Adam P. Generale

Contact Information

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Education

Georgia Institute of Technology, Atlanta, GA, USA — 2024

Ph.D. Materials Informatics, George W. Woodruff School of Mechanical Engineering

- Thesis: "Neural Inverse Microstructure Design with Bayesian Scale-Bridging"
- Advisor: Surya R. Kalidindi

University of Manchester, Manchester, UK — 2014

M.S. Mechanical Engineering, School of Engineering

- Thesis: "Generalized Deformation in Heterogeneous Materials in Mode I Fracture"
- Advisor: Andrey Jivkov

Rensselaer Polytechnic Institute, Troy, NY, USA — 2011

B.S. Mechanical Engineering, School of Mechanical, Aerospace, and Nuclear Engineering

Research Experience

Georgia Institute of Technology, Atlanta, GA, USA — Sep 2019 - Jan 2024

Graduate Research Assistant

- Focus on flow-based generative models (e.g., continuous normalizing flows, flow matching), Bayesian statistics, and Gaussian processes applied towards enabling data-driven materials exploration, learning latent process dynamics, and statistical model calibration.

Air Force Research Laboratory, Dayton, OH, USA — Jun 2020 - Oct 2020

Research Intern

- Developed framework for the Bayesian calibration of a multimode constitutive damage model through fusing information from disparate experimental measurements.

Professional Experience

Pratt & Whitney, East Hartford, CT, USA — July 2023 - Present

Senior Principal Engineer

- Developed and applied advanced machine learning architectures (e.g., diffusion models and normalizing flows), to solve scientific inverse problems involving physics-based models.
- Utilized Bayesian inference to quantify uncertainty and calibrate models, driving more accurate predictions and informed decision-making.
- Integrated and analyzed multimodal data (multivariate time series, images, destructive measurements) to inform product performance and field deployment strategies, leveraging insights from inverse problem solving to optimize product design and development.

Multiscale Technologies, Atlanta, GA, USA — Jan 2023 - July 2024

Principal Applied Scientist

- Developed Neural ODE/SDE architectures for efficiently learning dynamical systems from unaligned marginal data and identifying families of inverse solutions (e.g., materials and process synthesis design) through conditional transport maps.
- Implemented information-theoretic strategies for the construction of optimal experimental designs through active learning towards identifying novel materials.

Awards

IMECE Travel Award, American Society of Mechanical Engineers	2023
CMS3 Fellowship, Texas A&M University	2023
Sloan Foundation Fellowship, Alfred P. Sloan Foundation	2020
President's Fellowship, Georgia Institute of Technology	2020
Team of the Quarter, Pratt & Whitney	Q2 2016, Q4 2017
Best Dissertation, University of Manchester	2014
Best Overall Performance, University of Manchester	2014
Rensselaer Leadership Award, Rensselaer Polytechnic Institute	2007

TECHNICAL KNOWLEDGE

Statistical Modeling, Bayesian Statistics, Machine Learning, Signal Processing, Data Analysis, Numerical Methods, Finite Element Analysis, Continuum Mechanics, High-Performance Computing
Software: ABAQUS, ANSYS, Fluent, Star-CCM+
Languages: Proficient: Python (*PyTorch, GPyTorch, Pyro, Jax*), MATLAB; Familiar: Fortran C/C++,

PUBLICATIONS

Generale, A.P., Robertson, A.E., Kalidindi, S.R. (2024). Conditional Variable Flow Matching: Transforming Conditional Densities with Amortized Conditional Optimal Transport. *arXiv*. arXiv:2411.08314

Buzzy, M.O., Montes de Oca Zapain, D., **Generale, A.P.**, Kalidindi, S.R., Lim, H. (2025). Active learning for the design of polycrystalline textures using conditional normalizing flows. *Acta Materialia*. doi: 10.1016/j.actamat.2024.120537

Generale, A.P., Robertson, A.E., Kelly, C., Kalidindi, S.R. (2024). Inverse Stochastic Microstructure Design. *Acta Materialia*. doi: 10.1016/j.actamat.2024.119877

Marshall, A., **Generale, A.P.**, Kalidindi, S.R., Radhakrishnan, B., Belak, J. (2024). A Gaussian process autoregressive model capturing microstructure evolution paths in a Ni–Mo–Nb alloy. *J. Mater. Sci.*. doi: 10.1007/s10853-024-09345-6

Robertson, A.E., **Generale, A.P.**, Kelly, C., Buzzy, M.O., Kalidindi, S.R. (2024). MICRO2D: A Large, Statistically Diverse, Heterogeneous Microstructure Dataset. *Integrating Materials and Manufacturing Innovation*. doi: 10.1007/s40192-023-00340-4

Generale, A.P., Kelly, C., Harrington, G.R., Robertson, A.E., Buzzy, M., Kalidindi, S.R. (2023). A Bayesian Approach to Designing Microstructures and Processing Pathways for Tailored Material Properties. *NeurIPS Workshop - AI for Accelerated Materials Design*.

