Hassan A. **Mahmoud**

Postdoctoral Fellow

KAUST, Thuwal, Kingdom of Saudi Arabia

hassan.mahmoud@kaust.edu.sa | orcid.org/0000-0001-8553-4914 | www.linkedin.com/in/hassanamahmoud

Education

King Abdullah University of Science and Technology (KAUST) — *Saudi Arabia*

Doctor of Philosophy in Mechanical Engineering — *Fall 2025*
- Dissertation: "Ultra-thin, Wireless and Flexible Sensors for Smart Structures"

Cairo University, Faculty of Engineering — *Egypt*

Master of Mechanical Design and Production — *Fall 2021*
- Thesis: "Analysis of Composite Bolted Connections under Out-of-Plane Loading"

Cairo University, Faculty of Engineering — *Egypt*

Bachelor of Mechanical Design and Production — *Fall 2017*
- Thesis: "Reverse Engineering, Static and Dynamic Analysis of Turbocharger"

Research & Professional Experience

Postdoctoral Fellow — *Saudi Arabia*

MCEM Lab, KAUST — *Nov. 2025 – Present*
- Leading the development of fully printable wireless piezoelectric sensing platforms for structural health monitoring of mechanically demanding composite systems.
- Developed sensing methodologies for monitoring mechanical loading, environmental degradation, curing, and damage evolution in composite structures.
- Conducting in-situ testing of thin-ply CFRP composites using synchrotron X-ray computed tomography and digital volume correlation (DVC) to quantify internal deformation and damage evolution under mechanical loading.
- Developing sensing technologies for inspection of non-metallic pipelines under the *ENERCOMP* consortium in collaboration with *Saudi Aramco*.
- Contributing to the preparation and coordination of multidisciplinary research proposals targeting smart sensing and infrastructure monitoring.

PhD Student — *Saudi Arabia*

MCEM Lab, KAUST — *Aug. 2021 – Nov. 2025*
- Conducted interdisciplinary research integrating printed electronics, composite mechanics, and RF sensing to enable ultra-thin, passive, and wireless sensing platforms for structural health monitoring applications.
- **Ultrasensitive Cracked-based Wireless Passive Strain Sensor:** Developed ultrasensitive cracked-based passive wireless strain sensors using microfabrication technologies; developed a novel design pattern to control sensor sensitivity.
- **Fully Printable, Flexible, and Chipless Passive Wireless Strain Sensors:** Designed and fabricated flexible, fully printable wireless strain sensors with ultra-high strain sensitivity; optimized sensor linearity using variable spacing interdigitated electrode capacitive sensors; utilized e-tattoo transfer technology.
- **High Precision Wireless Strain Gauges for SHM** (collaboration with R&D Center, KAUST, Saudi Aramco): Developed highly sensitive, flexible, and on-demand wireless capacitive strain gauges; integrated with IoT system with wake-up radio for ultra-low power consumption; performed field tests at Aramco facilities.
- **Flexible Temperature Sensors using Laser-Induced Graphene (LIG):** Fabricated flexible thermoelectric sensors using processing-controlled Seebeck modulation in laser-induced graphene; implemented thermopile architectures to enhance thermoelectric sensitivity.
- **Flexible E-Tattoo Wireless Sensors for Smart Structures:** Designed integrable e-tattoo wireless strain sensors for real-time monitoring of composite structures; demonstrated in-situ monitoring of composite bonded joints during curing and service loading; developed low-power IoT-enabled sensing nodes for wireless data acquisition.
- **Enhanced Fracture Toughness of Composite and Hybrid Bonded Joints:** Performed research to enhance fracture toughness of adhesive joints using sacrificial cracks; developed a novel auxetic metal stiffener for metal-composite T-joints.
- **Wearable and Human-Machine Interface Sensing:** Developed stretchable capacitive sensors for gesture recognition in collaboration with *BrightSign Gloves* (UK); integrated sensing systems into wearable platforms for sign language monitoring.
- **Semantic-Native Event-Driven IoT Communication for SHM** (in collaboration with Qualcomm): Developed an AI-driven event-based architecture integrating Fast-SCNN edge inference with ultra-low-power wake-up radio sensors for on-demand sensing and transmission; validated for concrete crack detection with 90% lower data transmission, 96.8% communication reliability, and >3× longer sensor lifetime than conventional duty-cycled IoT systems.

