



RESEARCH DIRECTIONS

**ELECTRICAL AND MECHANICAL ENGINEERING DEPARTMENTS
FACULTY OF ENGINEERING – AIN SHAMS UNIVERSITY**

2022



FACULTY DEPARTMENTS AND SPECIALIZATIONS

ELECTERICAL ENGINEERING DEPARTMENTS

1- Power and Electrical Machines Engineering Department

- Electrical Power Systems
- High Voltage
- Electrical Machines
- Power Electronics
- Electrical Power Network Planning
- Renewable Energy
- Electrical Power Systems Control

2- Electronics & Electrical Communication Engineering Department

- Electronics
- Communication
- Optical Communication
- Digital Signal Processing
- Microwave
- Integrated Circuits Design
- MEMS Design
- Microelectronics

3- Computer and Systems Engineering

- Systems and Software Engineering
- Computer Organization
- Artificial Intelligence and Machine learning
- Computer Network Security
- Database Systems
- Computer Vision
- High Performance Computing
- Embedded Systems



FACULTY DEPARTMENTS AND SPECIALIZATIONS

MECHANICAL ENGINEERING DEPARTMENTS

1- Design and Production Engineering Department

- Production and Manufacturing Engineering Technologies (Forming, Machining, Additive Manufacturing, Welding, Casting, ...etc)
- Materials Engineering and Processing (Metallurgy, polymers, ceramics, composites, ...etc)
- Injection Molding
- Die and Molds Design
- Industrial Engineering (Supply chain management, production management and planning, facility planning,etc.)
- Quality control
- Mechanical Systems Design and Stress Analysis
- System Dynamics and Machine Mechanics
- Vibration and Acoustics
- Measurements and Metrology

2- Mechanical Power Engineering Department

- Thermal Systems (Thermodynamics, Heat transfer, ...etc.)
- Fluid Mechanics
- Turbo-Machines

- Engines and Combustion
- Renewable Energy
- Refrigeration and Air Conditioning
- Thermofluids
- Water Desalination
- Solar Energy

3- Automotive Engineering Department

- Automotive Engineering
- Automotive Design
- Automotive Control Systems
- Automotive Dynamics
- Autotronics

4- Mechatronics Engineering Department

- Mechatronic Systems Design and Integration
- Model based design of multidisciplinary systems
- Control Systems Design
- Robotic systems design, analysis and control (Industrial, walking, underwater, healthcare,etc.)
- Autonomous Systems Design

Examples of Research Activities



مركز بحوث الصوتيات
و الاهتزازات و الهياكل الذكية
كلية الهندسة، جامعة عين شمس



Center for Sound,
Vibration & Smart Structures
Ain Shams University

Sound and Vibration Research

Tamer Elnady

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CVS³

Virtual Reality Lab

Digital Learning Lab

Product Design Lab

ETCC Energy Technology & Climate Change Laboratory

Soundscape Urban Ambiances Lab



DYNAMIC SYSTEMS & DIGITALISATION CLUSTER

dcdc.eng.asu.edu.eg

- **Acoustics performance characterization**

- **Absorbing materials**
- **Appliances sound power**
- **Exhaust / Intake systems**
- **Industrial machines sound power**



- **Vibration analysis**
 - Preinstallation vibration surveys
 - Consultations for vibration problem
 - Vibration dampers design and selection
 - Vibration measurements
 - Qualification tests for products



