

TARIQ A. KHAMLAJ

DAYTON, OHIO

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🔍 RESEARCH INTERESTS

- Wind turbine (HAWT/VAWT) and windfarm aerodynamics and optimizations
- Car aerodynamics and optimizations
- Turbomachinery

🎓 EDUCATION

Ph.D., University of Dayton, Dayton, Ohio 2015 – 2018

Aerospace Engineering

Dissertation Title: Analysis and Optimization of Shrouded Horizontal Axis Wind Turbines

Adviser: Dr. Markus P. Rumpfkeil

M.S., University of Tripoli, Tripoli, Libya 2009 – 2011

Mechanical and Industrial Engineering

Thesis Title: Designing Centrifugal Pump Volute under different geometrical and operating conditions.

Adviser: Prof. Elhadi I. Dekam

B.S., Sabratha University, Sabratha, Libya 2003 – 2007

Mechanical Engineering

Project Title: Designing the Single Degree of Freedom Experimental Apparatus with Forced Vibration

Adviser: Dr. Munair Abd-Alwahid

⚙️ SKILLS

- *Design and Simulation:* OpenFOAM, ANSYS FLUENT, SOLIDWORKS, ABAQUS, ParaView, GMSH, Snappy-hexMesh, GAMBIT
- *Programming Languages:* C++, parallel programming with MPI, Visual Basic, Perl, Python, Latex, MS Office (Word, Excel, and Power-point)
- *Platforms:* Windows, Linux (Ubuntu), and MAC

📖 PUBLICATIONS

-Refereed Journal Publications-

1. Khamlaj, Tariq A., and Rumpfkeil, Markus P. "Analysis and Optimization Study of Ducted Wind Turbines," Journal of Energy (2018), Volume 162, 1234-1252, DOI: 10.1016/j.energy.2018.08.106.
2. Khamlaj, Tariq A., and Rumpfkeil, Markus P. "Theoretical Analysis of Shrouded Horizontal Axis Wind Turbines," Energies (2017), Volume 10, no. 1: 38; DOI: 10.3390/en10010038.

-Refereed Conference Publications-

1. Khamlaj, Tariq A., and Rumpfkeil, Markus P. "Optimization Study of Shrouded Horizontal Axis Wind Turbine," 2018 Wind Energy Symposium, AIAA SciTech, (AIAA 2018-0996), DOI: 10.2514/6.2018-0996.

-Presentations-

1. Khamlaj, Tariq A., and Rumpfkeil, Markus P. "Analysis and Optimization Study of Shrouded Horizontal Axis Wind Turbine," Academic Research Colloquium for Engineering Ph.D. Candidates (ARC), University of Dayton, Ohio, October 11, 2018.
2. Khamlaj, Tariq A., and Rumpfkeil, Markus P. "Analysis and Optimization Study of Ducted Wind Turbines," 43rd AIAA Dayton-Cincinnati Aerospace Sciences Symposium (DCASS), Dayton, Ohio, February 27, 2018.
3. Khamlaj, Tariq A., and Rumpfkeil, Markus P. "Analysis and Optimization of Shrouded Horizontal Axis Wind Turbines," Graduate Student Showcase, University of Dayton, Ohio, April 5, 2017 (poster).

4. Khamlaj, Tariq A., and Rumpfkeil, Markus P. "Performance analysis of open and ducted wind turbines," 42nd AIAA Dayton-Cincinnati Aerospace Sciences Symposium, Dayton, Ohio, March 1, 2017.
5. Khamlaj, Tariq A., and Rumpfkeil, Markus P. "Theoretical Analysis for the Shrouded Horizontal Axis Wind Turbine," 41st AIAA Dayton-Cincinnati Aerospace Sciences Symposium, Dayton, Ohio, March 1, 2016.