R&D Intern — *Saudi Arabia*

EXPEC ARC, Saudi Aramco — *Jun. 2025 – Aug. 2025*
- Conducted collaborative research with the advanced sensing team at KAUST Upstream Research Center (KURC), EXPEC Advanced Research Center (ARC) on sensing technologies for monitoring subsurface and energy infrastructure.
- Developed and experimentally validated a wireless capacitive sensing platform for low-frequency seismic signal detection.
- Demonstrated high sensitivity within seismic frequency ranges relevant to subsurface exploration applications.

Graduate Research Assistant

Egypt

Center for Advanced Materials (CAM), The British University in Egypt (BUE) *Jun. 2019 – Jul. 2021*

- Conducted multidisciplinary research in materials mechanics, composite structures, and renewable energy systems while contributing to student supervision and laboratory activities.
- **Wind Turbine Design:** Designed and analyzed a 5 kW vertical-axis and 10 kW horizontal-axis wind turbine using FEM (ABAQUS); supervised composite blade manufacturing via vacuum infusion; the manufacturing of the mechanical components, the assembly process, and field testing.
- **Optimization of Bandpass Absorption Glass Filters:** Investigated bandpass absorption glass filters through compositional optimization using rare-earth dopants; fabricated and characterized glass filters to evaluate photovoltaic efficiency impact.

Undergraduate Research Assistant

Egypt

Mechanical Vibrations & Rotor Dynamics Lab (Prof. Aly El-Shafei's Lab), Cairo University *Sep. 2016 – Jun. 2017*

- Performed high-resolution 3D scanning of turbocharger components and reconstructed CAD geometries using Geomagic Design X for structural and fluid analyses.
- Conducted elemental and microstructural characterization using energy-dispersive X-ray spectroscopy (EDX).
- Performed CFD and fluid–structure interaction simulations of turbine and compressor rotors using ANSYS.

Technical Expertise

Modeling & Simulation	Finite element and multiphysics simulation in ABAQUS (structural, thermal, composites, fracture/damage mechanics) and ANSYS (mechanical, thermal, Maxwell); electromagnetic/RF modeling in HFSS and CST Studio; circuit-level and multiphysics modeling in LTSpice and COMSOL; solid modeling and geometry processing in SolidWorks, Geomagic Design X, Avizo, and Clewin
Scientific Computing	MATLAB and Python for data analysis, multiphysics modeling, and sensor signal processing; LaTeX, Inkscape, and KeyShot for scientific documentation and figure preparation
Fabrication & Prototyping	Composite manufacturing (hand layup, vacuum infusion, prepreg processing); micro/nanofabrication (sputtering, electroplating, wet etching, plasma RIE, photolithography, UV alignment, laser direct writing); rapid prototyping and printed electronics (polymer/SLS 3D printing, screen printing, dispenser printing with Voltera NOVA, waterjet/laser cutting)
Characterization	Mechanical testing (material characterization, vibration, bulge test, nanoindentation, Split Hopkinson Pressure Bar test); Fracture and damage characterization, In-situ testing and characterization (SEM, X-ray CT scan, X-ray synchrotron, DIC, DVC); imaging/materials characterization (CT, SEM, optical microscopy, Raman spectroscopy, DSC, FTIR, contact/non-contact profilometr); electrical/RF characterization (VNA, LCR meters, impedance analyzers, probe stations, nanovoltmeters, four-point probe)
Languages	Arabic (native), English (proficient)

Grants & Research Funding

High Precision Wireless Gauges for Structural Health Monitoring *Total: $191,814*

