# 2 **Research Laboratories Portfolio** Federal University of Ceará







Universidade EDERAL DO CEARÁ



# Federal University of Ceará

#### THE GREATEST HERITAGE OF THE BRAZILIAN PEOPLE

**Created**: December 16,1954 **Established**: June 25, 1955

UFC has earned the maximum rating of 7 for three of it's graduate programs, while seven others were awarded a rating of 6, wich places it as the top university in the North and Northeast according to the latest ranking by CAPES (an organization in charge of quality assurance in higher education, sponsored by the Federal Government).

45% of our graduate programs have received awards for excelence, 11% of wich are international accolades.



7.055 Students 52 Doctoral Degree (Ph.D.) Programs 80 Master's Degree Programs 8 Specialist Degree Programs (Shorter, market-oriented programs)



**Crateús Campus** 



**Sobral Campus** 





Quixadá Campus



#### **Graduate Studies**

#### **Undergraduate Studies**

As of 2020, UFC has awarded more than 115 thousand undergraduate degrees. 121 undergraduate programs, 9 distance education programs across 30 municipalities over **30 thousand** active students, 6,358 seats avaliable in 2020.

**Russas Campus** 



Itapajé Campus



# Laboratories of the Federal University of Ceará







Please select a laboratory for more information





# LABVIS Interactive Visualization and Simulation Laboratory of the Undergraduate Program in Digital Systems and Media

Link to the laboratory's website

#### **Fields of Research**

Digital Simulation, Augmented Reality, Virtual Reality and 3D Printing.

#### **Ongoing projects or project proposals**

The Laboratory is in its establishment phase, with the support of the Interdisciplinary Center for Image Analysis (CMAI), a project promoted by the Ceará Foundation for Scientific and Technological Development (FUNCAP) and coordinated by Prof. José Xavier-Neto. In return, the laboratory is responsible for implementing the Center's several actions in the scope of scientific data visualization and simulation of biological models.



#### **Researchers**

Adriano Anunciação Oliveira - Lattes Antônio José Melo Leite Junior - Lattes **George Allan Menezes Gomes - Lattes Ricardo Brauner Dos Santos - Lattes** 



# LPACO<sub>2</sub> LABORATORY OF ADSORPTION AND CO<sub>2</sub> CAPTURE

Link to the laboratory's website

#### **Fields of Research**

- Carbon Capture, Utilization and Sequestration (CCUS)
- Modelling of gas separation and purification by adsorption
- Biogas upgrading
- Hydrogen purification
- Natural gas storage and cleaning
- Treatment of flue gases
- CO2 conversion
- Oxygen production from air

#### Researchers

Prof. Dr. Diana Cristina Silva de Azevedo - Lattes **Prof. Dr. Moises Bastos Neto - Lattes Prof. Dr. Célio Loureiro Cavalcante Jr - Lattes** 

Prof. M.Sc. Antônio Eurico Belo Torres - Lattes Prof. Dr. Enrique Vilarrasa-Garcia - Lattes

#### **Projects**

- **Plant Tests. Grantor: ENEVA**

- SHELL/FAPESP

• CO2 Capture Post-Combustion of Mineral Coal - Synthesis of Zeolites and Pilot

• Direct Synthesis of DME from CO2 - Basic Research. Grantor: Petrobras

• Degradation study of molecular sieves used in natural gas drying for process

optimization in a pre-salt production unit. Grantor: Petrobras

• Pilot Unit of Hospital O2 Production. Grantor: FUNCAP

• Project based on the optimization of adsorption systems by temperature oscillation for biomass gases containing CO2 in large scale. Grantor:



#### LABORATORY OF ADSORPTION AND CO<sub>2</sub> CAPTURE

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# LAMEFF Laboratory for Fracture Mechanics and Fatigue

Link to the laboratory's website

#### **Fields of Research**

- Polymeric Composites
- Conductive Membranes
- Material Damage and Fracture Mechanics

#### Projects

- Development of biodegradable polymeric composites
- Proton Exchange Membranes for Fuel Cells

#### Researchers

Enio Pontes de Deus (Department of Metallurgical and Materials Engineering) - <u>Lattes</u> José Osvaldo Bezerra Carioca (Department of Food Technology) - <u>Lattes</u>





# **Renewable Energy and Hydrogen Laboratory**

#### **Fields of Research**

- Green Hydrogen
- Microbial Eletrochemistry Technology
- Advanced Engine Combustion Systems

Fernanda Lobo - Lattes André Bueno - Lattes Paulo Alexandre Rocha - Lattes Maria Eugênia Vieira da Silva - Lattes

#### **Projects**

- New Routes for green Hydrogen production using microbial electrolysis cell couple with ultrasound for industrial wastewater treatment.
- Hybrid system for green hydrogen production using microbial desalination and electrolysis cell couple to steam reform of glycerol with solar energy.
- New low-cost materials for hydrogen production in microbial electrolysis cell.

#### Researchers

• Experimental evaluation of operation and security conditions of a big consumer using mixtures of natural gas, biomethane and green hydrogen.

