Mostafa Sedky

design and prototyping | numerical optimization | multiphysics simulation

portfolio: https://mssedky.github.io/ — **email:** msedky@berkeley.edu — **location:** Bay Area, CA

EDUCATION

University of California, Berkeley — Berkeley, CA
PhD Candidate in Mechanical Engineering — *Aug 2023 – May 2027*
M.Sc. in Mechanical Engineering | GPA: 4.0/4.0 — *May 2025*

The American University in Cairo — Cairo, EG
B.Sc. in Mechanical Engineering | Minor in Physics | GPA: 4.0/4.0 | Class rank: 1/364 — *Jun 2021*

RESEARCH & INDUSTRY EXPERIENCE

Berkeley Sensor & Actuator Center (BSAC) — Berkeley, CA
PhD Candidate — *Oct 2025 – Present*

- Currently working on the simulation driven optimization, fabrication, and prototyping of acoustic housings of MEMS piezoelectrc transducers for high amplitude ultrasonic sonochemistry and directional noise cancellation with Professor Liwei Lin.

University of California, Berkeley — Berkeley, CA
PhD Student in the Multiphysics, Simulation, and Optimization Lab — *Aug 2023 – Oct 2025*

- Worked on applying techniques from numerical linear algebra, computer graphics, convex / nonconvex optimization, and numerical methods to build and optimize in house multiphysics solvers from raw, custom code.

AI Institute for Next Generation Food Systems — Berkeley, CA
PhD student researcher in the AIFS — *Aug 2023 – Oct 2025*

- Funded by the NSF and the USDA to research digital twin technologies to optimize light emitting diode design for optimal air and energy flow.
- Designed and implemented GPU-parallelized differentiable rasterizers and ray tracers, achieving up to million times faster energy flow estimation and enabling large-scale greenhouse simulations.

Meta Reality Labs — Sunnyvale, CA
Research Scientist Intern (FEA Engineer Intern) — *May 2024 – Aug 2024*

- Ran design of experiments (DOEs) and corroborated findings with experimental prototyping to successfully identify and solve a 3 year thin film lamination failure during my 4 month internship.
- Worked on combining large scale parallel computing with finite element analysis (FEA) multiphysics models to design innovative manufacturing techniques for the optical systems of next generation mixed reality headsets.

AUC Microfabrication & Advanced Sensing Technologies Lab — Cairo, EG
Graduate Researcher (w/ Professor Mohamed Serry) — *Jun 2021 – Jun 2023*

- Worked on the optimization, control, design and prototype of wearable electromagnetic and shape memory alloy insulin micropumps. Two granted patents.
- Developed classification boosted gradient approaches for precise micropump dose administration control.

Berkeley Sensor & Actuator Center (BSAC) — Berkeley, CA
Undergraduate Visiting Researcher at the Maboudian Lab (w/ Professor Roya Maboudian) — *Dec 2019 - Feb 2020*

- Worked on fabricating a tin-based metal organic framework (MOF) for ethanol gas sensing over a broad linear dynamic range ($< 100\ ppm$).

Oxford Instruments Plasma Technologies — Bristol, UK
Mechanical Design Intern — *Jan 2017*

- Worked on the design and modeling of a custom order Atomic Layer Disposition (ALD) machine vacuum chamber tailored for high-temperature applications.

PATENTS

M. Sedky, A. Ali, M. Abdel-Mottaleb, and M. Serry. "A new rapid-release SMA-activated micropump with incorporated microneedle Arrays and polymeric nanoparticles for optimized transdermal drug delivery." US Patent US20250144387A1, 2025. | Patent

M. Sedky and M. Serry. "Electromagnetically actuated 3D printed micropump" US Patent US12392334B1, 2025. | Patent

PUBLICATIONS

M. Sedky, M. Horii, T. Hosmer, T. Zohdi, and K. Pister. "Multi-objective mission planning for solar sails and swarm networks." Accepted in Computer Methods in Applied Mechanics and Engineering (CMAME), 2025. | Paper

E. Mengi, C. Becker, **M. Sedky**, S. Yu, and T. Zohdi, "A digital-twin and rapid optimization framework for optical design of indoor farming systems." In Computational Mechanics, 2024. | Paper | Project Page

M. Sedky, A. Ali, M. Abdel-Mottaleb, and M. Serry. "A new rapid-release SMA-activated micropump with incorporated microneedle Arrays and polymeric nanoparticles for optimized transdermal drug delivery." In Sensors & Actuators B: Chemical, 2024. | Paper | Project Page

F. Fawzi, **M. Sedky**, Y. Abohammar, H. Sharara, and M. Serry. "Open source AI-enhanced 3D-printed insulin pump." In IEEE, Applied Sensing Conference (APSCON23), 2023. | Paper | Project Page

M. Sedky and M. Serry, "High efficiency 3D printed electromagnetic micropump with a synchronous active valve," In Sensors and Actuators A: Physical, 2022. | Paper | Project Page

PROJECTS, AWARDS, and HONORS

Wildfire Prevention Competition Award *Spring 2024*

- Placed 3rd out of 50 teams and awarded a monetary prize for a wildfire safety design in the IBHS fire competition.