♡ HONORS AND AWARDS

Outstanding PhD Research Award in the Mechanical and Aerospace Engineering, University of Dayton	March 2017
Graduate Student Summer Fellowship at the University of Dayton	May 2017
Sigma Xi University of Dayton Chapter, Presentation Award 2nd Prize	April 2017
Ranked in top three out of 100 for 2007 graduation, Sabratha University	2007

🐾 RESEARCH EXPERIENCE

Researcher

Jan. 2019 – May. 2019

University of Dayton Department of Mechanical and Aerospace Engineering, Dayton, USA

As a researcher, I am currently working on two projects:

- Employing the active subspace method (ASM) for shrouded wind turbines to;
 1. Discover and exploit low-dimensional trends in quantities of interest for design.
 2. This will allow to find optimal designs with reduced computational cost.
- Vertical axis wind turbines, such as Darrieus turbines, exhibit lower performance compared to horizontal axis wind turbines. Hence, further research is needed to increase their performance to match higher demand in power generation from small-scale applications. I am currently working on;
 1. Developing a fast and accurate CFD simulation tool for the performance prediction of Darrieus-type turbines.
 2. Increasing the output power coefficient C_p of a straight-bladed Darrieus wind turbine (H-rotor) using OpenFOAM and a multi-objective genetic algorithm.

Graduate Research Assistant (Ph.D.)

Jan. 2015 – Dec. 2018

University of Dayton Department of Mechanical and Aerospace Engineering, Dayton, USA

Ph.D. Dissertation Title: Analysis and Optimization of Shrouded Horizontal Axis Wind Turbines

Key Achievements:

- Integrated a blade element momentum model into the Reynolds-averaged Navier-Stokes equations (RANS) utilizing the open-source CFD software package OpenFOAM.
- Utilized the open-source mesh generator GMSH to generate high-quality structured 2D and 3D computational meshes.
- Conducted grid convergence studies and compared results to wind tunnel and various numerical results from other researchers for verification and validation purposes.
- Studied the influence of various turbulence models such as $k-\epsilon$, $k-\omega$ SST, and Spalart-Allmaras on the flow through and around ducted turbines.
- Implemented a Bezier curve parameterization for the blade twist and chord distribution.
- Implemented an optimization framework via python that couples a multi-objective genetic algorithm implemented in DAKOTA and the actuator disk model in OpenFOAM to change both the turbine rotor as well as the duct profile to maximize power production and minimize thrust and drag.
- Developed an analytical 1D model by utilizing elementary governing equations of fluid mechanics to predict the power production of a ducted wind turbine.
- Extended expertise using Finite Element Analysis (FEA) via ABAQUS, enabling work in several aspects of 1D/2D/3D CAD modeling and FE analysis of mechanical components, structures, and heat transfer analysis.

Graduate Research Assistant (M.S.)

Jan. 2008 – Dec. 2011

University of Tripoli Department of Mechanical and Industrial Engineering, Tripoli, Libya

Key Achievements:

- Developed an analytical 1D model using the elementary governing equations of fluid mechanics to predict the radial thrust forces on the impeller and compared results to the empirical Stepanoff equation.
- Conducted CFD analysis using ANSYS FLUENT of the centrifugal pump setup.
- Performed mesh resolution studies using Gambit to understand the dependence on grids of the quantity of interest.
- Conducted a numerical study using ANSYS FLUENT and Gambit for radial horizontal centrifugal pumps with open-backward radial impellers and single volute as well as stage, which dealt primarily with the relationship between the induced radial thrust in centrifugal pumps and their geometrical and operating conditions.

Undergraduate Researcher (B.S.)

Oct. 2003 – July 2007

Sabratha University Faculty of Engineering, Sabratha, Libya

Key Achievements:

- Designed and manufactured a single degree of freedom experimental apparatus with forced vibration based on the harmonic excitation of a cantilever beam using the rotating unbalanced vibration concept.
- Gained four months of experience using turning, milling and drilling machines to manufacture the single degree of freedom apparatus.

TEACHING EXPERIENCE

Adjunct Faculty Lab Instructor of Record, Materials Lab

Jan. 2019 – May 2019

University of Dayton Department of Mechanical and Aerospace Engineering, Dayton, USA

Key Achievements:

- Guiding approximately 105 students.
- Coordinate with the Material Science class instructors as well as instruct TAs for the lab experiments.
- Create/develop fun and engaging weekly lesson plans; develop content, data analysis *Excel* sheets, student lab instructions, presentations, and examples to suit needs of the materials lab and to reflect course content.
- Resolve problems encountered by students.
- Supervise student examinations, grade lab work submissions as well as uploaded grades to university website.
- Offer constructive feedback based on student performance.

Table 1: Recent Student Evaluations (rating out of 5).