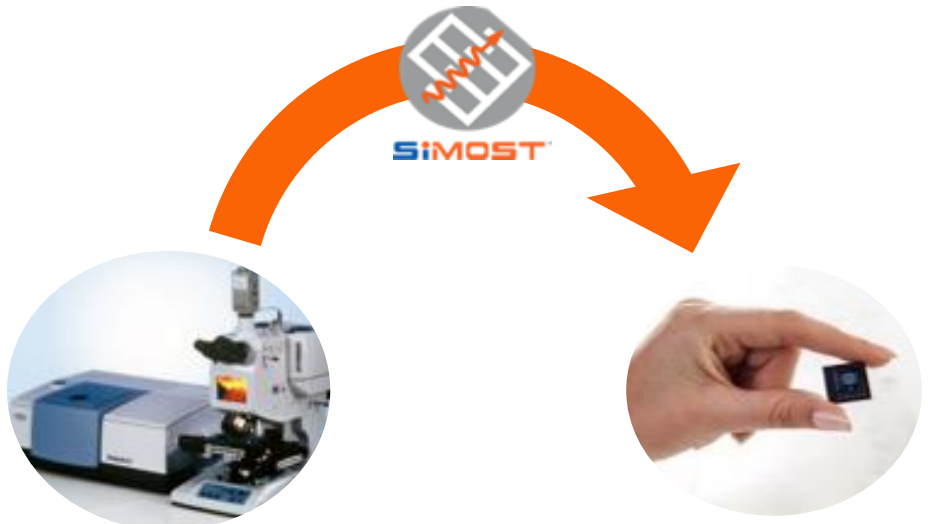
The background features a faint, light gray illustration of a hand holding a device, possibly a spectrometer, with several vertical lines extending upwards from the device. Overlaid on this is a spectral plot showing a series of peaks and troughs. The text is centered over the hand and device illustration.

***Miniaturized FTIR Spectrometer for
Quality of life***

Miniaturized FTIR Spectrometer for Quality of life

Mission

To bring spectroscopy and material analysis from the lab to the average consumers.



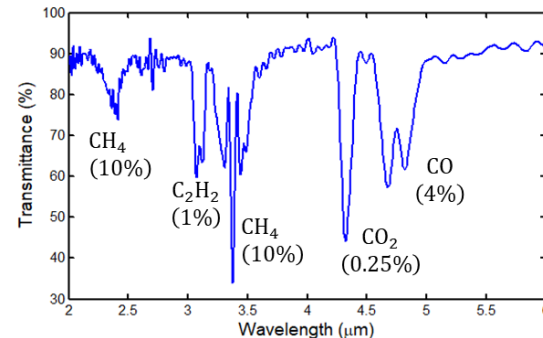
Conventional Spectrometer

Spectral Sensor
On a chip

Vision

A paradigm shift in the material sensing / analysis supported by the IoT technology will change the world and enhance the quality of our life

Cell Phone & Wearables

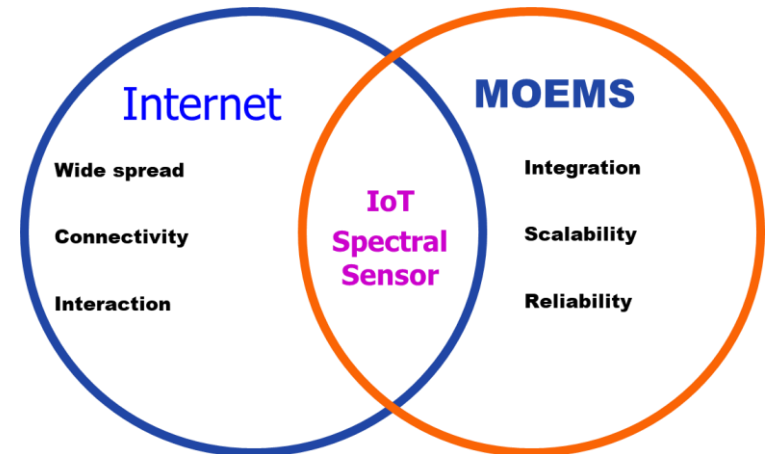




Why a Spectral Sensor ?

- ❑ Each material has an ID spectrum
- ❑ Molecules have their fundamental spectral signatures.
- ❑ Material Sensing → Identification → **Quality of life**
- ❑ Applications

- Food quality monitoring
- Oil & gas analysis
- **Pollution Monitoring**
- Biomedical applications
- Industrial process control
- ...etc.



