

Curriculum Vitae

Wardeh Al-Younis

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EDUCATION

August 2021 **New Mexico State University (NMSU)**, Las Cruces, NM, USA.

Ph.D. Degree in Electrical Engineering, GPA: 3.76/4.

Dissertation Title: Measurement and Prediction of Image Displacement Due to Atmospheric Refraction.

Research Areas: Optical communication and imaging through atmosphere.

My dissertation research focuses on studying atmospheric refraction phenomenon and its effects on optical communication and imaging for low-angle and near-ground paths within the Earth's troposphere. These effects were observed and measured experimentally and then predicted using Numerical Weather Prediction (NWP) approach and Machine Learning Algorithms.

June 2016 **Yarmouk University**, Irbid, Jordan.

Master Degree of Science in Communication Engineering, in Wireless Communication, GPA: 91.1%.

Thesis Title: Fiber Bragg Gratings: Analysis and Application to Pulse Compression.

Research Areas: Fiber-Optics Communication.

My thesis research examines the analysis of Fiber-Bragg Grating (FBG) and its applications in fiber-optics communication system. Pulse compression is one of the most significant applications of FBG that was explored in my research. FBG was chosen and utilized to compensate dispersion in communication networks among other techniques due to its low insertion losses.

August 2012 **Yarmouk University**, Irbid, Jordan.

Bachelor Degree of Science in Communication Engineering, GPA: 82.9%.

Relevant Coursework: Signals, Analog systems, Probability and random processes, Digital communication, Digital signal processing, Mobile communications, Fiber-Optics Communications, Electromagnetic fields and waves, Antenna systems, Microwave communications, Laser and applications, Radiometry and photometry, fundamental of photonics, statistical optics.

TECHNICAL SKILLS

Computer Languages: Python, MATLAB, C++.

Software/Hardware: Zemax, HFSS, AutoCAD, OptiGrating, Mathcad.

Other Skills: -Supervised and unsupervised Machine Learning: Linear regression models, linear discriminant functions, clustering, feed-forward neural networks, statistical pattern classification and regression, maximum likelihood, naive Bayes, non-parametric density estimation, mixture models, decision trees, and ensemble learning.

-Data visualization and analysis, statistical modeling.

-Experienced with the utilization of lab equipment such as oscilloscopes, digital multimeters, optical systems elements (such as lenses, mirrors, and laser), and function generators.

EXPERIENCE

1. Teaching Experience

- **Full-time Lecturer at Jadara University, Engineering Faculty, Communication and Computer Engineering Department,**
October 2023- Present.

Courses I teach:

- Digital Signal Processing
- Modern Communications Systems.
- Wireless Computer Networks.
- Networks and Protocols of Wireless Communications.
- Modeling and Simulation
- Computer and Network Security.

- Protocols of Computer Networks.
- Electrical Circuits
- Digital Logic Design.
- Data Structure and Algorithms.
- Programming for Engineers using C++, and Python.

■ **Teaching Assistant/Engineer -New Mexico State University, January 2018 – May 2021**

New Mexico State University- Las Cruces, NM, USA

- Teaching assistant of introduction to optics lab for undergraduate students: The lab requires scientific demonstration of simple optical experiments demos including light reflection and refraction, imaging using lenses and mirrors components, polarization, refraction in prism, and diffraction phenomena.
- Teaching assistant of photonics lab for undergraduate and graduate students. The lab requires to build optical elements and systems including ray, wave and guided optics, lasers and thermal sources, radiometry, photon detection, elements of photonic crystals, polarization, acousto-optics, electro-optics, and optical nanostructures.

2. Research Experience

■ **Research Associate -Optical Communications and Machine Learning Engineer, August 2021 – March 2023**

New Mexico State University- Las Cruces, NM, USA

- Developed and implemented advanced image and signal processing algorithms in MATLAB for optical wireless communication (OWC) and free-space optical (FSO) propagation research. Designed dense optical flow techniques to estimate atmospheric-induced image motion from long-range time-lapse imagery, enabling characterization and mitigation of optical propagation impairments caused by atmospheric turbulence and refraction.
- Developed and evaluated image restoration and deconvolution algorithms to compensate for optical blur introduced by atmospheric effects and imaging system limitations, improving the quality and reliability of long-range optical sensing and communication imagery.
- Designed and implemented physics-informed machine learning and deep learning models to predict and compensate for atmospheric refractive distortions in optical propagation systems by integrating physical propagation models with data-driven learning techniques.

