# ABDULLAH A. ALFARHAN, Ph.D.

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San Marcos, TX

## RESEARCH EXPERIENCE

**Postdoctoral Researcher, Mechanical Engineering** **Jan 2025–Dec 2025**
University of Dayton, Dayton, OH

- Developed high-fidelity numerical models for **free-falling and obstructed particle curtain receivers** for concentrating solar power (CSP) tower systems.
- Coupled DEM-informed particle flow fields with coarse-grid Eulerian thermal–radiative solvers.
- Implemented Monte Carlo and reduced-order radiation models for particle curtains interacting with receiver walls and apertures.
- Conducted parametric studies on curtain thickness, mass flow rate, particle residence time, and receiver efficiency.

**Ph.D. in Mechanical Engineering** **2019–2024**
University of Dayton, Dayton, OH

- Developed phase-change interface tracking solvers using the Volume of Fluid (VOF) method in MATLAB and Python.
- Developed porous-media phase-change (evaporation and condensation) solvers in ANSYS FLUENT using User-Defined Functions (UDFs).
- Conducted techno-economic analyses for large-scale dual-use solar desalination systems.
- Fabricated sintered metallic porous wicks and experimentally characterized permeability, capillarity, and porosity.

**M.S. in Mechanical Engineering** **2017–2018**
University of Dayton, Dayton, OH

- Teaching Assistant for undergraduate courses: Thermodynamics, Heat Transfer, and Materials Science.
- Completed graduate coursework and projects in renewable energy systems (solar, wind, geothermal).

## RESEARCH SKILLS

- **CFD and numerical modeling**: Multiphase flow, heat and mass transfer, porous media, radiation, and phase change using MATLAB, Python, ANSYS FLUENT, and OpenFOAM.
- **CSP and particle receivers**: Modeling of free-falling and obstructed particle curtains, DEM-informed continuum solvers, radiative exchange, and receiver efficiency optimization.
- **Techno-economic analysis**: Levelized Cost of Energy (LCOE) and Levelized Cost of Water (LCOW) calculations for solar desalination and thermal systems.
- **Metallic porous wick fabrication and testing**: Sintering, permeability measurement, capillary rise experiments, porosity characterization, and LabVIEW-based data acquisition.

## EDUCATION

**Doctor of Philosophy, Mechanical Engineering** **2019–2024**
University of Dayton, Dayton, OH, USA

**Master of Science, Mechanical Engineering** **2017–2018**
University of Dayton, Dayton, OH, USA

**Bachelor of Science, Mechanical Engineering** **2011–2015**
University of Texas at San Antonio, San Antonio, TX, USA

## TEACHING EXPERIENCE

**Assistant Professor of Instruction, Mechanical Engineering** **Aug 2026–Present**
Texas State University, San Marcos, TX

- Full-time faculty teaching undergraduate mechanical engineering courses.
- Courses include Statics, Dynamics, Strength of Materials, Thermodynamics, Heat Transfer, and Fluid Mechanics.

**Lecturer, Mechanical Engineering** **Jan 2026–Aug 2026**
Texas State University, San Marcos, TX

- Full-time faculty teaching undergraduate mechanical engineering courses.

**Adjunct Instructor, Mechanical Engineering** **2021–Present**
University of Dayton, Dayton, OH

- Mechanics I (Statics)
- Dynamics
- Mechanics II (Strength of Materials)
- Engineering Materials Science and Laboratory
- Thermodynamics
- Heat Transfer
- Fluid Mechanics

## ADDITIONAL EXPERIENCE

**Field Engineer, Well Services (Cementing)** **Sep. 2015–Nov. 2016**
Schlumberger, Horseheads, NY, USA

- Prepared and tested cement slurry designs for oil and gas wells.
- Conducted on-site pumping and quality control operations.

**Gas/Oil Plant Operator** **Jul. 2007–Aug. 2011**
Saudi Aramco, Dhahran, Saudi Arabia

- Operated sulfur recovery units and associated process equipment.
- Performed laboratory chemical analyses for condenser feedwater treatment.

## PUBLICATIONS

- Alfarhan, A.; Schrader, A. J. (2025). Numerical investigation of metallic porous structures for passive thermal management and desalination of dual-use floatovoltaic systems. *Desalination*, Article 119289. doi:10.1016/j.desal.2025.119289
- Lenhardt, A.; Alfarhan, A.; Brecha, R.; Mulford, R. B.; Schrader, A. J. (2025). Technoeconomic investigation of metallic porous structures for passive thermal management and desalination of dual-use floatovoltaic systems. *Desalination*, **601**, 118592. doi:10.1016/j.desal.2025.11
- Alfarhan, A.; Gilliam, B.; Schrader, A. J. (2025). Experimental evaluation of capillary performance of sintered metallic wicks for solar desalination systems. *Manuscript in preparation*.
- Alfarhan, A.; Schrader, A. J. (2025). Numerical and design analysis of free and obstructed falling particle receivers in solar tower systems. *Manuscript in preparation*.

## CONFERENCE PRESENTATIONS

- **ASME ES2022**, Washington, DC.
  Numerical Heat and Mass Transfer Modeling and Techno-Economic Analysis of Metallic Porous Structures for Passive Pumping in Solar-Thermal Desalination Systems.
  Authors: A. Alfarhan, A. J. Schrader.
- **ASME 2025**, Denver, CO.
  Numerical and design analysis of free and obstructed falling particle receivers in solar tower systems (Oral presentation).
  Authors: A. Alfarhan, A. J. Schrader.

## TECHNICAL SKILLS

- MATLAB, Python, ANSYS FLUENT, OpenFOAM, SolidWorks, LabVIEW, MS Office.
- Experimental diagnostics, data acquisition, and laboratory instrumentation.

## PERSONAL SKILLS

- Effective communicator with experience leading lectures, labs, and research teams.
- Strong teamwork, leadership, time management, and mentoring skills.