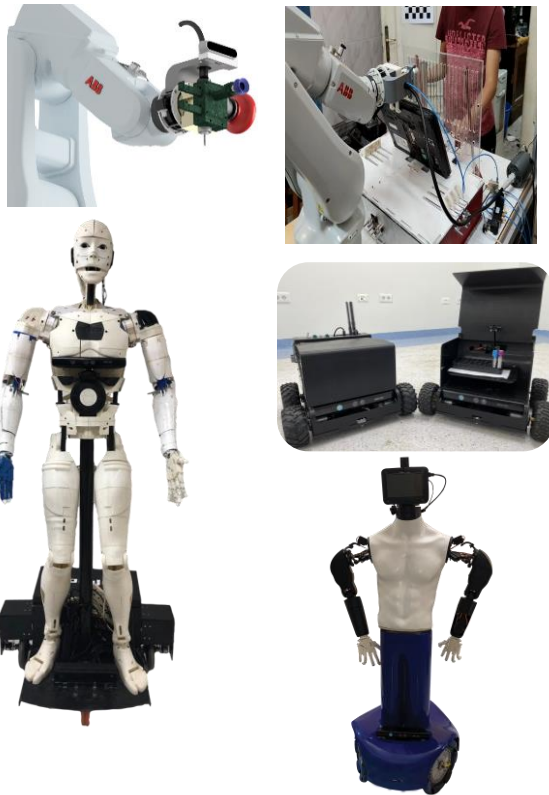
- ❑ Applications in the Pollution Monitoring may include:
 - Greenhouse solutions
 - Hydrocarbons for Natural gas analysis
 - Volatile Organic Compounds (VOCs) for Air quality monitoring and purification ...