ENERCOMP Consortium (KAUST & Saudi Aramco) *2024*

RTF – Stretch Sensors for Integration into Smart Gloves *Total: $751,600*

KAUST Research Translation Grant *2022*

Honors & Awards

2026	**EWSHM 2026 Students and Young Professional Challenge Awards,** EWSHM 2026	*France*
2025	**Honorary Certificate of Appreciation (Top 20 in 2025 ComSoc Student Competition),** IEEE ComSoc 2025	*Taiwan*
2025	**Top PhD Student Ambassador at KAUST,** Qualcomm	*KSA*
2025	**Outstanding Performance Award, EXPEC ARC KURC,** Saudi Aramco	*KSA*
2025	**PSE Dean's Research Award,** KAUST	*KSA*
2024	**PSE Dean's Research Award,** KAUST	*KSA*
2024	**Best Poster Award, LOPEC 2024,** LOPEC	*Germany*
2022	**Recognition Award of Engineering Achievements,** The British University in Egypt	*Cairo, Egypt*

Publications

Journal Publications – Published

1. N. Divakaran, Y. Kara, **Hassan A. Mahmoud**, E. Hill, G. Lubineau, "Frequency-Tunable Piezocapacitive PDMS/MWCNT Nanocomposite Stretchable Sensors for Sign Language Recognition.", *Materials & Design*, 2026. DOI: 10.1016/j.matdes.2026.116194
2. A. Abdou, **Hassan A. Mahmoud**, M. Al Refae, Y. Zhang, H. Rekik, A. Seno, G. Lubineau, "Leveraging Process-Induced Electromechanical Anisotropy of Laser-Induced Graphene for One-shot Engraving of Highly Sensitive Strain Sensors," *ACS Applied Nano Materials*, 2026. DOI: 10.1021/acsanm.5c05242
3. W. Badeghaish, A. Wagih, **Hassan A. Mahmoud**, S. Abdel-Monsef, P. Maimi, G. Lubineau, "Effect of Supercritical CO_2 Aging on the Microstructure and Fracture Properties of 3D Printed PEEK," *Journal of Materials Research and Technology*, 2025. DOI: 10.1016/j.jmrt.2025.12.085
4. A. Wagih, F. E. Oz, R. Melentiev, **Hassan A. Mahmoud**, P. Maimi, M. Abdelaziz, G. Lubineau, "Hydrogen Storage and Transportation Polymeric Tanks: Damage, Permeation Mitigation, and Sensing," *International Journal of Hydrogen Energy*, 2025. DOI: 10.1016/j.ijhydene.2025.151334
5. **Hassan A. Mahmoud**, A. AlJafari, M. Bahabri, M. A. Alrefae, G. Lubineau, "Processing-Controlled Seebeck Modulation in Laser-Induced Graphene for Flexible Temperature Sensors," *ACS Applied Electronic Materials*, 2025. DOI: 10.1021/acsaelm.5c00562
6. **Hassan A. Mahmoud**, H. Nesser, G. Lubineau, "A Fully Printable Strain Sensor Enabling Highly-Sensitive Wireless Near-Field Interrogation," *Advanced Science*, 2025. DOI: 10.1002/advs.202411346
7. G. Lubineau, M. Alfano, R. Tao, A. Wagih, A. Yudhanto, Z. Li, K. Almuhammadi, M. Hashem, P. Hu, **Hassan A. Mahmoud**, F. Oz, "Harnessing Extrinsic Dissipation to Enhance Toughness of Composites and Joints," *Advanced Materials*, 2024. DOI: 10.1002/adma.202407132
8. **Hassan A. Mahmoud**, H. Nesser, A. Wagih, G. Lubineau, "Optimization Fragmentation of Metallic Film for Cracked-Based Strain Sensors," *ACS Applied Electronic Materials*, 2024. DOI: 10.1021/acsaelm.4c00819
9. A. Wagih, **Hassan A. Mahmoud**, G. Lubineau, "3D Printed Auxetic Stiffener for Metal–Composite T-Joints," *Materials & Design*, 2024. DOI: 10.1016/j.matdes.2024.112963
10. A. Alshedayfat, A. Wagih, A. Yudhanto, **Hassan A. Mahmoud**, G. Lubineau, "Mode II Fatigue Characteristics of a Composite Bonded Joint with Microstructured Adhesive Bondline through Tailored Sacrificial Cracks," *Composites Part A: Applied Science and Manufacturing*, 2024. DOI: 10.1016/j.compositesa.2024.108090
11. A. Wagih, H. Junaedi, **Hassan A. Mahmoud**, G. Lubineau, A. Kumar, T. A. Sebaey, "Enhanced Damage Tolerance and Fracture Toughness of Lightweight Carbon-Kevlar Fiber Hybrid Laminate," *Journal of Composite Materials*, 2024. DOI: 10.1177/00219983241235853
12. H. Nesser, **Hassan A. Mahmoud**, G. Lubineau, "High-Sensitivity RFID Sensor for Structural Health Monitoring," *Advanced Science*, 2023. DOI: 10.1002/advs.202301807
13. A. Wagih, **Hassan A. Mahmoud**, R. Tao, G. Lubineau, "Towards Tough Thermoplastic Adhesive Tape by Microstructuring the Tape Using Tailored Defects," *Polymers*, 2023. DOI: 10.3390/polym15020259

