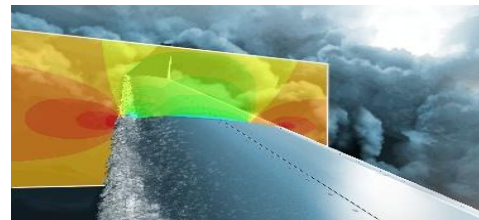
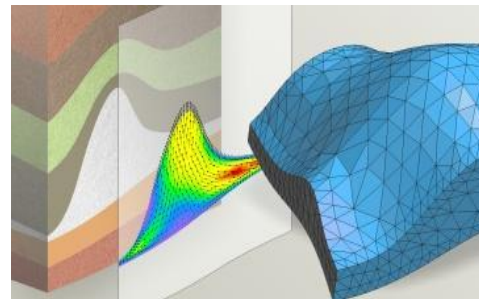
- Development of numerical tools (via simulation) for solving problems related to petroleum engineering, fluid mechanics, heat transfer, multiphase flows (also experiments) and coupled flow problems with geomechanics in porous media.

## Partnerships:

Petrobras; University of Texas at Austin;  
University of Padova; PRH-ANP/MCTI & PFRH;  
ESSS - Engineering Simulation And Scientific  
Software.

## Supervisor:

Prof. Clovis Maliska  
maliska@sinmec.ufsc.br  
Site: [www.sinmec.ufsc.br](http://www.sinmec.ufsc.br)





## Porous Media and Thermophysical Properties Laboratories

### Research Focus:

- Porous media properties and numerical simulation
- X-ray micro and nanotomography
- Surface physics
- Development of thermal transducers
- Thermal comfort research
- Energy efficiency of buildings

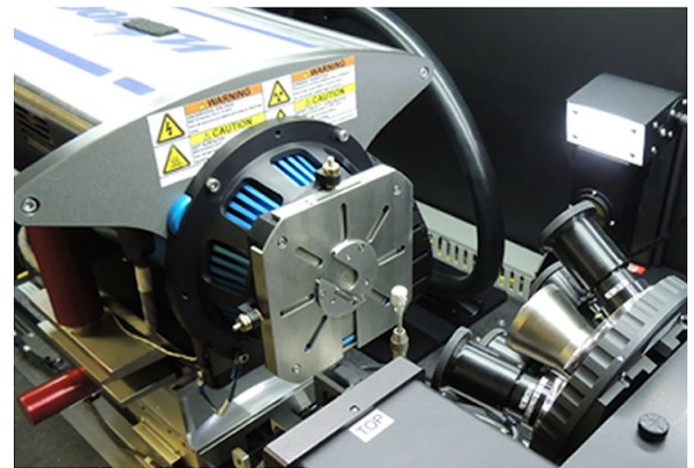
Partnerships: University of Edimburg, Université de Lille, Université Aix-Marseille, University of Cape Town, Laboratório de Petrofísica (UFCG)

### Supervisor:

Prof. J. A. Bellini

bellini@lmpt.ufsc.br

Site: <http://www.lmpt.ufsc.br>





More than 3,000 m<sup>2</sup> of built area are home to the laboratories LABTUCAL, BOILING e LABSOLAR



### Research Focus:

- Processes of two-stage heat pipe and thermosiphon technologies (LABTUCAL)
- Innovative renewable energy cycles for electricity generation
- Simulation and optimization of solar energy plants for electricity
- Heat transfer processes with phase change (BOILING)
- Solar energy for process heat in petrochemical and industrial

### Partnerships:

FINEP, Petrobras, AEB, Embraer, Tractebel, INPE CPTEC, CNPq, CAPES, VOLVO, TUE, IKE-Univ. of Stuttgart, Univ. of Chile, Laval University, UT-Austin

### Supervisor:

Prof. Sergio Colle

[sergio.colle@ufsc.br](mailto:sergio.colle@ufsc.br)

Site: <http://www.lepten.ufsc.br>

## Research Focus:

- Energy conversion: Combustion, fuels, biofuels
- Mobility: Energy efficiency, internal combustion engines, fuel cells, aerodynamics
- Energy: Energy efficiency, cogeneration, alternative sources, renewable energy, exergo-economic-environmental analysis, life cycle analysis
- Biotérmica: Vascular flow, laser tissue ablation, ionic transport modeling
- Modeling and measurement of properties and characteristics of thermal conversion of liquid and gaseous fuels
- Design of energy conversion, cogeneration and renewable energy systems

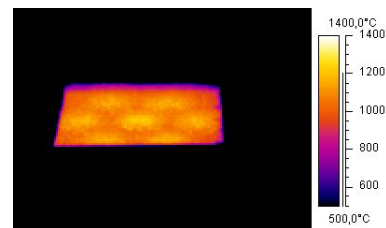
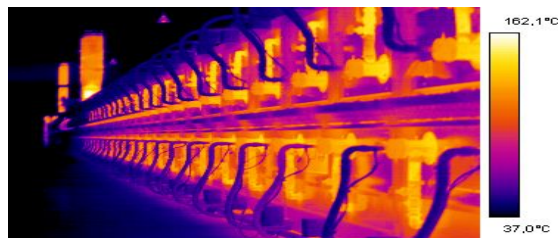
## Partnerships:

CENPES/PETROBRAS, SCGAS, ATLAS, Instituto de Dinâmica dos Gases, Univ. of Duisburg-Essen; Combustion Chemistry Center, National Univ. of Ireland; Future Energy Center, Univ. Malardalen; Technical University of Lisbon; Centrale Supelec, Université Paris-Saclay; Univ. Pereira.

## Supervisor

Prof. Amir A. M. Oliveira  
amir.oliveira@gmail.com

Site: <http://www.labcet.ufsc.br>



### Research Focus:

- Development of teaching equipment in the area
- Experimental teaching activity in the area
- Support to other laboratories in the area in research activities
- Extension activities and various service provision.

### Partnerships:

Companhia de Gás de Santa Catarina;  
Companhia Catarinense de Águas e Saneamento; Empresas de Santa Catarina.