Robotics and Autonomous Systems

Research Activities

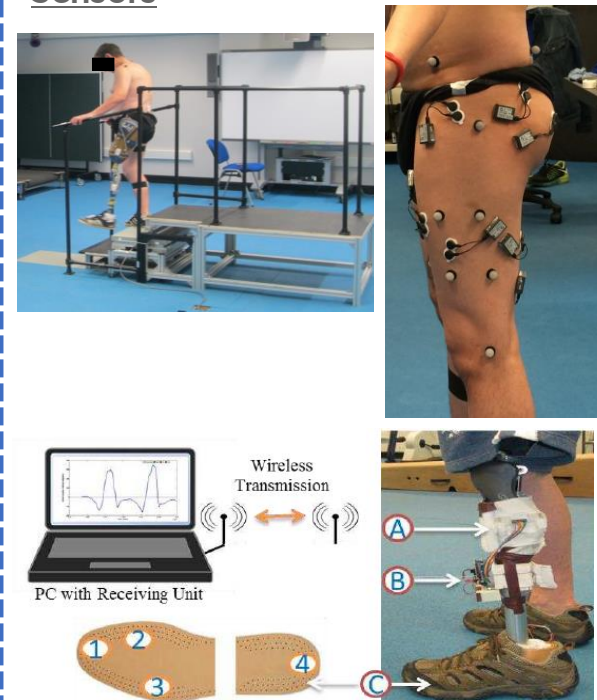
Robotics and Autonomous Systems



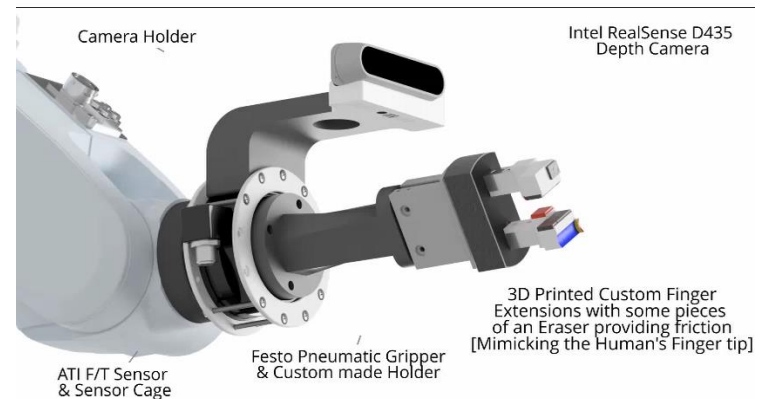
Prostheses and Biomechanics



Gait Analysis and Smart Wearable Sensors



Robotics and Autonomous Systems



Robot Arm in Automated Recycling of E-waste

PRESENT

**MULTI AGENT ROBOT FOR
SPECIMENS TRANSFER**

Robots For Transferring **Specimens**

Robot Arm in Automated Assembly/Disassembly

3D Printing Using Robot Arm

Robotics and Autonomous Systems





VR and Digital Technologies

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3D Scanning and Digitization - What we do

- To build 3D models from scanned real objects and sites
- Applications
 - Antiquities & artifacts
 - Historical sites
 - Halls and buildings
 - Oil & Gas and industrial plants
- To produce 3D models with accurate geometry and real looking textures
- Scanning techniques
 - Laser Scanning
 - Photogrammetry



VR Production - What we do



360 Virtual Tours



3D Interactive Environments



AR Applications

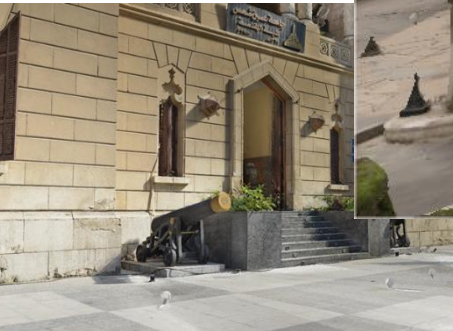


Across different channels; desktop, web, VR headsets, and mobile phones.





Ain Shams University



Physics Laboratories for Faculty of Engineering, ASU

e-Lab Temperature Coefficient of Resistance Experiment

Perform the experiment Remaining Time: 29:49

Open the source to start heating the oil then click next.

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e-Lab AC Circuit Experiment

Part I: Main values calculation Remaining Time: 29:31

Use the multimeter to measure the required values and move to the next scene.

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e-Lab Magnetic Field Experiment

Measurement of the magnetic field against X Remaining Time: 28:47

Calibrate the Tesla meter, then use it to measure the magnetic field against x.

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e-Lab AC Circuit Experiment

Part I: Drawing the phasor diagram Remaining Time: 28:30

Draw the phasor diagram using the existing components.

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e-Lab Newton Rings Experiment

Remaining Time: 28:50

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Virtual Experiments for Nursing