Journal Publications – Under Review/Submitted

1. M. S. Ibrahim, S. Ye, **Hassan A. Mahmoud**, H. B. Seresht, M. Y. Bayoumy, G. Lubineau, W. R. Wagner, Y. Chun, "A Novel Arterial Pulsation Driven In-Situ Surface Maintenance System Using Thin Piezoelectric Layer to Enhance Hemocompatibility in Endovascular Devices."
2. **Hassan A. Mahmoud**, O. Khalifa, Y. Shi, A. Wagih, T. AlNaffouri, G. Lubineau, "Integrable E-Tattoo Wireless Sensors for In-Situ Health Monitoring of Composite Structures."
3. **Hassan A. Mahmoud**, H. E. Rekik, G. Lubineau, "Enhancing Linearity in Printed Capacitive Strain Sensors using Variable Spacing Interdigitated Electrodes."
4. Y. Shi, **Hassan A. Mahmoud**, X. Li, P. Hu, A. H. Seno, G. Lubineau, "Printable Multifunctional Interface Enabling Wireless Self Diagnosis: A Pathway Toward Smart Structures."
5. A. Abdou, **Hassan A. Mahmoud**, M. Kattoah, N. Wehbe, Y. Zhang, S. Thoroddsen, G. Lubineau, "Parameter-Insensitive Parahydrophobicity: Laser-Induced Graphene via Underwater CO_2 Laser Processing."
6. **Hassan A. Mahmoud**, O. Khalifa, A. H. Seno, M. A. Hussaini, N. Kouzahya, A. Asiri, A. Al-Jarro, A. Shehri, H. Saiari, T. Al Naffouri, G. Lubineau, "IoT-Integrated Capacitive Strain Sensor with On-Demand Wireless Communications for Structural Health Monitoring under Harsh Environmental Conditions."

7. A. Wagih, **Hassan A. Mahmoud**, K. Chouchen, G. Lubineau, "Damage Evolution in Thin-Ply Thermoplastic Composites Using In Situ X-Ray Synchrotron Inspection and Digital Volume Correlation."
8. Y. Shi, P. Hu, **Hassan A. Mahmoud**, X. Li, G. Lubineau, "Dielectric Monitoring of Hydrothermal Aging of GFRP Revealing the Mechanism of Degradation in Mechanical Properties."
9. R. Zhagypar, O. Khalifa, **Hassan A. Mahmoud**, G. Lubineau, T. AlNaffouri, "When Meaning Controls the Network: Event-Driven Semantic Communication at the Edge"