### Supervisor:

Prof. Vicente Nicolau  
vicente@lmpt.ufsc.br

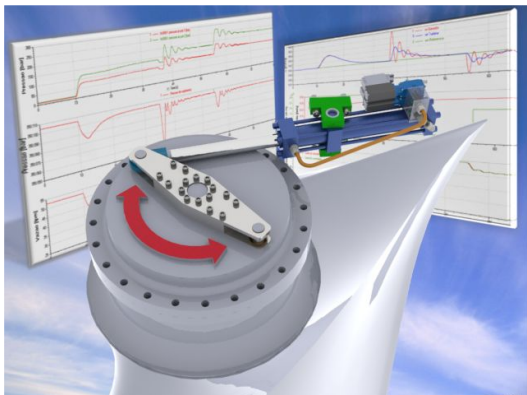
Site: <http://www.labtermo.ufsc.br/>

Laboratory dedicated to experimental teaching in the area, serving undergraduate and graduate courses



### Research Focus:

- Analysis and Design of Hydraulic and Pneumatic Components and Systems
- Methods for the Development of Mechatronic Systems with Hydraulics and Pneumatics
- Computer Systems to Support the Design of Hydraulic and Pneumatic Components and Systems



Recognized by the international community as a reference in Hydraulics and Pneumatics in Latin America

### Partnerships:

FLUMES – Division of Fluid and Mechatronic Systems – Univ. of Linköping  
Center for Fluid Power and Motion Control – Univ. of Bath  
Institute for Fluid Power Drives and Control – RWTH Univ. of Aachen  
Maha Fluid Power Research Center – Univ. Purdue  
CNPq,- Global Fluid Power Society – (Membro)  
NFPA – National Fluid Power Association (EUA) – (Parceria Institucional)  
CISB – Centro de Pesquisa e Inovação Sueco-Brasileiro (Parceria Institucional)  
ABCM – Associação Brasileira de Engenharia e Ciências Mecânicas  
ASME – American Society of Mechanical Engineers – Fluid Power Systems & Technology Division

### Supervisor:

Prof. Victor J. De Negri  
victor.de.negri@ufsc.br  
Site: <http://www.laship.ufsc.br>

## Research Focus:

- Synthesis and analysis of parallel robots and mechanisms
- Robotic surgery
- Design of engine mechanisms
- Vehicle dynamics
- Underwater robots

## Partnerships:

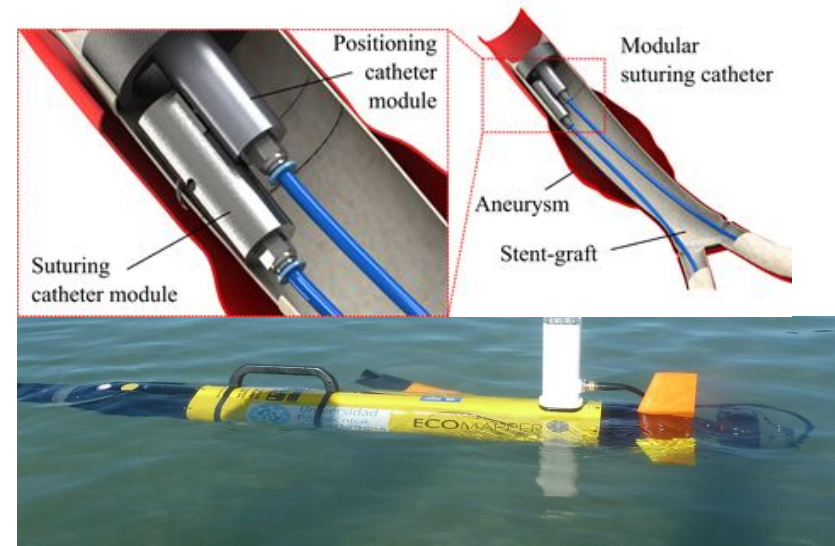
King's College London, University College London, London South Bank, Univ. de Salford (Reino Unido);, Univ. de Tianjin, Univ. de Tsinghua, Univ. de Beihang, Univ. de Linkoping (Suécia), Univ. de Ferrara (Itália).

## Supervisor:

Prof. Daniel Martins

daniel.martins@ufsc.br

Site: <http://www.robotica.ufsc.br>



LAR operates in Patent Research (mapping opportunities); synthesis and development of new mechanisms and robots; Davies method (tool for solving static and kinematic mechanisms and robots).





## Machining and Numerical Control Laboratory

### Research Focus:

- Teaching laboratory composed of servers with technical training
- Use the equipment in conjunction with the Precision Mechanics Laboratory (LMP)
- Teach practical classes in the manufacturing area
- Prototype production workshop for the Department

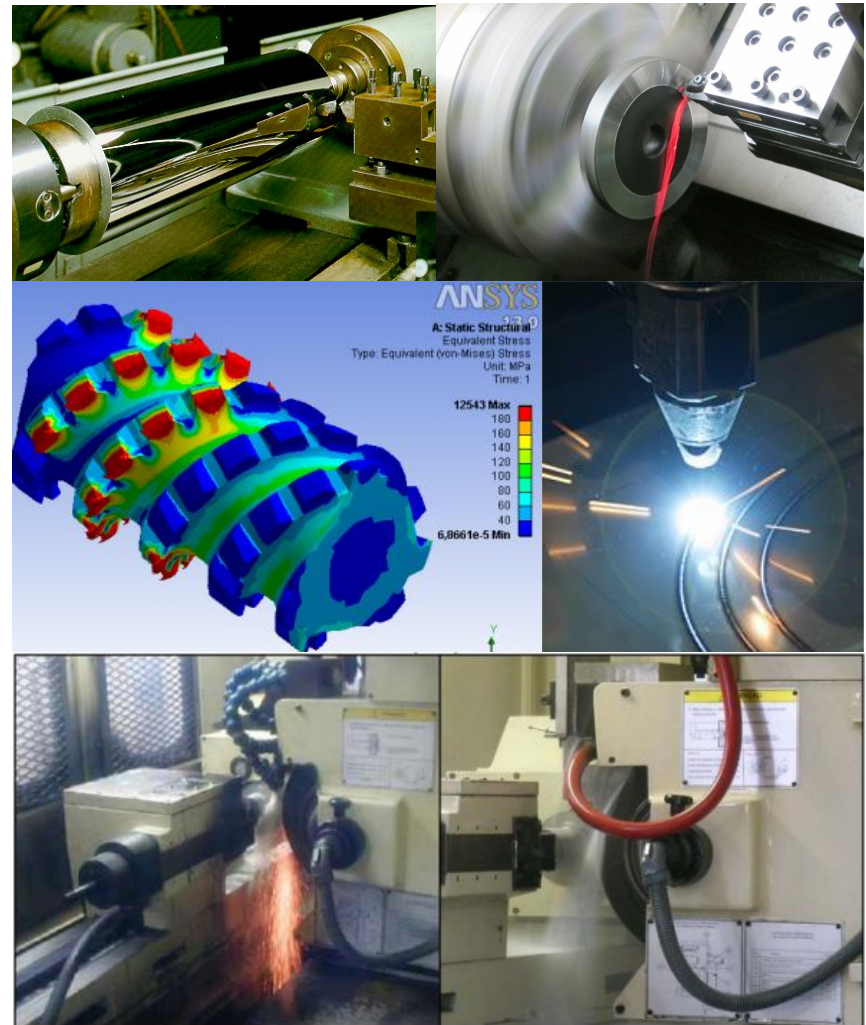
### Supervisor:

Eng. João Bento Rovaris

joao.rovaris@ufsc.br

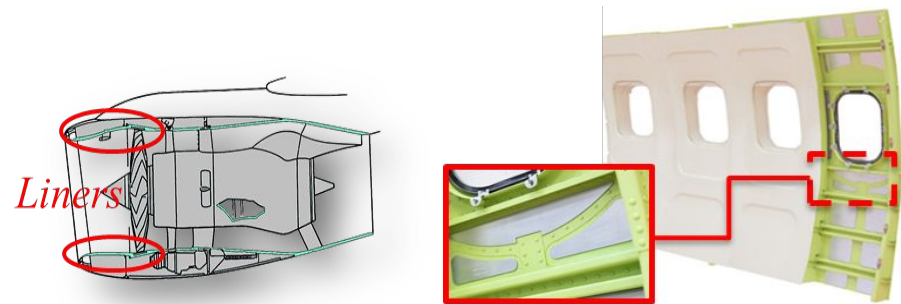
Site: <http://emc.ufsc.br/portal/laboratorios/usicon/>

Operates in machining processes and numerical control; research on machining processes and material machinability; manufacture of complex parts and prototypes and development of special projects, under the order of cooperative companies and institutions



## Research Focus:

- Noise and vibration control on machines and aircraft
- Biomechanics of voice and hearing
- Aeroacoustics
- Underwater acoustics
- Structural and architectural acoustics
- Numerical methods



## Partnerships:

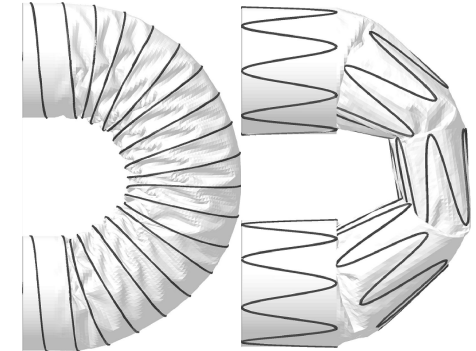
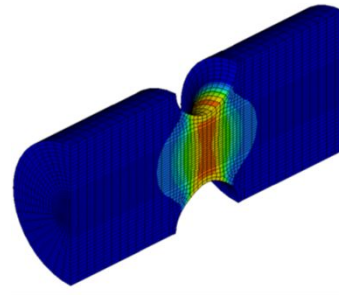
FINEP, CNPq, CAPES, FAPESC, EMBRACO,  
EMBRAER, PETROBRAS, FIAT / GM  
Instituto Tecnológico Real / KTH  
Brigham Young University / BYU  
Univ. McGill  
Univ. de Southampton  
Univ. de Aachen / RWTH  
Univ. do Texas / Dallas

## Supervisor:

Prof. Andrey R. da Silva  
andrey.dasilva@lva.ufsc.br  
Site: <http://lva.ufsc.br/>

### Research Focus:

- Modeling, experimental analysis and numerical simulation in mechanics of solids and structures

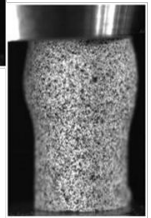
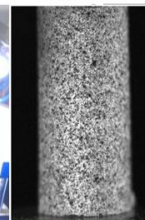
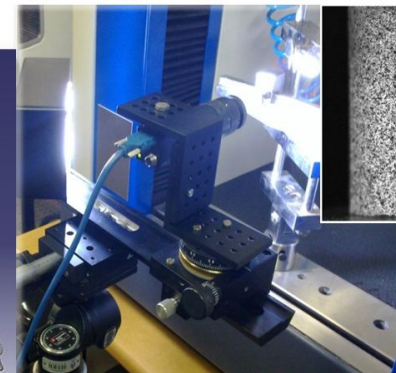
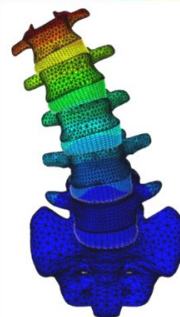
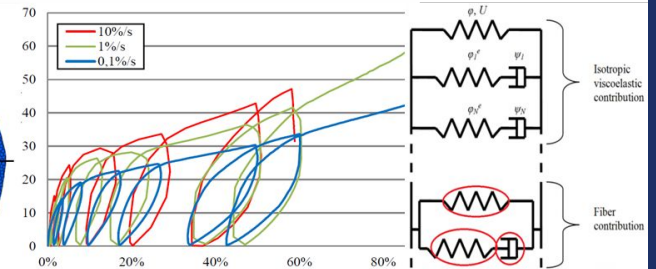
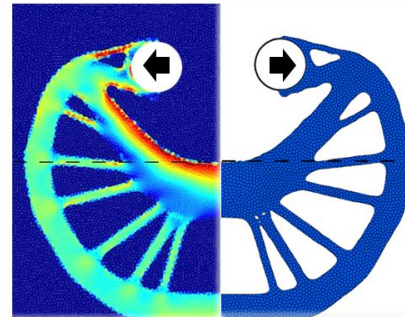


### Partnerships:

École Centrale de Nantes – Fr  
Swansea University – Uk  
Laboratório Nacional de Computação Científica – LNCC/MCT - Br.