• HCCI Combustion Sistem to flex-fuel engines

• New hybrid powertrain system to the **Brazilian automotive industry** 



Test rig in the wind tunnel



SD 300 PRO® 3D printer



Test rig in the wind tunnel

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Test rig in the wind tunnel



Test rig in the wind tunnel



# **LAERO - OPL** Wind energy for hydrogen production and supply chain planning.

#### **Linked Laboratory**

Aerodynamics and fluid Mechanics Laboratory (LAERO) e Operational Research in Production and Logistics (OPL)

#### **Research lines**

Numerical simulation, Wind speed analysis; Vibration analysis of wind turbines; Study the use of windenergy for the production of green hydrogen by new approaches; Simulation and optimization oflogistics systems; Vehicle routing problems; Supply chain management; Time series analysis and demand forecasting; Study the green hydrogen supply chain, consideringproduction, storage, transportation and distribution.

#### Researchers

Carla Freitas de Andrade - <u>Lattes</u> Bruno de Athayde Prata - <u>Lattes</u> Anselmo Ramalho Pitombeira Neto - <u>Lattes</u> Paulo Alexandre Costa Rocha<u>Lattes</u>



# **CRAB** Computer graphics, virtual Reality and Animation Group

Link to the Laboratory's website

#### **Research areas**

Computer Graphics, Virtual Reality, Computer Animation and Visualization

#### **Selected Projects (Approved or Ongoing)**

- Physically-based Simulation and Animation for Computer Graphics and Virtual Reality
- SILVi Integrated System for Virtual Laboratories for Physics in the UAB
- VDL Virtual Distance Learning
- Virtual System for Shooting Training
- AVAL Virtual Environment for Language Learning
- Mesh Generation and Adaptation for Reservoir Simulation
- Simulation and Visualization of Fracture Propagation
- SALA 3D Three-dimensional Visualization System



#### Researchers

Creto Augusto Vidal - <u>Lattes</u> Joaquim Bento Cavalcante Neto - <u>Lattes</u> Emanuele Marques Rodrigues Santos - <u>Lattes</u> Yuri Lenon Barbosa Nogueira - <u>Lattes</u>

## GPAR **Research Group on Automation, Control and Robotics**

Link to the Laboratory's website

#### **Linked Laboratory**

Process Control Lab, Advanced Mobile Robotics Lab, Electric Vehicles Lab.

#### **Lines Research**

- Robust, adaptive, predictive, and intelligent control of dynamical processes represented by linear, LPV, and nonlinear systems;
- Modeling and identification of real complex dynamical systems:
- Mobile robotics, autonomous indoor and outdoor navigation, tracking and trajectory planning.
- IoT, IoV, artificial intelligence, computer vision, signal processing, and pattern recognition.
- Electronic instrumentation and embedded systems;

- processes.

• Development of mobile robots and UAVs for automation, inspection, and diagnosis of industrial

• Point clouds generation and processing, 3d mapping, and 3d aerial scanning.

• Applications on industrial processes. thermal chambers, electrical machines, UAV, ROV, AGV, mobile robots, reverse osmosis desallination, electrical power systems, and biomedical engineering.

#### **Ongoing projects or project proposals**

The Automation, Control, and Robotics Research Group – GPAR/UFC aims to develop new technologies to improving the performance and reliability of industrial plants, electrical systems, and biomedical processes. The mission is develop high impact research by enabling graduate and undergraduate students to undertake scholarly study and advanced research and prepare for professional work. Furthermore develop R&D projects with companies and public agencies.

#### Researchers

Prof. Fabrício Gonzalez Nogueira - <u>Lattes</u>	Prof
Prof. Bismark C. Torrico - <u>Lattes</u> Prof. Victor Hugo Costa de Albuquerque - <u>Lattes</u>	Prof. Prof.



#### **Research Group on Automation, Control and Robotics**

a. Laurinda Lúcia Nogueira - <u>Lattes</u> Arthur Plínio de Souza Braga - <u>Lattes</u> Diego de Sousa Madeira - Lattes

# **GPEC** The Power Electronics and Electric Energy Processing Group

Link to the Laboratory's website

#### **Research areas**

The Power Electronics and Energy Processing Group (GPEC) within the Electrical Engineering Department (DEE) of the Federal University of Ceará (UFC) is a research team working in technological solutions in the field of power electronics and renewables, with strong partnership with national industry, utilities, and research institutes in Brazil and abroad.

The group research in the areas of power electronics, power quality, and new technologies to produce electricity from renewables aiming at the sustainable and efficient use of electrical energy in industry, commerce, and through all the electricity chain from generation to end users. The team is formed by researchers most of them working in the Electrical Engineering graduate program of UFC, qualifying professionals to work in areas such: Power Systems, Power Electronics, Industrial Drives, Power Quality and the Use of Renewable Energy Sources.



Hardware development space





Sevice of commisioning a PV system for Distributed Generation



Simulation space

#### **Research areas**

three laboratories:

- Power Electronics Laboratory,
- The Smart Grid Laboratory

The Power Electronics Laboratory has an infrastructure of modern and state-of-the-art equipment such as: digital oscilloscopes, high-power supplies, high-precision measurement systems, loads and data acquisition systems. This laboratory is essential in the research developed in the Graduate Program in Electrical Engineering at UFC. About 100 MSc dissertations and 20 PhD theses were concluded under the GPEC team supervision in the last 10 years.