Conference Proceedings

1. **Hassan A. Mahmoud**, O. Khalifa, Y. Shi, A. Wagih, T. Y. Al-Naffouri, G. Lubineau "Printed E-Tattoo Wireless Sensor for Smart Monitoring of Composite Structures" *Proceedings of the 12th European Workshop on Structural Health Monitoring (EWSHM 2026)*
2. **Hassan A. Mahmoud**, O. Khalifa, A. H. Seno, M. A. Hussaini, N. Kouzahya, A. Asiri, A. Al-Jarro, A. shehri, H. Saiari, T. Y. Al-Naffouri, G. Lubineau "Capacitive Wireless Strain Sensors for Structural Health Monitoring of Composite Pipes" *Proceedings of the 12th European Workshop on Structural Health Monitoring (EWSHM 2026)*
3. **Hassan A. Mahmoud**, G. Lubineau, "Advanced E-Tattoo Wireless Strain Sensors for Smart Structural Health Monitoring of Composite Structures," *Proc. SPIE, Sensors and Smart Structures Technologies for Civil, Mechanical, and Aerospace Systems 2025*, vol. 13435, 134350D, 2025. DOI: 10.1117/12.3052549
4. **Hassan A. Mahmoud**, G. Lubineau, "Flexible Temperature Sensor using Laser Induced Graphene (LIG) Based on Processing-Controlled Seebeck Contrast," *Proc. SPIE, Sensors and Smart Structures Technologies for Civil, Mechanical, and Aerospace Systems 2025*, vol. 13435, 1343517, 2025. DOI: 10.1117/12.3050755
5. **Hassan A. Mahmoud**, H. Nesser, G. Lubineau, "Integrated Piezoresistivity and Frequency Modulation for High Sensitivity Printed Capacitive Strain Sensing," *IEEE FLEPS 2024*, DOI: 10.1109/FLEPS61194.2024.10604024
6. **Hassan A. Mahmoud**, H. Nesser, G. Lubineau, "Advancing Wireless Strain Sensing with Low-Cost Printable Supersensitive Radiofrequency Patches," *e-Journal of Nondestructive Testing*, 2024. DOI: 10.58286/29725
7. **Hassan A. Mahmoud**, H. Nesser, A. Wagih, G. Lubineau, "High Sensitivity Wireless Strain Sensor for SHM Applications," *Structural Health Monitoring 2023*, DOI: 10.12783/shm2023/36847
8. G. Lubineau, **Hassan A. Mahmoud**, H. Nesser, "Toward Smart Composites for Structural Health Monitoring via Highly Sensitive Capacitive Wireless Sensor," *ECCOMAS Thematic Conference on Smart Structures and Materials (SMART 2023)*, DOI: 10.7712/150123.9766.443434
9. **Hassan A. Mahmoud**, M. Shazly, Y. Bahie El-din, E. El-kashif, "Analysis of Composite Bolted Connection Joints under Out-of-Plane Loading," *Proc. ASME IMECE 2020*. DOI: 10.1115/IMECE2020-23303

Patents

All listed patents are provisional U.S. applications (submitted).

1. Y. Shi, **Hassan A. Mahmoud**, G. Lubineau, "Embedded Passive Wireless Capacitive Sensing System and Method for Real-Time Curing Monitoring", Docket No. 0338-855/2026-180-01, filed July 6, 2026.
2. A. Wagih, H. Ejaz, **Hassan A. Mahmoud**, G. Lubineau, "Inspection of GFRP Composite Adhesive Joint using Optical Transillumination", Docket No. 0338-843/2026-148-01, filed April 22, 2026.
3. **Hassan A. Mahmoud**, N. Jaber, G. Lubineau, "Wireless Capacitive Sensor for Low Frequency Vibrations,", Docket No. 158982-613140/SA 61314 PA.
4. **Hassan A. Mahmoud**, O. Khalifa, M. Abdullah, A. H. Seno, N. Kouzahya, A. Asiri, A. Al-Jarro, A. Shehri, H. Saiari, T. Al-Naffouri, G. Lubineau, "Capacitive Strain Sensing IoT Device with Secure On-Demand Wireless Data Transmission,", Docket No. 38136-3170001/SA 73651, filed November 15, 2025.
5. **Hassan A. Mahmoud**, O. Khalifa, M. Abdullah, A. H. Seno, N. Kouzahya, A. Asiri, A. Al-Jarro, A. Shehri, H. Saiari, T. Al-Naffouri, G. Lubineau, "Data Aggregator for Reading Sensed IoT Data on Demand", Docket No. 38136-3170001/SA 73658, filed November 15, 2025.
6. N. Divakaran, **Hassan A. Mahmoud**, G. Lubineau, "PDMS-MWCNT-Based Piezoresistive Ink with Tunable Viscosity for Stretchable Sensor Fabrication", No. 2026-029, filled September, 15, 2025.
7. **Hassan A. Mahmoud**, G. Lubineau, "Controlling the Sensitivity and Linearity of Capacitive Strain Sensors Using Non-Uniform Interdigitated Electrodes," Provisional U.S. Application No. 63/725,625, filed November 27, 2024.
8. A. Wagih, **Hassan A. Mahmoud**, R. Tao, G. Lubineau, "Toughening Thermoplastic Adhesive Tapes using Tailored Defects," Provisional U.S. Application No. 338-698/2022-0921-01, filed August 31, 2022.