### Supervisor:

Prof. Paulo de Tarso  
mendonca@grante.ufsc.br  
Site: <http://www.grante.ufsc.br>



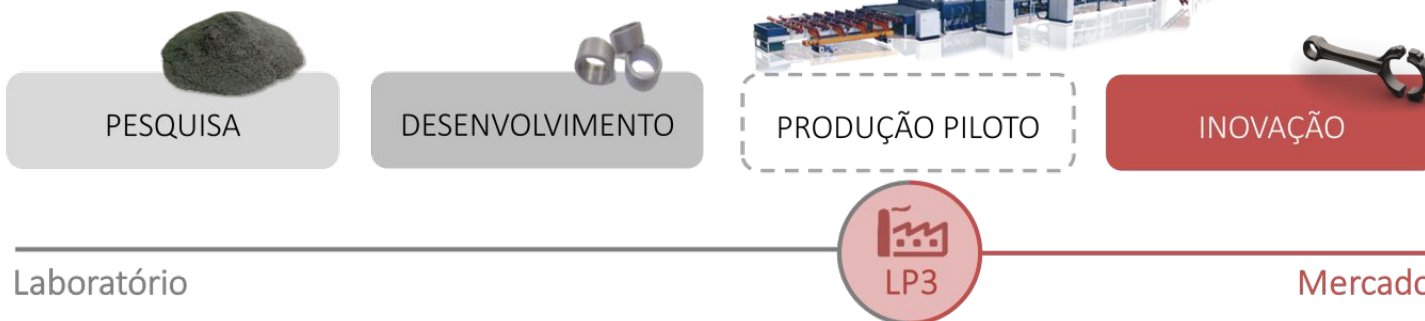
### Research Focus:

- Research on topics related to material development
- Processes for special applications

### Partnerships:

Embraco, Hydra Corona, BNDES, Capes, CNPq, Finep, Fapescc, UFRN, UFU, UFPR, Bremen, Bayreuth, Hamburg University of Technology

## Estratégia de desenvolvimento



Laboratório de Prototipagem e Produção de Lotes Piloto

Conectando os laboratórios à produção, reduzindo o gargalo entre Pesquisa & Desenvolvimento e Inovação

### Supervisor:

Prof. Aloisio Nelmo Klein

a.n.klein@ufsc.br

Site: <http://labmat.ufsc.br/>



## Laboratory of Innovation on Additive Manufacturing and Molding

### Research Focus:

- Research in the field of additive manufacturing (3D printing)
- Polymers molding focusing on the correlation between process parameters, microstructure and properties

### Partnerships:

FIAT, Embraer, Alkimat, Nanoendoluminal, Mormaii e outras; IFSC, SENAI, laboratórios da UFSC, UMinho-Portugal e outras.

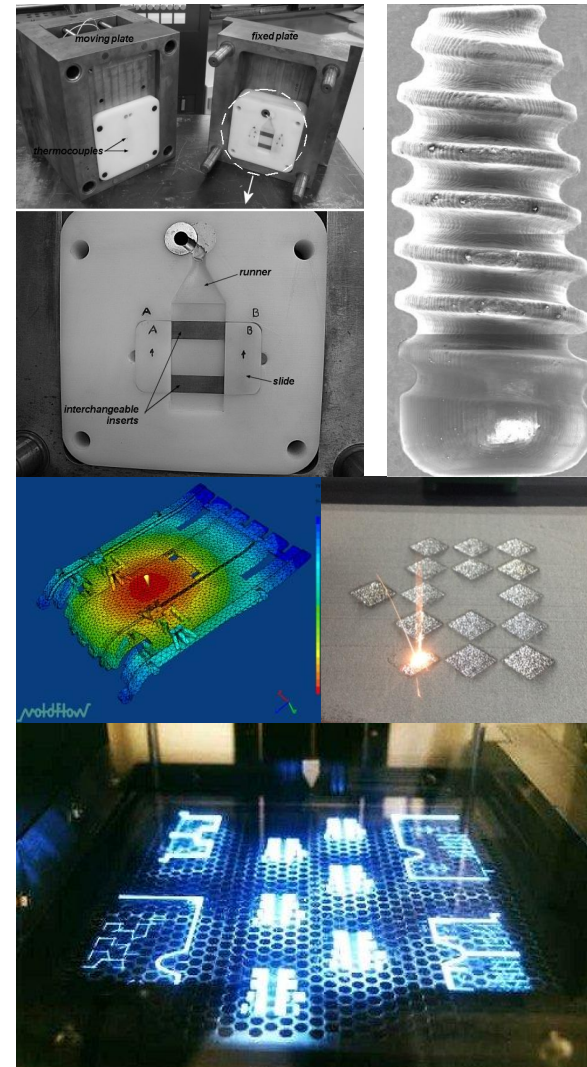
### Supervisor:

Prof. Carlos H. Ahrens

a.n.klein@ufsc.br

carlos.ahrens@ufsc.br

Site:<http://emc.ufsc.br/portal/laboratorios/nimma/>



### Research Focus:

- Development, production and characterization of glassy materials (glass, glass-ceramic and ceramic enamels)
- Development, production and characterization of ceramic structures through additive manufacturing (3D printing)
- Development, production and characterization of porous materials (porous filters, catalytic supports, porous radiant burners, thermal and acoustic insulation)
- Colloidal processing and nanotechnology
- Reuse of industrial solid waste

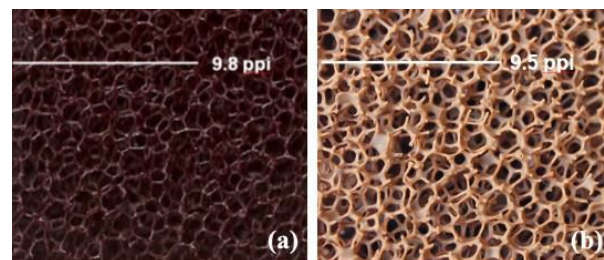


### Partnerships:

Univ. de Modena e Reggio Emilia  
Instituto de Cerâmica e Vidro  
Univ. de Aveiro  
Univ. do Minho  
Univ. de Padova  
Univ. de Erlangen  
Univ. de São Paulo (Campus SJC)  
Univ. de Ribeirão Preto  
Univ. do Extremo Sul Catarinense  
Univ. da Região de Joinville  
CAPES, CNPq, FAPESC

### Supervisor:

Prof. Antonio Pedro Novaes de Oliveira  
antonio.pedro@ufsc.br  
Site: <http://www.vitrocerv.ufsc.br/>





LABORATÓRIO DE CONFORMAÇÃO  
MECÂNICA - UFSC

## Mechanical Forming Laboratory

### Research Focus:

- Relationship between Microstructure, Manufacturing Process and Properties
- Transformation metallurgy: mechanical forming, thermal and thermochemical treatments
- Physical Metallurgy; phase transformation
- Mechanical properties