Digital Learning Lab **Acute Coronary Syndrome**

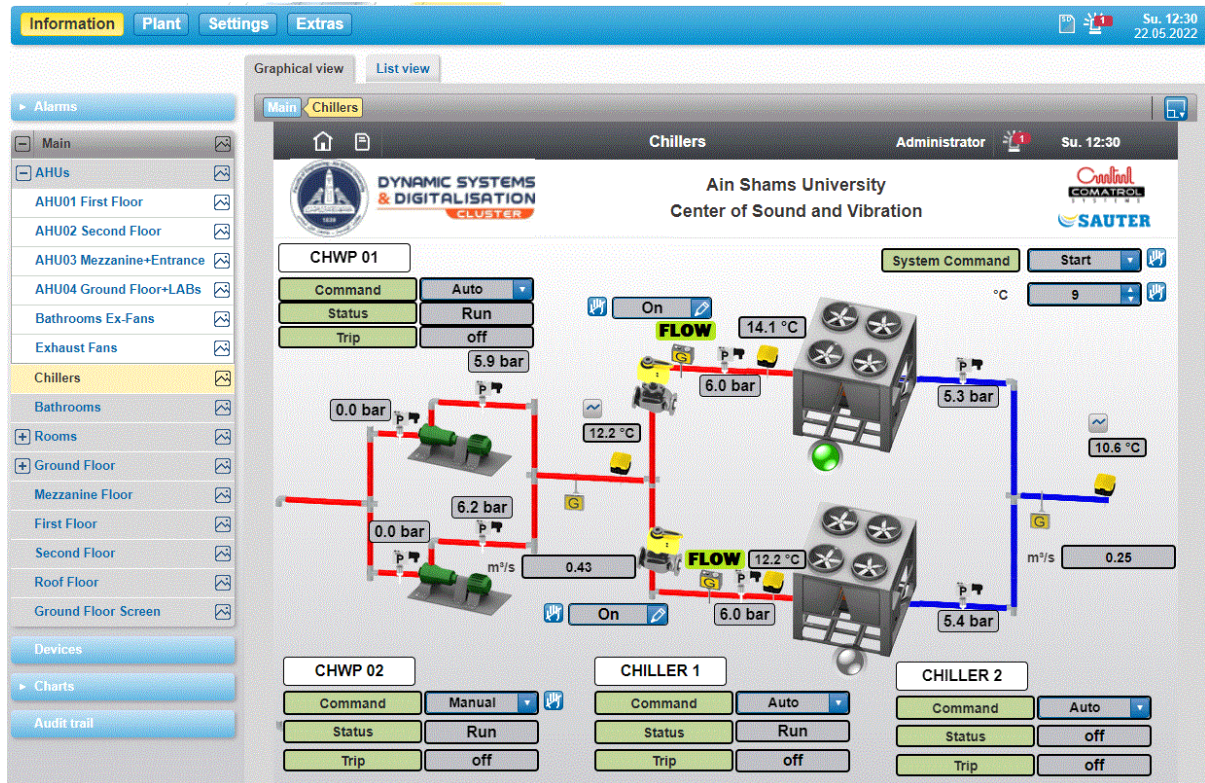
BACK **NEXT**

Start by clicking the hotspots and choosing the appropriate actions

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Building Management System

- Automatic Control of
 - Lighting
 - Air Conditioning



✓ PV Systems

- **Converters topologies for interfacing PV modules.**
 - **Isolated / nonisolated**
 - **Single-port / multi-port**
 - **Grid-connected / stand-alone mode of operation**
 - **Hard switching / softswitching**
 - **Interleaved / cascaded**
- **Maximum Power Point Tracking Techniques (MPPT)**
 - **Fixed-step**
 - **Variable-step**
- **Control strategies for PV systems.**

- ✓ **Power Electronics: Converters and applications.**
- ✓ **Wind Energy Conversion Systems**
- ✓ **DC, AC or hybrid Microgrids**
- ✓ **Power Quality: Monitoring and Mitigation**
- ✓ **Electrical Drives**



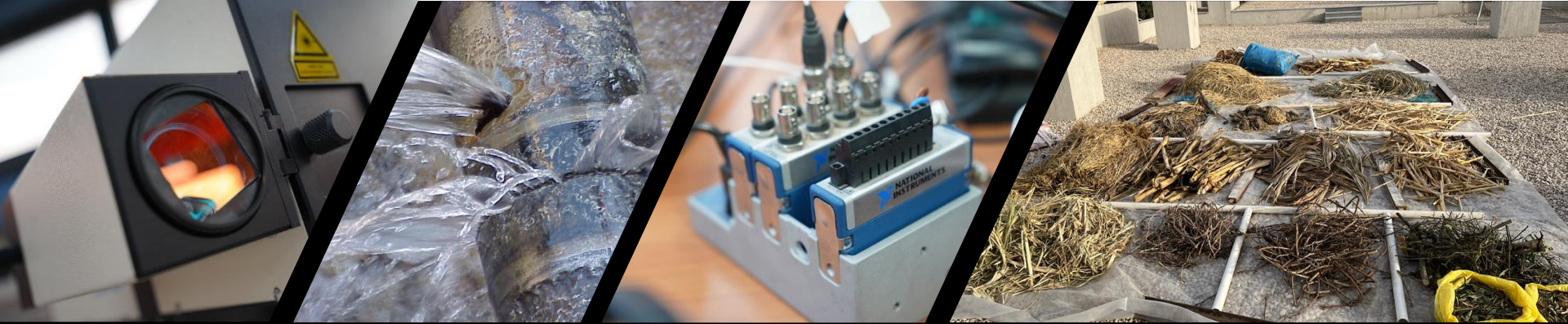
Energy Technology and Climate Change

Amr Elbanhawy

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Energy Technology and Climate Change Laboratory