UC Berkeley Chancellor's Fellowship *Fall 2023*

- Awarded 1 year fellowship offered to competitive entering doctoral students at UC Berkeley.

MechSE Outstanding Fellow *Fall 2023*

- Offered 1 year fellowship offered to competitive entering doctoral students at the University of Illinois at Urbana Champaign (UIUC).

Top I3oT Poster Prize *Spring 2022*

- Won 1st place out of 20 participating teams in the Intelligent Industrial Internet of Things (I3oT) poster competition.

President's Cup *Spring 2021*

- Awarded a monetary prize and the American University in Cairo's President's Cup for graduating as the class valedictorian. I ranked the first out of 364 students in the School of Sciences and Engineering.

Ahmed Zewail Prize Winner *Spring 2021*

- Awarded the Ahmed Zewail (Nobel Laureate) Endowed Prize for Excellence in the Sciences and Humanities for my work in additive manufacturing during COVID 19. Awarded to a single graduating student out of around 1,500 students.

First Place Award at the ASME SMRDC *Summer 2019*

- Placed first and received a monetary award as an undergraduate for designing a quadrupedal mechanism at the annual Student Mechanism and Robot Design Competition (SMRDC) at the ASME IDETC-CIE international conference.

Exchange student at the Universitat Autonoma de Barcelona. *Summer 2019*

Summer abroad student at the Stanford Summer Session. *Summer 2018*

MEDIA COVERAGE

Insurance Business: ”Revealed – winning wildfire-resilient landscaping designs” | Link *May 2024*

Local news: ”UC Berkeley, IBHS and CSAA Announce Winning Landscape Designs that can Reduce Wildfire Risk” | Link *May 2024*

”UC Berkeley, IBHS and CSAA Announce Winning Landscape Designs that can Reduce Wildfire Risk” | Link *May 2024*

Student spotlight: ”AUC Team Wins First Place at International Robot Competition” | Link *October 2019*

Local news: ”AUC Students Win First Place at International Robot Design Competition” | Link *October 2019*

Local news: ”AUC Mechanical Engineering Students Win Global Competition for Creating a Robot to Assist People with Special Needs” | Link *October 2019*

TEACHING

Graduate TA for *Modeling and Simulation of Advanced Manufacturing Processes*, UC Berkeley *Fall 2025*

Graduate TA for *Mechanical Design*, The American University in Cairo *Spring 2023*

Graduate TA for *Mechanical Design*, The American University in Cairo *Fall 2022*

Graduate TA for *Engineering Materials*, The American University in Cairo *Fall 2022*

Graduate TA for *Mechanical Systems*, The American University in Cairo *Fall 2021*

Graduate TA for *Dynamics*, The American University in Cairo *Fall 2021*

Graduate TA for *Fundementals of Manufacturing Processes*, The American University in Cairo *Fall 2021*

Undergraduate TA for *Finite Elements and Applications in Design*, The American University in Cairo *Spring 2021*

OTHER

Skills: Python, Pytorch, Pytorch3d, Open3d, CVXPY, C/C++, CUDA, MPI, OpenMP, OptiX, Julia, MATLAB, Git, LaTeX.
Computational Methods/Tools: COMSOL, ANSYS, SolidWorks, CATIA, Finite Element Analysis (FEA), Finite Difference Modeling (FDM), Lattice Boltzmann Method (LBM), Computational Fluid Dynamics (CFD), Convex Optimization.

RELEVANT GRADUATE COURSEWORK

Introduction to Computational Mechanics · Continuum Mechanics · Electromagnetic Theory · Finite Element Method · Numerical Solutions of ODEs/PDEs · Modeling and Simulation of Advanced Manufacturing Processes · Failure Analysis of Structural Materials · Convex Optimization · Advanced Matrix Computations · Applications of Parallel Computers · Foundations of Computer Graphics · Electrical Engineering Microelectromechanical Systems (MEMS) · Mechancial Engineering Microelectromechanical Systems (MEMS)