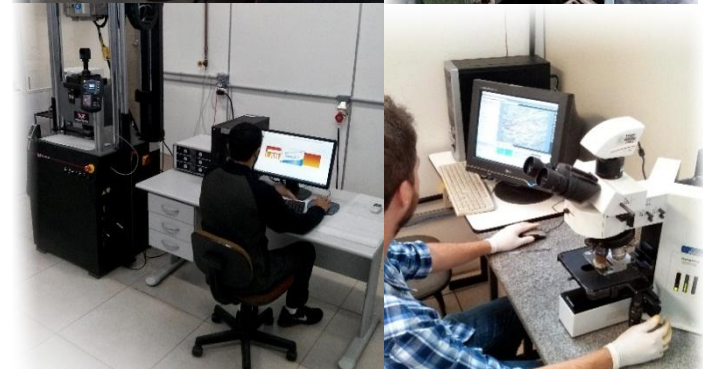
### Partnerships:

ArcelorMittal – Vega S. A.; Engie Brasil Energia S. A.; CNPq; CAPES; Marinha do Brasil - CTM/SP.

### Supervisor:

Prof. Carlos Augusto Silva de Oliveira  
carlos.a@ufsc.br

Site: <http://emc.ufsc.br/portal/laboratorios/labconf/>





## Welding and Mechatronics Institute

### Research Focus:

- Arc, LASER and Hybrid Welding Processes
- Energy Sources and Instrumentation
- Automation and Sensors Applied to Welding
- Additive Manufacturing via Welding Processes
- Torches and Special Devices
- It serves the sectors of Power Generation, Oil and Gas, Agricultural, Aerospace, Naval and Consumer Goods.

### Partnerships and Funders:

UFRJ, UFC, UFU, RWTH, Universidad Antofagasta, DURUM, SPA, PETROBRAS, ENGIE, EMBRACO, CNPQ, ANP, CAPES e FINEP.

### Supervisor:

Prof. Regis Silva

regis.silva@ufsc.br

Site: <https://labsolda.ufsc.br/index.php>



LABSOLDA adopted an unorthodox approach in the Brazilian academic environment, configured by the development of its own equipment and instrumentation. Open architecture allows for high flexibility compared to commercial equipment





## Biomechanical Engineering Laboratory

### Research Focus:

- Research topics related to the design and validation of the biomechanical performance of medical devices and biomaterials

### Parcerias:

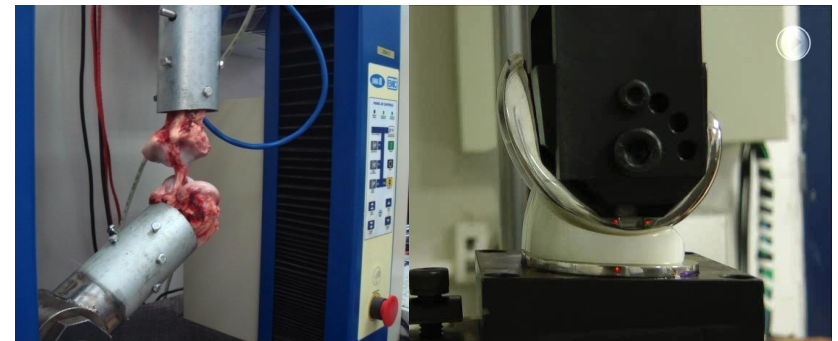
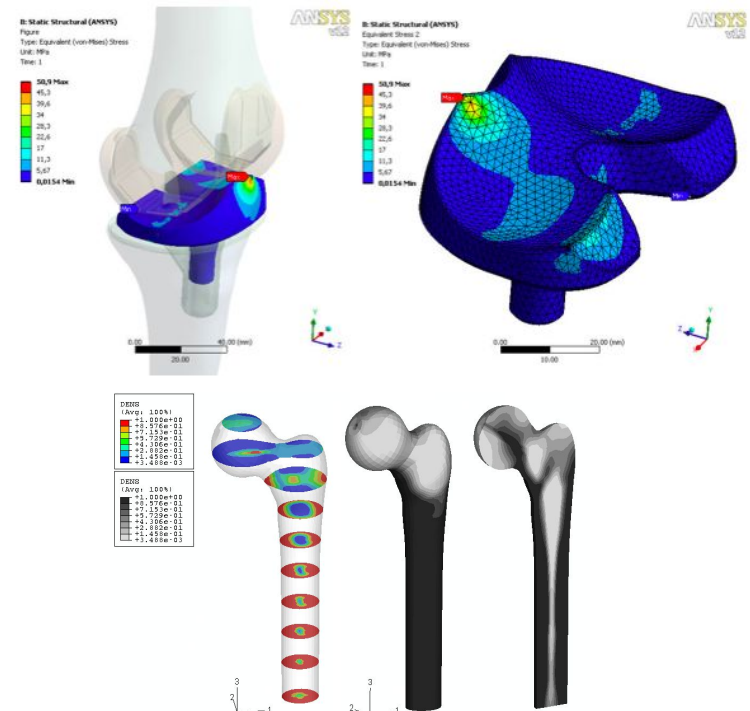
ANVISA – Agência Nacional de Vigilância Sanitária, INT – Instituto Nacional de Tecnologia, INTO- Instituto Nacional de Traumatologia e Ortopedia. MDT Implantes, Spine Implantes e outros.

### Supervisor:

Prof. Carlos Rodrigo Roesler

r.roesler@ufsc.br

Site: <http://www.lebm.ufsc.br/>



## Research Focus:

- Materials, synthesis and processing
- Mechanical behavior: Simulation and Measurement

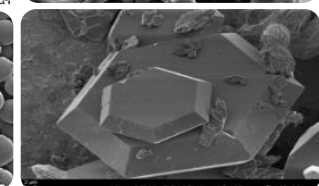
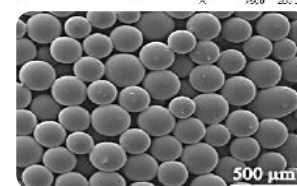
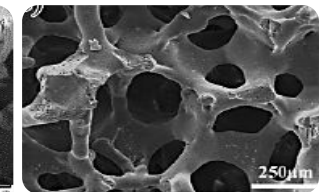
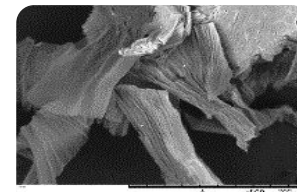
## Partnerships:

ISI-Laser, CMC Tecnologia, Cetarch, Petrobras, Fundação CERTI, Eletrobras, NanoEndoluminal, Cebrace, Celesc, P.I. Germer, SCGás, FAU-Biomaterials/De, TUHH-Hamburg/De, Linden Nanotecnologia, UMinho/Pt, Unimore/It, UFRN, CCB, U.UPPSALA/Sw, EMPA/CH, INSA-Lyon/Fr, THi-Ingolstadt/De.