Semester	Course No.	Enrolled	Responses	Instructor Rating
Spring 2019	MEE312L	103	96	4.1

Graduate Student Instructor, Materials Lab

Jan. 2018 – Dec. 2018

University of Dayton Department of Mechanical and Aerospace Engineering, Dayton, USA

Facilitated students laboratory learning experiences. Experiments included tensile testing, three point bend testing, and heat treatment. Delivered short lectures, helped students with their reports, graded homework assignments under the supervision of **in** Dr. Margaret Pinnell.

Key Achievements:

- Tested the mechanical properties of given materials and dealt with tensile testing of material, three point bend tests of composite materials, heat treatment of copper, steel, and aluminium.
- Guided students in three classes through daily lab experiments from inception to completion.

Teaching Assistant - Fluid Mechanics

Aug. 2015 – May 2017

University of Dayton Department of Mechanical and Aerospace Engineering, Dayton, USA

Held weekly office hours to facilitate the learning of Fluid Mechanical concepts to undergraduate students under the supervision of Dr. Markus Rumpfkeil. Graded weekly homework assignments and midterms.

Key Achievements:

- Streamlined procedures of grading weekly assignments, quizzes, and midterms to convey feedback and advice regarding the performance of the students.

Teaching Assistant - Computational Method for Design

Aug. 2015 – Dec. 2016

University of Dayton Department of Mechanical and Aerospace Engineering, Dayton, USA

Enhanced the knowledge of undergraduate students about MATLAB by successfully developing understanding of various aspects in collaboration with Dr. David Myszka.

Key Achievements:

- Helped during absences of the course instructor by directing classes and guiding students.

Teaching Assistant - Aerodynamics

Jan. 2016 – May 2016

University of Dayton Department of Mechanical and Aerospace Engineering, Dayton, USA

Performed duties of teaching Aerodynamics to students by coordinating and taking guidance from Dr. Jose Camberos. Formulated detailed solutions for all home-work assignments for students.

Key Achievements:

- Ensured every student learns materials taught within class by conducting weekly office hours.

Adjunct Lecturer - Heat Transfer and Fluid Mechanics

Jan. 2012 – May 2012

Sabratha University, Sabratha Faculty of Engineering, Sabratha, Libya

Key Achievements:

- Taught both fluid mechanics and heat transfer as well as their labs (junior level) for three months, including preparing course materials, generating homework assignments and exams.

Lab Teaching Assistant - Fluid Mechanics Labs

Jan. 2008 – Jan. 2009

Sabratha University, Sabratha Faculty of Engineering, Sabratha, Libya

Facilitated the students during experiments, including investigations of Bernoulli's Theorem, Buoyancy and Flotation, Viscosity, Flow measurement, Flow through small orifices, Pumps in series and in parallel, and Minor and Major Losses.

Key Achievements:

- Ability to validate theories taught in the Fluid Mechanics class such as Bernoulli's principle, Buoyancy and Flotation, and Viscosity.
- Reproduced Moody diagram or Moody chart through Minor and Major Loss experiments.
- Guided students in daily lab experiments from inception to completion.

Lab Teaching Assistant - Heat Transfer

Jan. 2008 – Dec. 2011

Sabratha University, Sabratha Faculty of Engineering, Sabratha, Libya

Facilitated the students during experiments, including Linear and radial head conduction, Natural and Forced Convection, Stefan Boltzmann law, and a Cooling tower.

Key Achievements:

- Helped the students understand the fundamental principles and apply them to weekly experiments.
- Guided students in daily lab experiments from inception to completion.

OTHER EXPERIENCE

IT Technician

Aug. 2015 – Feb. 2016

University of Dayton Information Technology, Dayton, USA

- Demonstrated the ability to communicate electronically as well as in-person with end users experiencing difficulties with computer system.
- Proven track record of responding to tickets quickly and recognizing technical problems immediately.
- Gained experience with a wide range of operating systems.

REFERENCES

Contact Information

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2. Dr. Margaret Pinnell, Associate Professor
Associate Dean for Faculty and Staff Development
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300 College Park, Dayton, OH 45469, USA
Tel: +1-937-694-7411 Fax: +1-937-229-4766
E-mail: mpinnell1@udayton.edu
Relationship: GA supervisor
3. Dr. Elhadi I. Dekam, Professor
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University of Tripoli

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Tripoli-Libya
Email: eidakkam@hotmail.com
Relationship: Master thesis adviser

i MISCELLANEOUS

- Blog: <http://www.tariqkhamlaj.com>
- GitHub: <https://github.com/khamlaj1>
- Languages: English - fluent, Arabic - native speaker