■ **Research Assistant –Optical Communications and Machine Learning Engineer, January 2017 – July 2021**

New Mexico State University- Las Cruces, NM, USA

- **Radiometry and Photometry**: Developed radiometric modeling and simulation software in MATLAB for optical sensing and free-space optical (FSO) propagation analysis. Integrated atmospheric transmission modeling using MODTRAN and Google Earth visualization for simulation and validation against analytical models.
- **Remote Sensing**: Designed, deployed, and evaluated long-range imaging and remote sensing systems for atmospheric propagation experiments across multiple desert sites in New Mexico, enabling data collection for optical propagation and environmental sensing studies.
- **Image Processing & Computer Vision**: Developed image processing and computer vision algorithms, including optical flow, object tracking, image segmentation, and image transformation techniques, to quantify atmospheric refraction and turbulence effects from time-lapse imagery.
- **Statistics/ Machine Learning**: Developed linear and nonlinear machine learning models to predict atmospheric refractive distortions from meteorological measurements, combining statistical analysis with data-driven modeling to improve prediction accuracy.

- **Optical System Design:** Designed and optimized optical imaging systems using Zemax OpticStudio, performing sequential and non-sequential ray tracing, physical optics propagation, and optical system optimization to reduce aberrations and improve imaging performance.
- **Numerical Weather Prediction (NWP):** Developed physics-based atmospheric propagation models using the Weather Research and Forecasting (WRF) model and ray-tracing techniques to estimate refractive gradients and predict atmospheric effects on optical propagation.
- **Digital Communications Engineer:** Developed MATLAB simulation models for digital communication systems, including baseband and bandpass modulation schemes, channel coding, bandwidth analysis, and bit error rate (BER) performance evaluation.

Trainee at Orange Company, Feb 2012 - August 2012, ~ 6 months

Orange Company- Amman/Jordan

- Position: Network and digital service engineer.
- Experienced with the utilization of telephone network components, Public Switching Telephone Network (PSTN), and Asymmetric Digital Subscriber Line (ADSL) services.
- Ability to relate problems and network failures faced by subscribers to PSTN and ADSL.
- Programming any kind of ADSL modem.
- Having excellent background about Leased line, SDSL, HDSL, SHDSL services.

COURSES

- Training Certificate: Attended training course of 30 hours at Yarmouk University in participating academic work in universities and university colleges. The course was held on May 2022 and included the following topics:
 1. Teaching and Learning,
 2. Using Modern Teaching Methods,
 3. Educational Technology, and
 4. Open Sources E-Learning Platforms.
- Granted a work license certificate from the higher education, Jordan.

PROJECTS

- The German Research Foundation “Deutsche Forschungsgemeinschaft” (DFG) Project No. KE 2453/2-1 supported the scientific research of Dr. Gael Kermarrec in atmospheric sensing and stochastic modeling. The project focused on developing advanced statistical methods for atmospheric boundary layer characterization and geospatial data analysis, providing methodologies that are relevant to the modeling and assessment of atmospheric effects on optical wave propagation and free-space optical communication systems.
- Novel Characterization Measurements and Meteorological-Driven Modeling of Turbulence and Refraction in the Lower Atmosphere for Directed Energy Applications supported by US Office of Naval Research through the Directed Energy Joint Transition Office (DE JTO); Award No. N00014-17-1-2535.
- Physics Based Modeling Tool for Hostile Fire Spectral Signatures Sensing at Range and through Atmospheric Attenuation project supported by the US Army Research Laboratory through Contract W911QX-15-D-0022 with New Mexico State University (Physical Science Laboratory).

MEMBERSHIP

- Active member of Optica (formerly known as The Optical Society of America (OSA)).
- Active member of the International Society for Optics and Photonics (SPIE).

HONORS & AWARDS

- A scholarship to pursue MSc degree at Yarmouk University, Jordan, 2013-2015. (Sponsor: The Ministry of Higher Education and Scientific Research, Jordan).

