**Michael Borish**

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Education

**University of Florida**

Doctor of Philosophy in Computer Science December 2016

Master of Science in Computer Engineering December 2009

**Duke University**

Bachelor of Science in Electrical and Computer Engineering May 2006

Bachelor of Science in Computer Science

Minored in Economics

Current and Prior Experience

Researcher - Oak Ridge National Lab January 2017 - Present

Conducted research related to the development of large-scale additive manufacturing technology.  Research included work in multiple areas of computer science including: computational geometry, path planning, UI design, 3D graphics, computer vision, and augmented reality.

* Successfully established and led cooperative research and development agreements (CRADAs) and user agreements (UAs) with commercial partners. Secured internal seed funding for new projects. Total CRADA, UA, and seed agreements in excess of $700k.
* Expanded internship recruitment pool and assisted in hiring of multiple staff members.  Regularly mentored multiple interns and early staff through programs including SULI, URSI, GRSI, HERE, and ASTRO.
* Supported numerous projects in furtherance of yearly milestones.  Software lead for those projects.
* Developed next-gen solutions utilized by multiple projects including:
	+ ORNL’s Slicer 2 - open-source slicer platform to support next generation research into novel 3D printing algorithms. Currently has nearly 200 users comprising approximately 50 partners and their customers. Organizations include commercial, DOE/DOD, and academia.
	+ Command/Control systems - novel machine control algorithms utilizing sensors such as laser profilometers and thermal imaging to allow machines to detect and self-correct defects.
	+ SAMARAI - augmented reality interface for additive and subtractive systems coupled with standardized communication interface. Project helped to expand active research areas.
* Filed 5+ patents and invention disclosures as a result of novel algorithms.
* Published 20+ professional articles including conference papers, journals, and a book.
* Established and organized annual user group seminar (SLUG) for path planning and visualization. Most recent gathering included 50+ attendees.
* Participated in multiple professional societies including IEEE and SME. Served on organizing committee for SPIE Thermosense and chaired multiple sessions.
* Served as editor for special issue for Materials journal.

Ph.D. candidate - Virtual Experience Research Group August 2010 - December 2016

Developed methodologies for the use of virtual humans to assist in the training of medical personnel in rare or high risk scenarios.  Methodologies focused on the integration of crowdsourcing techniques into traditional and novel simulations.

* Taught Intro Computer Science course for three semesters.
* Implemented natural language processing (NLP) matcher currently utilized by virtual human simulation.
* Invented methodology to utilize crowdsourced non-experts to assist with: virtual humans’ empathetic response, construction and development of virtual humans, and combined machine learning model for virtual human nonverbal behavior.
* Collaborated with VA Medical personnel to develop a virtual grocery store experience targeting veterans with PTSD.

Computer Science Specialist - Civil Service/Tybrin Contractor May 2006 – August 2010

Assisted in system level design and development of distributed hardware/software architectures for systems used in support of Eglin AFB’s missions. Development included specialized architecture such as VxWorks and CORBA deployed at customer locations, networking and command/control software suites in .NET, and interactive graphical overlays for real-time feedback.

* Received multiple awards including Outstanding Project Lead, Civilian of the Quarter (Division and Group levels), Civilian of the Year (Division, Group, Wing, Base-wide levels), and three Merit Awards with bonus pay.
* Assumed configuration management lead for group in addition to regular duties.  Reduced overhead spent on configuration management and assisted in audit for process improvement.

Professional Organizations and Leadership

Society of Manufacturing Engineers (SME) January 2019 - Present

Institute of Electrical and Electronics Engineers (IEEE) January 2019 - Present

Organizing committee member of SPIE Thermosense March 2021 - Present

External member of PhD committee August 2022 - Present

Skills

Programming Languages and Tools

* C/C++, C#, JavaScript, HTML/CSS, ASP.NET, Java, Mono, Python, OpenCV, CUDA

Platforms

* Windows, VxWorks, Android, Linux

Development Environments

* Qt, Visual Studio, Unity, PyCharm, Eclipse

Patents/Invention Disclosures

Loading Balancing for Powder Bed Additive Manufacturing.  Invention disclosure pending.

**Borish, M.**, Roschli, A., Ahmed, H., Heineman, J. (2022). Software for Wire Anchoring for Co-Extruded Printing. Patent pending.

Gibson, B., Richardson, B., Love, L., Mhatre, P., & **Borish, M**. (2022). Site-Specific Melt Pool Size Control in Additive Manufacturing. US Patent 2022/0105569.

**Borish, M**., Roschli, A., Post, B., Chesser, P., & Kim, P. (2021). Continuous Toolpaths for Additive Manufacturing. US Patent 2021/0055710.