## Supervisor:

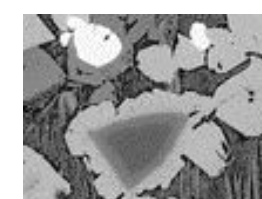
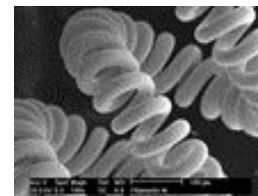
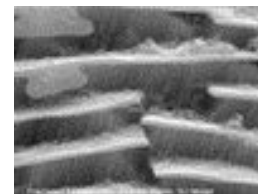
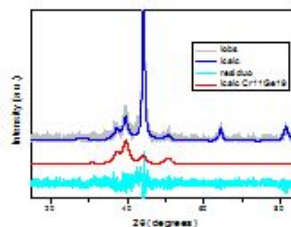
Prof. M. C. Fredel  
m.fredel@ufsc.br

Site: <http://www.ceremat.ufsc.br>



## Research Focus:

- Structural and microstructural characterization of materials.



## Partnerships:

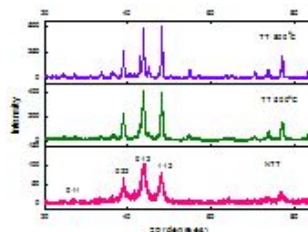
UFPR, UTFPR, IFSC

## Supervisor:

Prof. Cristiano Binder

cristiano.binder@ufsc.br

Site: <http://emc.ufsc.br/portal/laboratorios/lcm/>



The laboratory has infrastructure for structural and microstructural characterization of materials. Can support research, teaching and companies that characterize and / or develop new materials

**Research Focus:**

- Development and application of instrumentation and measurement systems
- Industrial inspection and testing systems

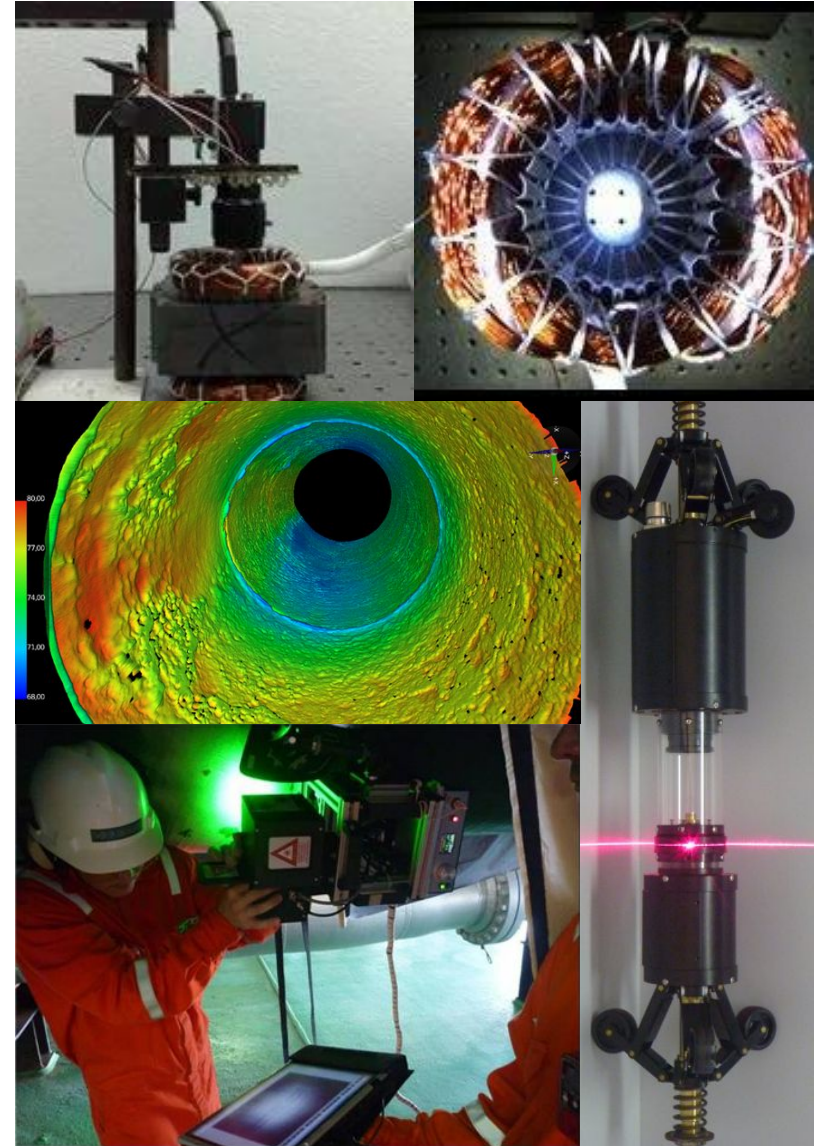
**Partnerships:**

Univ. RWTH Aachen, Univ. Stuttgart, Univ. Basilicata, UFRS, UFU, Photonita, EngeMovi, Petrobras, Embraco, CELESC.

**Supervisor:**

Armando Albertazzi Gonçalves Jr.  
a.albertazzi@ufsc.br

Site: <http://www.labmetro.ufsc.br>





# Integrated Product Development Nucleus

## Research Focus:

- Product development
- Methodologies for product innovation
- Expert systems applied to engineering
- Methodologies for system reliability and maintainability
- Development of machinery and equipment prototypes

## Partnerships:

Univ. Linköping (Suécia), Technische Hochschule, Ingolstadt (Alemanha), FIESC, SESI

## Supervisor:

Prof. André Ogliari  
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Site: <http://www.nedip.ufsc.br/>

Generate and disseminate knowledge in Integrated product development, contributing to the formation of highly qualified professionals in this field, with the advancement of research in Brazil and the development of the national industry