Teaching & Mentorship

[ME 205] Basic Laboratory Skills Course

Mechanical Engineering, KAUST

Fall 2023, Spring 2024, Fall 2024

- Mentored master's students in experimental research methods and core laboratory practices.
- Instructed students on CAD and fabrication workflows, including 3D printing and laser cutting.
- Trained students in microscopy, image processing, oscilloscope operation, high-speed imaging, mechanical testing, strain gauge implementation, and material characterization.

Mentorship

Co-mentoring two PhD students — *KAUST* — *Ongoing*

- Guided one PhD project on capacitive sensing for in-situ curing and aging monitoring of polymer composites.
- Guided a second PhD project on processing–structure–property relationships in laser-induced graphene.

Mentored two undergraduate research interns — *KAUST* — *Completed*

- Supervised research on laser-induced graphene-based flexible and stretchable strain/temperature sensors from design to validation.

Peer Review Activities

Reviewer for leading journals including:

- ACS Applied Electronic Materials (ACS)
- Carbon (Elsevier)
- Carbon Letters (Springer Nature)
- Surfaces and Interfaces (Elsevier)
- Advanced Engineering Materials (Wiley)

Conferences & Presentations

2026	European Workshop on SHM – EWSHM 2026 (Oral + Demo Session)	*Toulouse, France*
2025	MECC 19	*Dhahran, KSA*
2025	IEEE PIMRC (Oral + Demo Session)	*Istanbul, Turkey*
2025	SPIE Smart Structures + NDE 2025 (Oral and Poster)	*Vancouver, Canada*
2025	LOPEC 2025 (Poster)	*Munich, Germany*
2024	IEEE FLEPS 2024 (Poster)	*Tampere, Finland*
2024	European Workshop on SHM – EWSHM 2024 (Oral)	*Potsdam, Germany*
2024	LOPEC 2024 (Poster)	*Munich, Germany*
2023	Int. Workshop on SHM – IWSHM 2023 (Oral)	*Stanford, USA*
2023	ECCOMAS SMART 2023 (Oral)	*Patras, Greece*
2023	Energizing the Future with Composites (Poster)	*KAUST, KSA*
2022	European Workshop on SHM – EWSHM 2022 (Oral)	*Palermo, Italy*
2020	ASME IMECE 2020 (Oral, Virtual)	*Virtual*

Courses & Workshops

2026	The Era of AI and Digitalization for Structural Applications, TU Delft	*The Netherlands*
2023	SHM for Integrity Management of Civil Structures and Infrastructures, Politecnico di Milano	*Italy*
2022	Basic Electromagnetic FEA, NAFEMS	*Virtual*
2022	SHM using Statistical Pattern Recognition, Los Alamos Dynamics, LLC	*Virtual*
2022	Composites Design Workshops XXII, Stanford University	*Virtual*

References

Gilles Lubineau

Professor, Physical Science and Engineering Division, KAUST
- Email: gilles.lubineau@kaust.edu.sa

Ahmed Wagih

Research Scientist, Physical Science and Engineering Division, KAUST
- Email: ahmed.abdelhady.1@kaust.edu.sa

Tareq Al-Naffouri

Professor, Computer, Electrical and Mathematical Science and Engineering Division, KAUST
- Email: tareq.alnaffouri@kaust.edu.sa

Nizar Jaber

Team Lead, EXPEC ARC (KAUST Center), Saudi Aramco
- Email: nizar.jaber@aramco.com