Kim, P., Kunc, V., Hassen, A., Lindahl, J., Post, B., Roschli, A., Chesser, P., **Borish, M**., Dreifus, G., Love, L., Blue, C., & Beard, B. (2020). System and Method for Additive Manufacturing with Toolpath Bridges and Resultant Structure. US Patent 2020/0230888.

**Borish, M.**, Roschli, A., Post, B., Chesser, P. (2019). Single Layer Time Alteration via Thermal Imaging for Large-Scale Polymer Additive Manufacturing.

Books

Roschli, A., **Borish, M**., MacDonald, E., Wang, P., Feldhausen, T., & Barnes, A. (2022). The Fundamentals of Slicing. Publication pending.

Publications

Wang, P., Robertson, G., Gibson, B.T., Fancher, C., Reynolds, J., **Borish, M.**, MacDonald, E., Cruz, J., Chesser, P., Stump, B., Jackson, A. (2023). Improved Productivity with Multi-Laser Rotary Powder Bed Fusion Additive Manufacturing. Publication pending.

White, L., Quaife, B., & **Borish, M.** (2023). A novel approach for adaptive skeleton toolpath generation. Publication pending.

Jackson, A., Atkins, C., Barnes, A., Kishore, V., Post, B., Hershey, C., **Borish, M**., Tekinalp, H., Roschli, A., Chesser, P., Smith, T., Kim, P., Kunc, V., Love, L., Snowberg, D., & Carron, S. (2022). Oak Ridge National Laboratory: Additive Manufacturing Design Guidelines for Wind Industry.

**Borish, M**. & Roschli, A. (2022). Automated Path Planning for Wire Feeding in Large Format Polymer Additive Manufacturing. In 2022 International Solid Freeform Fabrication Symposium. University of Texas at Austin.

Wade, C. & **Borish, M**. (2022). Hybrid Curve Fitting for Accurate Object Construction. In 2022 International Solid Freeform Fabrication Symposium. University of Texas at Austin.

Crockett, B. & **Borish, M**. (2022). Toolpath Planning for Multiple Build Points using K-Means Clustering. In 2022 International Solid Freeform Fabrication Symposium. University of Texas at Austin.

Mhatre, P., Gibson, B., **Borish, M**., Potter, J., Vaughan, J., & Love, L. (2022). Dynamic Bead Geometries Achieved with Site-Specific Control for Defect Mitigation and Near Net-Shape Printing in Directed Energy Deposition. Additive Manufacturing, publication pending.

Gibson, B., Mhatre, P., **Borish, M**., Atkins, C., Potter, J., Vaughan, J., & Love, L. (2022). Controls and Process Planning Strategies for 5-Axis Laser Directed Energy Deposition of Ti-6Al-4V using an 8-Axis Industrial Robot and Rotary Motion. Additive Manufacturing, 58, 103048. https://doi.org/10.1016/j.addma.2022.103048

**Borish, M**., Gibson, B., Adkins, C., Mhatre, P. (2022). Automated Process Planning for Embossing and Functionally Grading Materials via Site-Specific Control in Large-Format Metal-Based Additive Manufacturing. Materials, 15(12), 4152. https://doi.org/10.3390/ma15124152

**Borish, M.**, and Roschli, A. (2021). "ORNL Slicer 2.0: Towards a New Slicing Paradigm." In 2021 International Solid Freeform Fabrication Symposium. University of Texas at Austin.

**Borish, M**. (2021). A survey of thermal sensing application in additive manufacturing. In Thermosense: Thermal Infrared Applications XLIII (Vol. 11743, p. 117430A). International Society for Optics and Photonics. https://doi.org/10.1117/12.2587059

**Borish, M**., & Wade, C. (2021). A GPU-based Approach for Path Planning Optimization via Travel Length Reduction. Procedia Manufacturing, 53, 310-317. https://doi.org/10.1016/j.promfg.2021.06.034

Gibson, B. T., Mhatre, P., **Borish, M. C**., West, J. L., Betters, E. D., Smith, S. S., Richardson, B.S., Love, L. J., Sundermann, T., Potter, J., Vetland, E., Henry, W.C., & Allison, C. P. (2020). Accelerating Large-Format Metal Additive Manufacturing: How Controls R&D Is Driving Speed, Scale, and Efficiency. In ASME International Mechanical Engineering Congress and Exposition (Vol. 84485, p. V02AT02A038). American Society of Mechanical Engineers. https://doi.org/10.1115/IMECE2020-23322

Roschli, A., Post, B., Chesser, P., **Borish, M**., Love, L., & Kim, S. (2019). Creating Toolpaths Without Starts and Stops for Extrusion-Based Systems. In 2019 International Solid Freeform Fabrication Symposium. University of Texas at Austin.