# Research Group: Training in Numerical Command and Industrial Automation

## Research Focus:

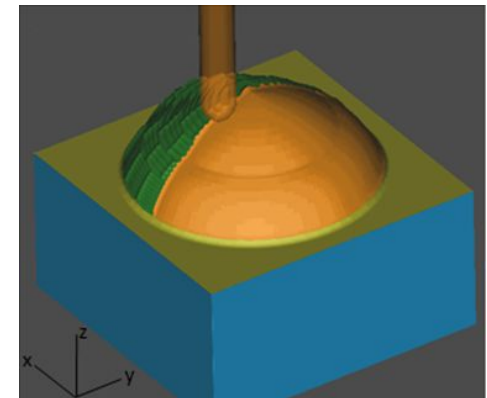
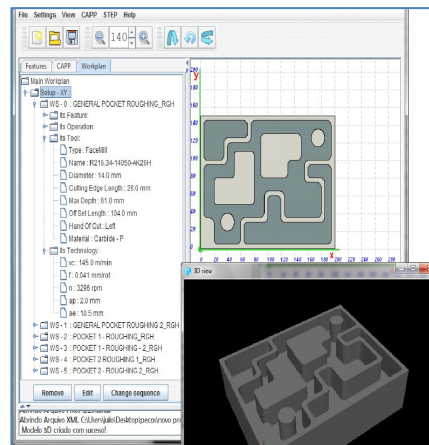
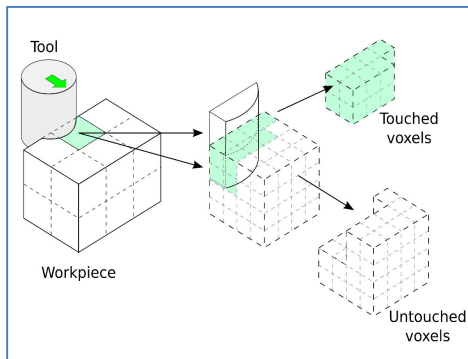
- Research in the areas of product design and manufacture within the scope of Industry 4.0 (Advanced Manufacturing)

## Supervisor:

Prof. João Carlos Espíndola Ferreira

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Site: <http://www.grima.ufsc.br/>





- UFSC is a pioneer in Brazil in having an organization like UFSC Compete
- It was created in 2007 to provide support and legal representation to the university's competition teams.
- Seven multidisciplinary competition teams with workshops at EMC bring together an average of 200 students / semester
- More than 40 TCCs conducted by its members on team topics
- Offer courses, lectures and workshops to the community, in addition to promoting social projects



UFSC  
compete

Viabilizando conquistas

## Competition Teams



UFSC  
BAJA SAE

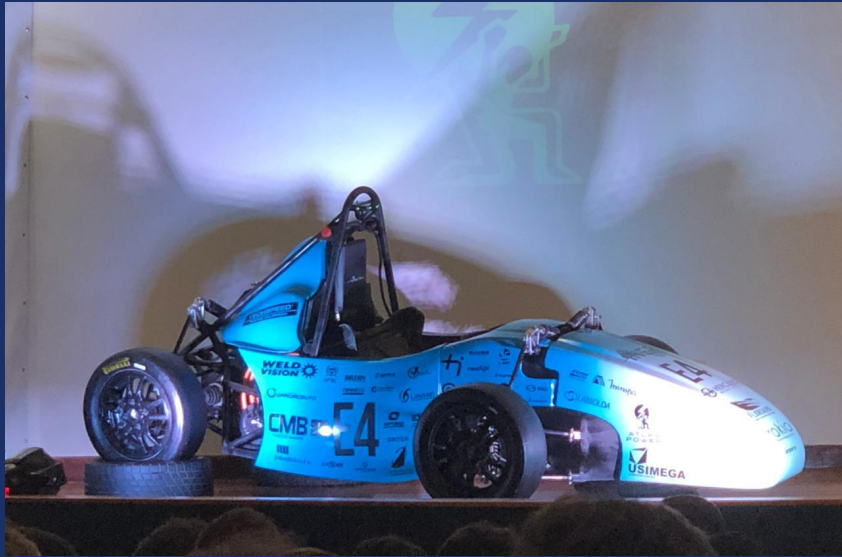


E3-EQUIPE UFSC  
DE EFICIÊNCIA ENERGÉTICA



BARCO SOLAR UFSC  
FLORIANÓPOLIS - SC - BRASIL





- Supervised by Prof. Marcelo Lobo
- Created in 2012
- Participated in its 1st competition in 2014
- Aims to design, build and drive a high-performance electric vehicle to compete in Formula SAE
- About 50 members per semester
- Organize the 2nd most important electric mobility event in Latin America
- Most expressive classification:  
3rd place overall Formula SAE® Brazil electric 2016





- Supervised by Prof. Amir A. M. de Oliveira Jr.
- Created in 2018
- Participated in its 1st competition in 2019
- On average, 15 members
- It aims to promote a breakthrough in aerospace at UFSC
- Seeks to develop rockets with heights greater than 1000 meters within the design and safety requirements of competitions



- Supervised by Prof. Lauro Nicolazzi
- Created in 1997, it is the oldest competition team at UFSC
- It has approximately 20 members
- Development of off-road prototypes for competitions in different types of terrain
- Students are challenged to design, manufacture and pilot the vehicle
- Participated in two world stage competitions
- Most expressive classification:  
Heptacampeã of the South Regional Stage



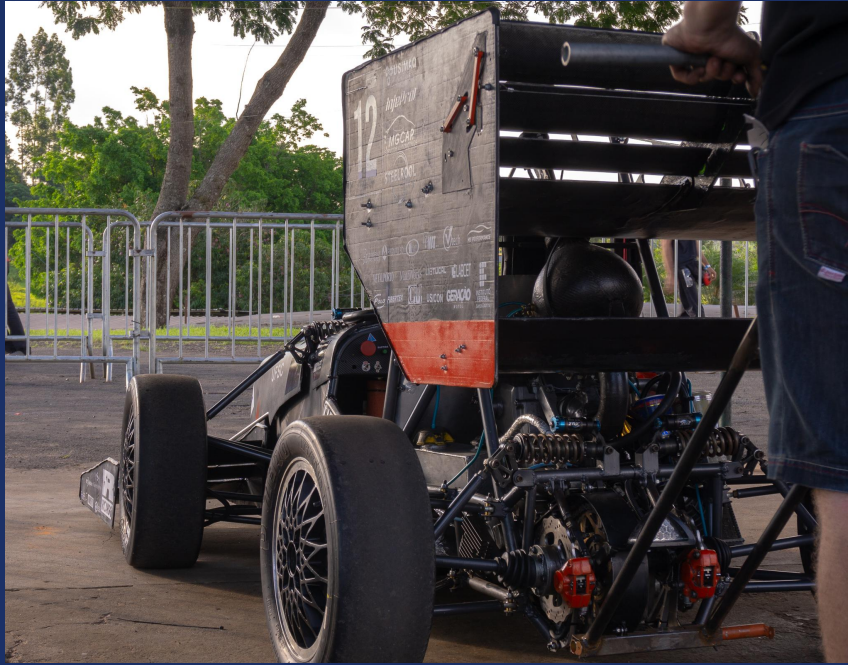
- Supervised by Prof. Amir A. M. de Oliveira Jr.
- Created in 1999
- It has an average of 25 members
- Design and build a radio-controlled cargo aircraft that fulfills its purpose efficiently and effectively
- It competes in three classes: micro, regular and advanced
- Most expressive classification:  
3rd place and trophy for greater structural efficiency in the 2013 world stage, in Texas.





