Michael N. Olaya, PH.D. CANDIDATE

✉ michael.n.olaya@gmail.com
✉ michael_olaya@student.uml.edu

in LinkedIn
R⁶ ResearchGate

Education

2018 – ····	📄 **Ph.D., University of Massachusetts Lowell** in Mechanical Engineering Thesis title: *Multiscale process modeling of polymer matrix and polymer-derived composites for high-peformance applications* Expected defense date: December 2024
2009 – 2013	📄 **B.Sc., University of Delaware** in Mechanical Engineering

Ph.D. Research Overview

- Developed a physics-based, parallelized, virtual process modeling framework for predicting generation of *in*-situ residual stresses in polymer matrix and polymer-derived composites designed for high-performance applications.
- Established a multiscaling approach for process modeling analyses which employs a hierarchical computational homogenization scheme to obtain effective thermo-chemical-mechanical material properties as a function of processing parameters.
- Co-led microscale process modeling analysis efforts for the AIAA SciTech 2022 ICME Competition.
- Applied hierarchical modeling approach to studying novel phenolic matrix 3D textile composite featuring high porosity and blended tow architectures.
- Investigated and modeled thermal gradients in lab-scale composite specimens resulting from non-uniform cure and the highly exothermic curing reaction.
- Produced a simplified 1D process modeling approach to aid in optimization of wind turbines blade repair protocols.
- Devised a novel methodology for characterizing two-part polymer matrix materials as a function of cure state by leveraging off-stoichiometry formulations serving as proxies for the partially cured, stoichiometric polymer.
- Experimentally characterized thermal, chemical, and mechanical properties of both fully and partially cured polymer matrix materials.

Research Projects

2021 – 2024	🔖 **Physics-based process modeling for high-temperature and high-strength composites** *Sponsor*: Air Force Office of Scientific Research *PI*: Dr. Marianna Maiarù *Grant No.*: NSF 2145387 and AFOSR FA9550-21-1-0100
2022 – 2023	🔖 **Multiscale process modeling of a highly porous phenolic composite** *Sponsor*: NASA (Summer internships) *PIs*: Dr. Trenton M. Ricks (Mentor), Dr. Evan J. Pineda (Co-mentor), and Dr. Marianna Maiarù

Research Projects (continued)

2020 – 2023   📑 **ICME optimization of advanced composite components of the Aurora D8 aircraft**
Sponsor: NASA
PI: Dr. Marianna Maiarù
Grant No.: NASA Transformational Tools and Technologies (TTT) project within the Aeronautics Research Mission Directorate under NASA Research Announcement award 80NSSC21M0104 and NASA 80NSSC19K1246

2018 – 2022   📑 **Structural wind blade repair optimization**
Sponsor: I/UCRC for Wind Energy, Science, Technology, and Research (WindSTAR)
PI: Dr. Marianna Maiarù

2019 – 2021   📑 **Multiscale modeling of advanced fiber-reinforced thermoset composites during curing**
Sponsor: NASA
PI: Dr. Marianna Maiarù
Grant No.: NSF 2145387 and NASA 80NSSC19K1246

Publications

Journal Articles

1. S. P. Shah, **M. N. Olaya**, E. Plaka, J. McDonald, C. J. Hansen, and M. Maiarù, "Effect of moisture absorption on curing of wind blades during repair," *Composites Part A: Applied Science and Manufacturing*, vol. 173, p. 107 706, Oct. 2023, ISSN: 1359835X. 🔗 DOI: `10.1016/j.compositesa.2023.107706`.

2. **M. Olaya**, S. Shah, and M. Maiaru, "Thermoset polymers characterization as a function of cure state using off-stoichiometry proxies," Dec. 21, 2022. 🔗 DOI: `10.26434/chemrxiv-2022-ddlc9`.

3. K. Bukenya, **M. Olaya**, S. Shah, E. J. Pineda, T. M. Ricks, and M. Maiarù, "Residual stresses induced due to curing of the bulk matrix in a simplified three-dimensional (3d) woven repeating unit cell," p. 18, 2021.

4. S. Patil, S. Shah, **M. Olaya**, P. Deshpande, M. Maiaru, and G. Odegard, "Reactive molecular dynamics simulation of epoxy for the full cross-linking process," *ACS Appl. Polym. Mater*, vol. 3, no. 11, pp. 5788–5797, Nov. 2021. 🔗 DOI: `10.1021/acsapm.1c01024.`.

Conference Proceedings

1. **M. N. Olaya** and M. Maiarù, "HOMOGENIZATION METHODS FOR MULTISCALE PROCESS MODELING THROUGH FULL FACTORIAL DESIGN," in *American Society for Composites 2023*, Destech Publications, Inc., Sep. 18, 2023, ISBN: 978-1-60595-691-6. 🔗 DOI: `10.12783/asc38/36605`.

2. K. Bukenya, **M. N. Olaya**, E. J. Pineda, and M. Maiaru, "Process modeling of woven textiles," in *AIAA SCITECH 2022 Forum*, San Diego, CA & Virtual: American Institute of Aeronautics and Astronautics, Jan. 3, 2022, ISBN: 978-1-62410-631-6. 🔗 DOI: `10.2514/6.2022-1008`.