Generale, A.P., Kalidindi, S.R. (2023). Uncertainty quantification and propagation in the microstructure-sensitive prediction of stress-strain response of woven ceramic matrix composites. *Computers & Structures*, 286, 107110. doi: 10.1016/j.compstruc.2023.107110.

Wang, S., **Generale, A.P.**, Kalidindi, S.R., Joseph, V.R. (2023). Sequential Designs for Filling Output Spaces. *Technometrics* , 0, 1-12. doi: 10.1080/00401706.2023.2231042

Generale, A.P., Hall, R.B., Brockman, R.A., Joseph, V.R., Jefferson, G., Zawada, L., Pierce, J., Kalidindi, S.R. (2022). Bayesian calibration of continuum damage model parameters for an oxide-oxide ceramic matrix composite using inhomogeneous experimental data. *Mechanics of Materials*, 175, 104487. doi: 10.1016/j.mechmat.2022.104487.

Hall, R.B., Brockman, R.A., **Generale, A.P.**, Joseph, V.R., Kalidindi, S.R. (2022). A Viscous Damage Theory for Ceramic Matrix Composites in Multi-Axial Loading. *Proceedings of the 12th International Conference on the Mechanics of Time Dependent Materials*.

Generale, A.P., Kalidindi, S.R. (2021). Reduced-order Models for Microstructure-Sensitive Effective thermal Conductivity of Woven Ceramic Matrix Composites with Residual Porosity. *Compos. Structures*, 274, 114399. doi: 10.1016/j.compstruct.2021.114399

PATENTS

Jackson, R.W., **Generale, A.P.**, Liu, X., Zelesky, M.F., 2023. Airfoil having environmental barrier topcoats that vary in composition by location. US11608749B2.

Quach, S., **Generale, A.P.**, Surace, R., Dvorozniak, L., 2022. Engine with cooling passage circuit for air prior to ceramic component. US11492914B2.

Generale, A.P., Dvorozniak, L., Quach, S., 2022. Ceramic airfoil with cooling air turn. US11473444B2.

Generale, A.P., Dvorozniak, L., Quach, S., 2022. Baffle with impingement holes. US11415002B2.

Generale, A.P., Mongillo, D.J., 2022. Components for gas turbine engines. US11371360B2.

Quach, S., Dube, B.P., Propheter-Hinckley, T.A., Arisi, A.N., **Generale, A.P.**, Dvorozniak, L., Liles, H.J., 2022. Cooling arrangement including overlapping diffusers. US11339667B2.

Generale, A.P., Dvorozniak, L., Quach, S., Dube, B.P., 2022. Baffle with tail. US11280201B2.

Generale, A.P., Mongillo, D.J., 2022. Components for gas turbine engines. US11261749B2.

Generale, A.P., Mongillo, D.J., 2022. Trailing edge insert for airfoil vane. US11242758B2.

Generale, A.P., Propheter-Hinckley, T.A., 2021. Airfoil assembly with ceramic airfoil pieces and seal. US11162368B2.

Spangler, B.W., **Generale, A.P.**, Vu, K.H., 2021. Gas turbine engine cooling component. US11131212B2.

Generale, A.P., Liles, H.J., 2021. Airfoil with metallic shield. US11092015B2.

Generale, A.P., Dube, B.P., 2021. Thermal gradient reducing device for gas turbine engine component. US11078844B2.

Generale, A.P., Dube, B.P., 2021. CMC airfoil with cooling holes. EP3808940A1.

Spangler, B.W., **Generale, A.P.**, 2021. Shell and spar airfoil. US10934857B2.

Vu, K.H., **Generale, A.P.**, 2020. Vane platform leading edge recessed pocket with cover. US10822962B2.

Devore, M.A., **Generale, A.P.**, Propheter-Hinckley, T.A., 2020. Airfoil with geometrically segmented coating section. US10711624B2.

Spangler, B.W., **Generale, A.P.**, 2020. Axial flow cooling scheme with castable structural rib for a gas turbine engine. US10822963B2.

Mongillo, D.J., **Generale, A.P.**, 2020. Platform flow turning elements for gas turbine engine components. US10655496B2.

Spangler, B.W., **Generale, A.P.**, 2020. Gas turbine engine cooling component. US10648351B2.

Generale, A.P., Howard, B.L., 2020. Vane air inlet with fillet. US10619492B2.

Clum, C., **Generale, A.P.**, 2019. Adjustable flow split platform cooling for gas turbine engine. US1051 3947B2.

Thornton, L.M., **Generale, A.P.**, 2019. Vane including internal radiant heat shield. EP3567220B8.

PRESENTATIONS

AI/Data Informatics: Computational Model Development, Verification, Validation, and Uncertainty Quantification (TMS). Inverse Stochastic Microstructure Design. May, 2024.

Minisymposium on Integrated Computational Materials Engineering (ICME). Inverse Stochastic Microstructure Design. October, 2023.

Artificial Intelligence for Materials Science (AIMS) Workshop. National Institute of Standards and Technology (NIST). Stochastic Scale-Bridging. July, 2023.