The Power Electronics and Electric Energy Processing Group

Research and development activities are carried out in

• Electrical Power Quality Laboratory.



#### **Research fields**

- Multilevel converters
- Solid State Transformer
- UPS Systems
- Fast Battery Chargers for Electric Vehicles.
- Power Quality
- Power System Automation
- DC Distribution
- Smart Grids and Distributed Generation
- Wind and Solar Systems On-grid and Off-grid.
- Services provided:
- Certification of PV inverters, single phase and three phase, up to 10 kW
- Commissioning of PV systems

#### Researchers

Dalton Araújo - <u>Lattes</u> Demercil Oliveira Jr. - <u>Lattes</u> Domenico Sgro - <u>Lattes</u> Ernande Morais - <u>Lattes</u> Fernando Antunes - <u>Lattes</u> Luiz Henrique Barreto - Lattes Paulo Praça - <u>Lattes</u> Raimundo Furtado - <u>Lattes</u> Rene Pastor - <u>Lattes</u> Ruth Leão - <u>Lattes</u> Sérgio Daher - <u>Lattes</u>



#### The Power Electronics and Electric Energy Processing Group





GPEC team: Professors, MSc and PhD students (Photo taken before pandemic)

# LPC **Corrosion Research Laboratory**

#### **Fields of Expertise**

- Atmospheric Corrosion
- Electrochemical methods for corrosion testing
- Corrosion resistance evaluation considering metallic materials
- Anticorrosive coatings Paints, conversion coatings and metallic coatings;
- Accelerated Test Chambers ASTM: B117, G85, D2247, G154; DIN 50018;
- Autoclave Tests High Temperature, High Pressure.









#### **Research Projects**

- Companhia Siderúrgica do Pecém: Evaluation of Atmospheric Corrosion and Protection Systems in the Industrial Environment of Companhia Siderúrgica do Pecém.
- EDP/ENEVA: Aggressive atmosphere studies in coal-fired with TPP's semi-dry FGD: Development of diagnose methodologies & anticorrosive protection.

#### Researches

Prof. Walney Silva Araujo, Dr - Lattes Prof. Diego Lomonaco, Dr - Lattes Enga. Roberta Bastos Vasques, Msc - Lattes Eng. Otilio Braulio Freire Diogenes, Msc - Lattes Enga. Milena Jacinto da Silva Moura, MSc - Lattes



• Petrobrás: Evaluation of Corrosion Inhibitors for Carbon Steel Systems in CO2 Containing Medium: Influence of Salinity, Temperature, and Pressure.

• Fundação Cearense de Apoio ao Desenvolvimento **Científico e Tecnológico (Funcap)**: Development of Sustainable High Performance Novolac Epoxy **Coatings for Offshore Wind Tower Applications** 



# LAFFER Laboratory of the Thin Films and Renewable Energies

#### **Fields of Research**

LAFFER researches projects on thermal and solar photovoltaic solar energy. At the same time, in the laboratory, the students from the Mechanical Engineering and Renewable Energy Graduation Programs are in touch with frontier and consolidated technology on photovoltaic and thermal solar energy.

#### **Projects**

• Electrical transparent conductors

- Photovoltaic solar cells
- Silicon solar grade
- Devices construction
- Solar Hydrogen
- H2O Solar



RESEC

Prof. Dr. Francisco Nivaldo Aguiar Freire <u>Lattes</u> Profa. Dra. Ana Fabíola Leite Almeida <u>Lattes</u>

#### Researchers

# LAB3D Laboratory of Modeling and 3D Visualization

Link to the Laboratory's website

#### **Fields of Research**

- Energy storage
- CO2 capture and conversion
- Multiscale numerical models

- Chemical process modeling

#### Projects

- Optimization of green H2 storage systems for vehicle tanks. **Grantor: FUNCAP**
- Direct Synthesis of DME from CO2 Basic Research. Grantor: Petrobras
- Multiscale Modeling to Reduction of Uncertainties in Geomechanical Simulators at Pre-Salt Conditions. Grantor: Petrobras
- Petrobras
- treatment. Grantor: CNPq

• Molecular simulation applied to engineering problems

• Degradation study of molecular sieves used in natural gas drying for process optimization in a pre-salt production unit. Grantor:

• Study and optimization of scale inhibition processes mediated by adsorption/precipitation in pre-salt. Grantor: Petrobras • Metal-organic structures as drug nanocarriers for cancer







#### Researchers

Prof. Dr. Sebastiao Mardonio Pereira de Lucena - <u>Lattes</u> Prof. Dr. Pedro Felipe Gadelha Silvino - <u>Lattes</u> Prof. Dr. Hugo Rocha Peixoto - <u>Lattes</u> Dr. Daniel Vasconcelos Gonçalves - <u>Lattes</u> Dr. José Carlos Alexandre de Oliveira - <u>Lattes</u>





#### 25% Basal Plane Gasification

Simulation of the combustion process on a graphene sheet