3. **M. N. Olaya** and M. Maiaru, "A multi-scale approach for process modeling of polymer matrix composites," in *AIAA SCITECH 2022 Forum*, San Diego, CA & Virtual: American Institute of Aeronautics and Astronautics, Jan. 2022. 🔗 DOI: `10.2514/6.2022-0379.`.

4. S. U. Patil, **M. N. Olaya**, P. Deshpande, M. Maiaru, and G. M. Odegard, "Influence of stoichiometry on thermo-mechanical properties of DGEBF/DETDA epoxy," in *AIAA SCITECH 2022 Forum*, San Diego, CA & Virtual: American Institute of Aeronautics and Astronautics, Jan. 3, 2022, ISBN: 978-1-62410-631-6. 🔗 DOI: `10.2514/6.2022-0377`.

5. K. Bukenya, **M. N. Olaya**, E. J. Pineda, and M. Maiaru, "EFFECT OF BOUNDARY CONDITIONS ON PROCESS- INDUCED STRESSES IN a PLAIN WEAVE UNIT CELL," in *American Society for Composites 2021*, Destech Publications, Inc., Sep. 20, 2021, ISBN: 978-1-60595-686-2. 🔗 DOI: `10.12783/asc36/35853`.

6. P. P. Deshpande, S. Shah, S. U. Patil, **M. Olaya**, G. M. Odegard, and M. Maiaru, "PROCESS MODELLING THE CURE OF BISPHENOL-a EPOXY/JEFFAMINE SYSTEM USING ICME," in *American Society for Composites 2021*, Destech Publications, Inc., Sep. 20, 2021, ISBN: 978-1-60595-686-2. 🔗 DOI: `10.12783/asc36/35812`.

7. **M. N. Olaya**, G. Odegard, and M. Maiaru, "A novel approach to characterization of composite polymer matrix materials for integrated computational materials engineering approaches," in *AIAA Scitech 2021 Forum, VIRTUAL EVENT: American Institute of Aeronautics and Astronautics*, Jan. 2021. 🔗 DOI: `10.2514/6.2021-1889.`.

8. **M. N. Olaya**, G. M. Odegard, and M. Maiaru, "A novel approach to characterization of composite polymer matrix materials for integrated computational materials engineering approaches," in *AIAA Scitech 2021 Forum*, VIRTUAL EVENT: American Institute of Aeronautics and Astronautics, Jan. 11, 2021, ISBN: 978-1-62410-609-5. 🔗 DOI: `10.2514/6.2021-1889`.

9. **M. N. Olaya**, S. Patil, G. M. Odegard, and M. Maiarù, "A UNIQUE APPROACH TO EXPERIMENTAL CHARACTERIZATION OF a THERMOSETTING POLYMER MATRIX FOR ICME FRAMEWORKS," in *American Society for Composites 2021*, Destech Publications, Inc., Sep. 20, 2021, ISBN: 978-1-60595-686-2. 🔗 DOI: `10.12783/asc36/35814`.

10. S. Patil, **M. Olaya**, P. Deshpande, M. Maiarù, and G. Odegard, "EFFECTS OF STOICHIOMETRY ON PROPERTIES OF DGEBF/DETDA EPOXY USING MOLECULAR DYNAMICS," in *American Society for Composites 2021*, Destech Publications, Inc., Sep. 20, 2021, ISBN: 978-1-60595-686-2. 🔗 DOI: `10.12783/asc36/35845`.

11. P. P. Deshpande, S. Shah, S. Patil, *et al.*, "Multiscale modelling of the cure process in thermoset polymers using ICME," in *American Society for Composites 2020*, DEStech Publications, Inc., Sep. 9, 2020, ISBN: 978-1-60595-665-7. 🔗 DOI: `10.12783/asc35/34889`.

12. **M. N. Olaya**, J. Mcdonald, S. Shah, C. J. Hansen, S. E. Stapleton, and M. Maiaru, "Wind blade repair optimization," in *American Society for Composites 2020*, DEStech Publications, Inc., Sep. 9, 2020, ISBN: 978-1-60595-665-7. 🔗 DOI: `10.12783/asc35/34979`.

13. S. Patil, S. Shah, P. Deshpande, *et al.*, "Multi-scale approach to predict cure-induced residual stresses in an epoxy system," in *American Society for Composites 2020*, DEStech Publications, Inc., Sep. 9, 2020, ISBN: 978-1-60595-665-7. 🔗 DOI: `10.12783/asc35/34890`.

Skills

Coding	🔖	Python, Fortran, Matlab, LaTeX
Software	🔖	Abaqus, LAMMPS, Office
Lab	🔖	Differential scanning calorimetry (DSC), polymer matrix tensile test specimen fabrication and testing, digital image correlation (DIC), thermogravimetric analysis (TGA)

Awards

- 🏅 Winner, AIAA 2022 SciTech ICME Competition (co-recipient)
- 🏅 Winner, AIAA 2022 Student Paper Competition (co-author)
- 🏅 Shining Star Intern, NASA summer internship