1. **W. Al-Younis**, "Elevation-dependent turbulence-induced image degradation along a 20-km near-ground optical path from time-lapse imagery," *Optical Engineering*, vol. 65, no. 8, **Art. no. 083103**, Aug. 2026.
2. **W. Al-Younis** and G. Kermarrec, "Patch-based regression for reference-robust atmospheric turbulence correction in outdoor optical systems," *Applied Optics* 65(19) (2026).
3. **W. Al-Younis** and M. H. Bataineh, "Systematic comparison of Fiber Bragg Grating pulse compressor designs," *Results in Optics*, vol. 24, p. 101098, 2026.
4. G. Kermarrec, M. Sühring, and **W. Al-Younis**, "Impacts of atmospheric turbulence on optic measurements over heterogeneous flat terrain: insights from large eddy simulations," *Opt. Express* 33, 3522-3542 (2025).
5. G. Kermarrec, M. Sühring, and **W. Al-Younis**, "Impact of atmospheric turbulence on optical signal near the ground from Large Eddy Simulations", *Optica Imaging Congress*, June 2024.
6. **W. Al-Younis** and D. Voelz, "Correction and Analysis of Turbulence Effects in Time-Lapse Images Using Optical Flow Registration," in *Optica Imaging Congress (3D, COSI, DH, FLatOptics, IS, pcAOP)*, Technical Digest Series (Optica Publishing Group, 2023), paper PW3F.5.
7. **W. Al-Younis**, S. Sandoval, D. Voelz, and M. Abdullah-Al-Mamun, "A Physics-Guided Machine Learning Model for the Prediction of Atmospheric Refraction," In *Propagation Through and Characterization of Atmospheric and Oceanic Phenomena*, pp. PTh4F-4. Optica Publishing Group, 2022.
8. **W. Al-Younis**, S. Sandoval, D. Voelz, and P. Miller, "Extended Analysis of Atmospheric Refraction Effects Captured by Time-Lapse Imaging: Long-Term Trends and Machine Learning Image Shift Prediction," presented in *Proc. SPIE, Laser Communication and Propagation through the Atmosphere and Oceans X 2021*, 11834-1 (August 2021).
9. M. Abdullah-Al-Mamun, **W. Al-Younis**, E. Wijerathna, and D. Voelz, "Beam Trajectory Studies of Diurnal Refraction Effects for a Near-Ground Path involving Numerical Weather Prediction and Time-Lapse Imaging Measurements," presented in *Proc. SPIE, Laser Communication and Propagation through the Atmosphere and Oceans X 2021*, 11834-1 (August 2021).
10. **W. Al-Younis**, C. Nevarez, M. Abdullah-Al-Mamun D. Voelz, S. Sandoval, and S. Basu, "Image Shift Due to Atmospheric Refraction: Prediction by Numerical Weather Modeling and Machine Learning". *Opt. Eng.* 59(8), 2020.
11. **W. Al-Younis**, C. Nevarez, D. Voelz, S. Sandoval, and S. Basu, "Predicting atmospheric refraction with weather modeling and machine learning", *Proc. SPIE 11133, Laser Communication and Propagation through the Atmosphere and Oceans VIII*, 111330E (6 September 2019).
12. **W. Al-Younis**, C. Nevarez, and D. Voelz, "Time-lapse Imaging for Studying Atmospheric Refraction: Measurements with Natural Targets," *IEEE Aerospace Conference*, Big Sky, MT, USA, 2019.
13. **W. Al-Younis** and M. Bataineh, "Pulse compression using Fiber Bragg gratings," *2017 4th International Conference on Electrical and Electronic Engineering (ICEEE)*, Ankara, 2017.

Presented Conference Papers:

1. R. Abid, **W. Al-Younis**, I. Trrad, & A. Daraiseh, "Image segmentation and fractal feature engineering for AI-assisted pavement crack analysis,". Paper presented at the 3rd International Conference on Emerging Trends and Applications in Artificial Intelligence (ICETAI 2026), Istanbul Technical University, Istanbul, Türkiye.
2. **W. Al-Younis**, "Reconstruction Fidelity of Chirped FBGs via Discrete Layer Peeling: A Round-Trip Study." Presented at the Optica Advanced Photonics Congress 2026, California, USA, July 28, 2026.

3. I. Trrad, & **W. Al-Younis**, "Design Map for FBG Apodization under WDM Constraints," Presented at the Optica Advanced Photonics Congress 2026, California, USA, July 30, 2026.
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