**Borish, M**., & Westfall, J. (2020). Additive and Subtractive Manufacturing Augmented Reality Interface (ASMARI). In 2020 SoutheastCon (pp. 1-6). IEEE. https://doi.org/10.1109/SoutheastCon44009.2020.9249710

**Borish, M.**, Post, B. K., Roschli, A., Chesser, P. C., & Love, L. J. (2020). Real-Time Defect Correction in Large-Scale Polymer Additive Manufacturing via Thermal Imaging and Laser Profilometer. Procedia Manufacturing, 48, 625-633. https://doi.org/10.1016/j.promfg.2020.05.091

Gibson, B. T., Bandari, Y. K., Richardson, B. S., Roschli, A. C., Post, B. K., **Borish, M. C**.,  Thornton, A., Henry, W.C., & Love, L. J. (2019). Melt pool monitoring for control and data analytics in large-scale metal additive manufacturing. In 2019 International Solid Freeform Fabrication Symposium. University of Texas at Austin.

**Borish, M**., Post, B. K., Roschli, A., Chesser, P. C., Love, L. J., Gaul, K. T., Sallas, M., & Tsiamis, N. (2019). In-situ thermal imaging for single layer build time alteration in large-scale polymer additive manufacturing. Procedia manufacturing, 34, 482-488. https://doi.org/10.1016/j.promfg.2019.06.202

Roschli, A., Borish, M., Post, B., Chesser, P., Heineman, J., & Atkins, C. (2019). Design for Slicing in Large Format Fused Filament Fabrication. CAMX 2019. https://doi.org/10.33599/nasampe/c.19.0707

Roschli, A., Post, B., Chesser, P., **Borish, M**., Love, L., & Kim, S. (2019). Creating Toolpaths Without Starts and Stops for Extrusion-Based Systems. In 2019 International Solid Freeform Fabrication Symposium. University of Texas at Austin.

Gibson, B. T., Bandari, Y. K., Richardson, B. S., Roschli, A. C., Post, B. K., **Borish, M. C.**, Thornton, A., Henry, W.C., Lamsey, M., & Love, L. J. (2019). Melt pool monitoring for control and data analytics in large-scale metal additive manufacturing. In 2019 International Solid Freeform Fabrication Symposium. University of Texas at Austin.

**Borish, M**., Post, B. K., Roschli, A., Chesser, P. C., Love, L. J., & Gaul, K. T. (2019). Defect identification and mitigation via visual inspection in large-scale additive manufacturing. JOM, 71(3), 893-899. https://doi.org/10.1007/s11837-018-3220-6

Roschli, A., Gaul, K. T., Boulger, A. M., Post, B. K., Chesser, P. C., Love, L. J., Blue, F., & **Borish, M**. (2019). Designing for big area additive manufacturing. Additive Manufacturing, 25, 275-285. https://doi.org/10.1016/j.addma.2018.11.006

Chesser, P., Post, B., Roschli, A., Carnal, C., Lind, R., **Borish, M.**, & Love, L. (2019). Extrusion control for high quality printing on Big Area Additive Manufacturing (BAAM) systems. Additive Manufacturing, 28, 445-455. https://doi.org/10.1016/j.addma.2019.05.020

Levy, C., Halan, S., **Borish, M.**, Akande, C., Zalake, M., Myers, K., Marsiske, M., Miller, M.D., & Benjamin, L. (2017). Evaluation of V-Mart, a Virtual Reality Grocery Store for TBI and PTSD. Archives of Physical Medicine and Rehabilitation, 98(10), e14. https://doi.org/10.1016/j.apmr.2017.08.041

Foster, A., Chaudhary, N., Kim, T., Waller, J. L., Wong, J., **Borish, M.**, Cordar, A., Lok, B., & Buckley, P. F. (2016). Using virtual patients to teach empathy: a randomized controlled study to enhance medical students’ empathic communication. Simulation in Healthcare, 11(3), 181-189. https://doi.org/10.1097/SIH.0000000000000142

**Borish, M.**, & Lok, B. (2016). Utilizing unsupervised crowdsourcing to develop a machine learning model for virtual human animation prediction. Handbook of Human Motion. 1, 2289-2306. https://doi.org/10.1007/978-3-319-14418-4\_21.

**Borish, M.**, & Lok, B. (2016). Rapid low-cost virtual human bootstrapping via the crowd. ACM Transactions on Intelligent Systems and Technology (TIST), 7(4), 1-20. https://doi.org/10.1145/2897366

Cordar, A., **Borish, M**., Foster, A., & Lok, B. (2014). Building virtual humans with back stories: training interpersonal communication skills in medical students. In International Conference on Intelligent Virtual Agents (pp. 144-153). Springer, Cham. https://doi.org/10.1007/978-3-319-09767-1\_17

**Borish, M.**, Cordar, A., Foster, A., Kim, T., Murphy, J., & Lok, B. (2014). Utilizing real-time human-assisted virtual humans to increase real-world interaction empathy. Kansei Engineering & Emotion Research (KEER’14), 15.