- **Developing applied research solutions for an economical and equitable energy transition**
- **Addressing the impact of the emerging carbon economy on Egypt's carbon sensitive industry sectors.**
- **Disseminating knowledge on renewable and nuclear energy technology amongst students and academic staff**



Activities Supporting Egypt's Climate Action towards COP-27

Renewable Energy and Circular Economy

Efficient, longer living, and reliable Energy Assets

Local Development of Wind Technology

Climate policies impact on Agriculture and

Support for Egypt's Large National Projects

High end critical equipment reliability assurance studies for:

- The 900k Feddans Toshka South Valley Development Project
- The Egyptian Black Sand Project





Wind Turbine Research

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ASUWind

Hanzehogeschool
Groningen
University of Applied Sciences

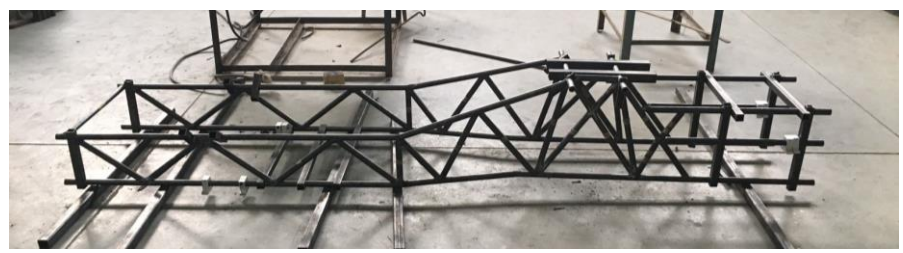
International Small
Wind Turbine Contest

International Small Wind Turbine Contest (ISWTC) held in Netherlands.



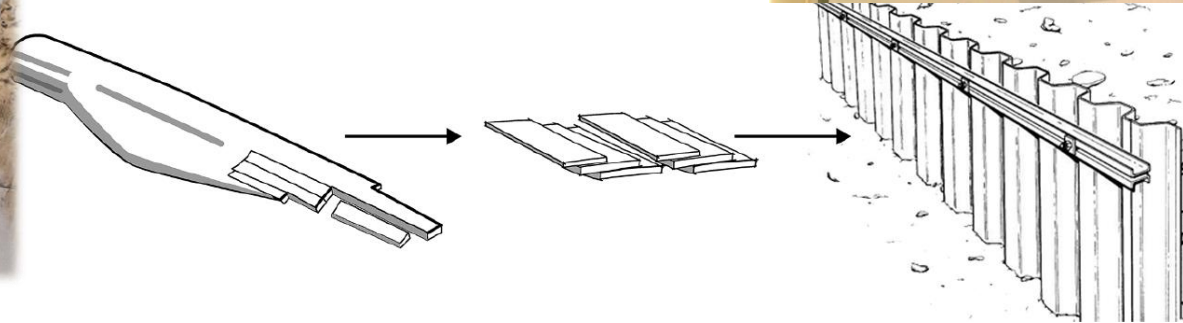
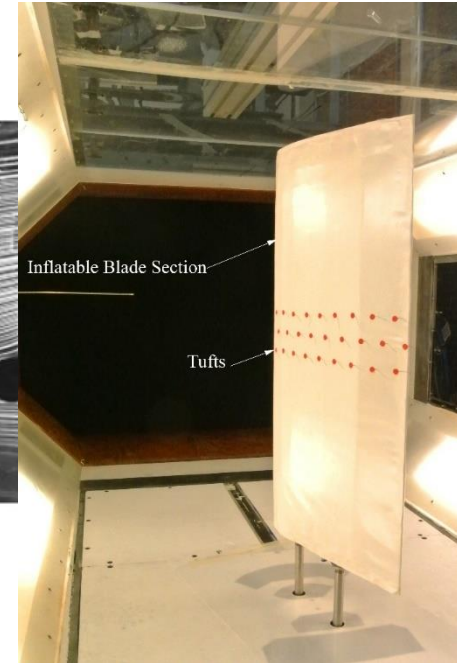
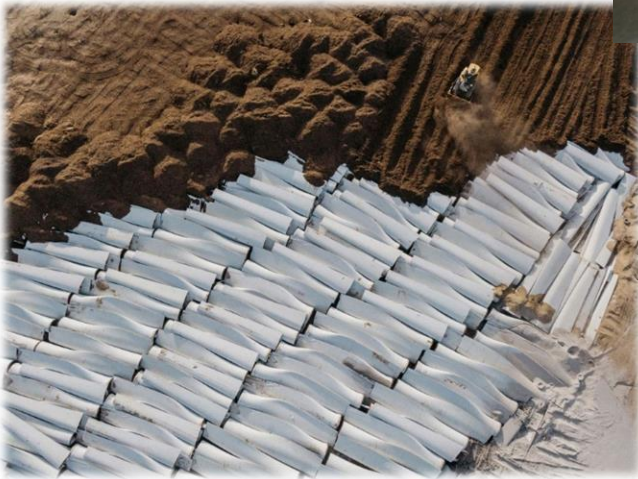
WINDENERGY
EVENTS