- Supervised by Prof. Henrique Simas
- Created in 2009
- It has an average of 25 members
- It aims to build a vehicle that reaches the best mileage mark using the least amount of energy possible
- Gas powered car
- Most expressive classification:  
525 km / L mark, reached at Shell Eco-Marathon Brasil 2017





- Supervised by Prof. Rodrigo Vieira
- Created in 2010
- It has an average of 25 members
- Designs and builds a high-performance combustion race car annually
- Pioneer in technologies such as the use of turbochargers in vehicles of the category
- Most expressive classification:  
5th place in the presentations at the Formula SAE® Brazil 2017 competition





- Supervised by Prof. Orestes Alarcon
- Created in 2009
- It has an average of 25 members
- Focused on the development of vessels powered by photovoltaic solar energy
- National reference in your area
- Most expressive classification:  
Five-time Brazilian champion at Desafio Solar Brasil, in the two categories that compete



# Junior Companies



- They are non-profit organizations that develop and provide services in the area of performance of the undergraduate courses in which they are inserted.
- Through a business experience, Junior Companies seek to train their members for the job market.
- In the Mechanical Engineering Department are located i9 Consultoria, from Mechanical Engineering, and EJEM, from Materials Engineering.

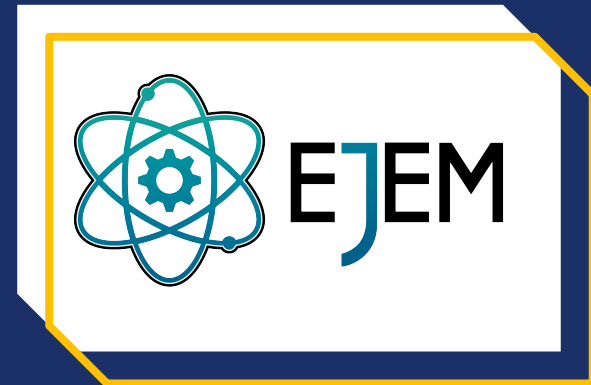
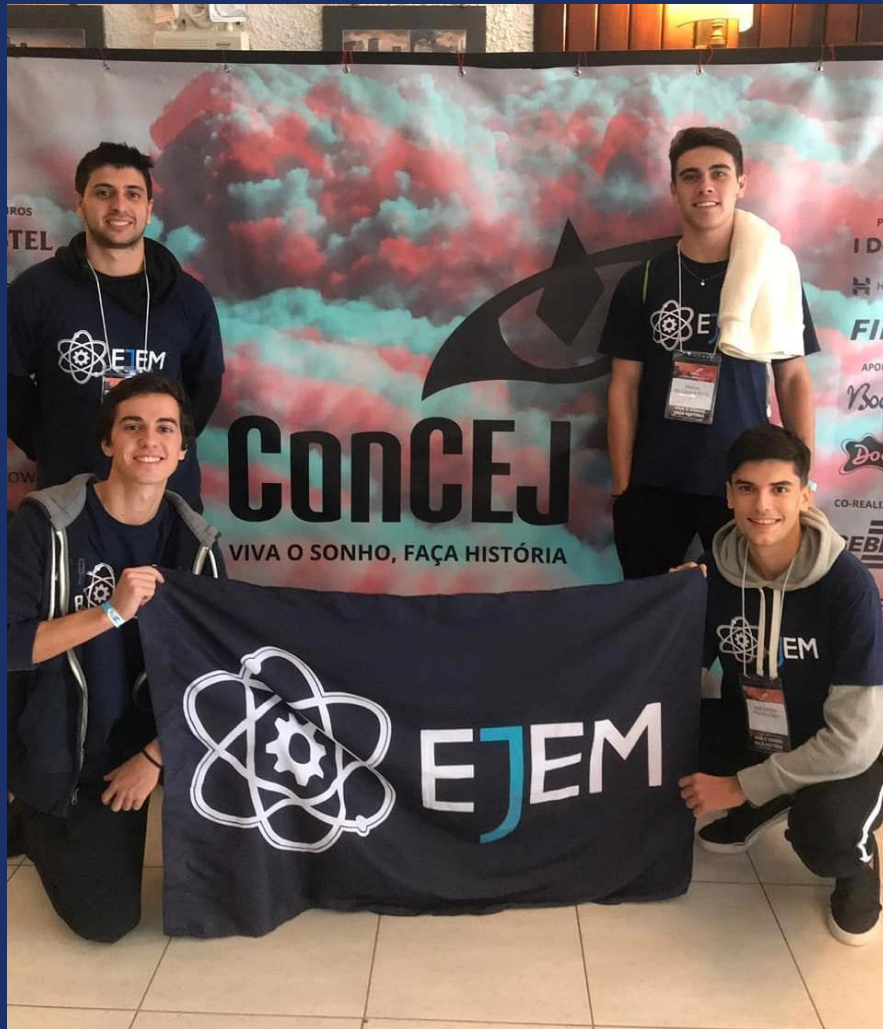






- Mechanical Engineering Junior Company
- Created in 1995
- It has an average of 20 members
- More than 170 completed projects
- Machinery and product development
- Support and consulting projects





- Materials Engineering Junior Company
- Created in 2016
- It has an average of 20 members / semester
- Development of mechanical tests
- 100% managed by students

- **Prof. Sergio Gargioni, Department Head**  
[sergio.gargioni@ufsc.br](mailto:sergio.gargioni@ufsc.br)
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