ASUWind



Research in Wind Energy

- End-of-Life repurposing
- Inflatable blade



Research in Wind Energy

- **Modeling of Inflatable sections**
 - Geometrical modeling
 - Mechanical behavior

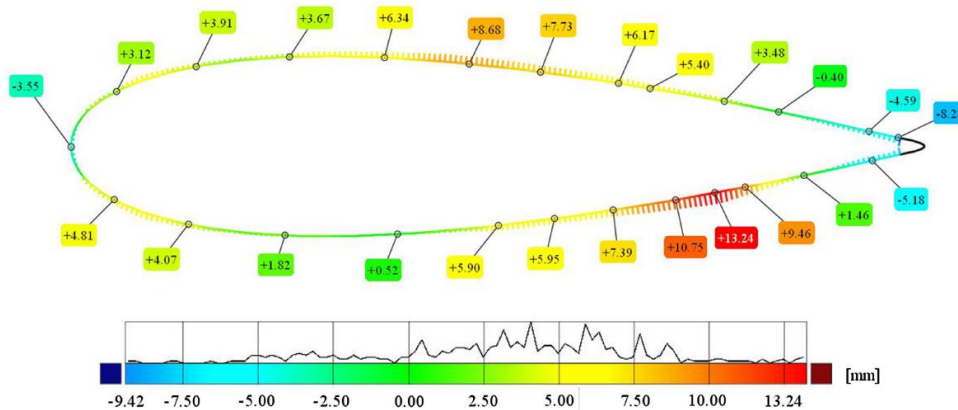
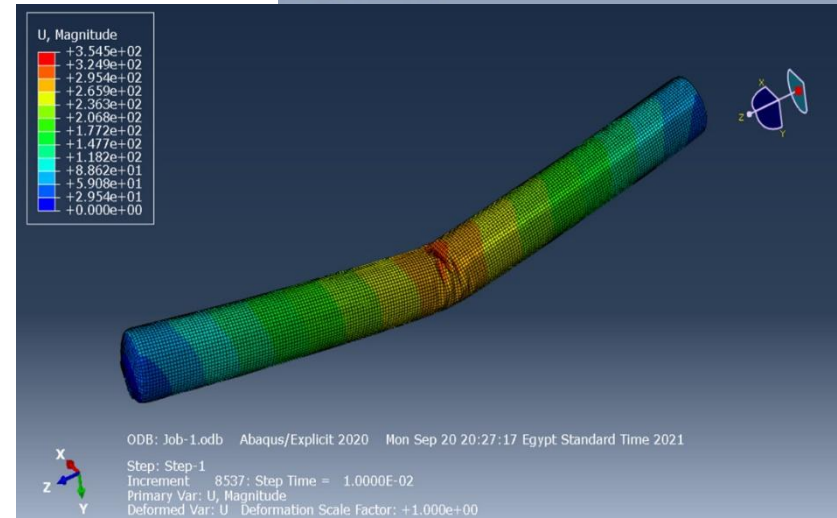
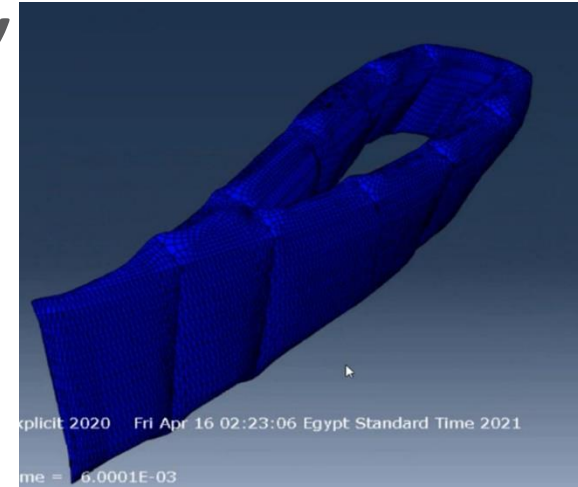
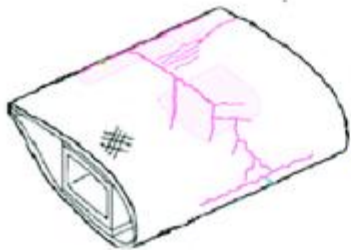
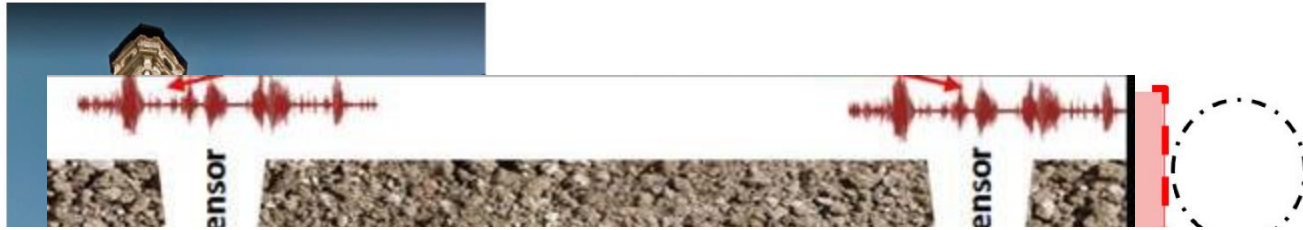


Fig. 4. Geometrical error of the laser-scanned inflatable airfoil (1 bar) compared to the standard NACA 0021 airfoil.



Condition Monitoring for Sustainable Technologies and Climate Change Mitigation





Signal



Repair



Project Information



1- Other Examples in research activities in Design and Production Departments

<https://eng.asu.edu.eg/research/635881/635898>

2- Other Examples for research activities in Electronics & Electrical Communication Engineering Department

<https://eng.asu.edu.eg/research/635881/635894>

3- Other Examples for research activities in Computer and Systems Engineering Department

<https://eng.asu.edu.eg/research/635881/635895>

4- Other Examples for research activities in Power and Electrical Machines Engineering Department

<https://eng.asu.edu.eg/research/635881/635893>

5- Other Examples for research activities in Mechatronics Engineering Department

<https://eng.asu.edu.eg/research/635881/635896>



Thank You