Mark Christian Messner

Argonne National Laboratory
Building 212
9700 Cass Ave.
Lemont, IL 60439

Phone: +1 (630) 252-6510
Email: messner@anl.gov

Additional contact information
Personal email: mark.messner@gmail.com
Home phone: +1 (847) 254-1740

Education

2011-2014	**Doctor of Philosophy**, *University of Illinois at Urbana-Champaign*, GPA 3.96/4.00 Major: Civil and Environmental Engineering Advisor: Robert Dodds, Jr. Dissertation: *Micromechanical models of delamination in Al-Li alloys* Computational Science and Engineering Certificate
2010-2011	**Master of Science**, *University of Illinois at Urbana-Champaign*, GPA 3.96/4.00 Major: Civil and Environmental Engineering Advisor: Robert Dodds, Jr. Computational Science and Engineering Certificate
2006-2010	**Bachelor of Science**, *University of Illinois at Urbana-Champaign*, GPA 3.97/4.00 Major: Civil and Environmental Engineering, Minor: German Degree awarded with Highest Honors and University Honors

Appointments

2016-	**Principal Mechanical Engineer**, *Argonne National Laboratory* Research topics: High temperature structural materials, design of high temperature nuclear reactors and concentrating solar power systems, crystal plasticity, machine learning methods for material and material model design, qualification of AM nuclear components Supervised a teams of 2-3 postdocs and 1-2 staff on projects supported by the U.S. Department of Energy, Office of Nuclear Energy and the Office of Energy Efficiency and Renewable Energy and the U.S. Nuclear Regulatory Agency Managed a research portfolio with greater than$1 million per year in total funding. Initiated several work on high temperature material simulation and qualification through several different NE programs. Initiated funded projects in new topic areas on concentrating solar power and advanced manufacturing Led work on the revision and improvement of several parts of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code, Section III, Division 5 covering the design and construction of high temperature nuclear reactors
2014-2016	**Postdoctoral Researcher**, *Lawrence Livermore National Laboratory* Supervisor: Nathan Barton Research topics: Multiscale material modeling of additively manufactured structured materials, modeling and optimization of lattice-structured meta-materials, multiscale modeling of HCP metals
2010-2014	**Research Assistant**, *University of Illinois at Urbana-Champaign* Supervisor: Robert Dodds, Jr. Research topics: Parallel performance of WARP3D, crystal plasticity, mesoscale modeling of fatigue/fracture processes, homogenization and multiscale damage calculations

Honors/Awards

2012-14	National Defense Science & Engineering Graduate Fellowship
2010-11	University Fellowship
2008-	Tau Beta Pi

Professional Affiliations

2016-	ASME
2016-	ANS
2014-2016	APS
2006-	ASCE, EMI

Professional Service

2018-	Generation IV Forum: Task Group on Advanced Manufacturing and Materials Engineering *co-chair*
2020-	ASME Boiler & Pressure Vessel Code *committee chair*: BPV III WG on Analysis Methods
2018-2020	ASME Boiler & Pressure Vessel Code *committee chair*: BPV III SWG on Inelastic Analysis Methods
2017-	ASME Boiler & Pressure Vessel Code *committee member*: BPV III SG High Temperature Reactors, WG on Analysis Methods, WG High Temperature Flaw Evaluation, WG Creep-Fatigue and Negligible Creep; BPTCS/BNCS Special Committee on Use of Additive Manufacturing for Pressure Retaining Equipment, BVP I/VIII WG on Elevated Temperature Design
2017-	PVP Conference: *Technical Program Representative*, co-Technical Program Representative, Honors and Awards Chair, track co-chair
2018-2019	WCCM/USNCCM: *track organizer*
2021	*Reviewer for (past year)*: Additive Manufacturing, Computer Methods in Applied Mechanics and Engineering, Engineering Fracture Mechanics, Materials Science and Engineering, Journal of Materials Engineering and Performance, PVP Conference Proceedings

Institutional and Community Service

2019-	Library User Committee member
2015-	Volunteer at middle school/high school DOE Science Bowl
2020-	STEM chat volunteer for local elementary and high schools
2017-2018	Undergraduate and graduate student summer research program mentor
2013-2014	Qualification exam review course, course organizer
	PhD committee member for: Alon Katz (Georgia Institute of Technology)

DOE:NE Work Packages Managed

2021-2022	ART: Several work packages – $300k/year
2019-2022	NEAMS: Structural Materials – $300k/year
2020-2021	NDMQi: High Temperature Qualification – $200k/year

Funding Awards

2021-2022	DOE:HPC4Energy: An ICME Modeling Framework for Metal Matrix Composites Focusing on Ultrahigh Temperature Matrix Material with Tungsten Carbide Reinforcement – $300k
2021-2023	DOE:EERE: Design Methods, Tools, and Data for Ceramic Solar Receivers – $955k
2020-2021	DOE:EERE: High Temperature Receiver Design Package – $517k
2019-2020	NRC: Assess State of Knowledge of Modeling and Simulation and Microstructural Analysis for Advanced Manufacturing Technologies (AMTs) – $200k
2019-2021	DOE:NE FOA: Modeling and Simulation Development Pathways to Accelerate KP-FHR Licensing (topic PI) – $500k
2018-2020	DOE:EERE Gen3 CSP: Creep-fatigue design for CSP receivers (topic PI) – $375k
2016	LLNL TechBase: Adaptive smart materials – $65k
2015	LLNL TechBase: Material model library for lattice structured meta-materials – $50k

Other Skills and Qualifications

Languages: German (Proficient)

Publications/Presentations

Refereed journal publications

[1] Aritra Chakraborty and Mark C. Messner. "Bayesian analysis for estimating statistical parameter distributions of elasto-viscoplastic material models". In: *Probabilistic Engineering Mechanics* 66 (2021), p. 103153.

[2] Aritra Chakraborty, Mark C. Messner, and T.-L. Sham. "A minimum creep rate for 2-1/4Cr-1Mo steel consistent with the ASME Section III, Division 5 rules". In: *Journal of Pressure Vessel Technology* 134.4 (2021), p. 044502.

[3] A. M. Katz, M. Messner, and Davesh Ranjan. "A novel approach for bounding the stress experienced by the core of utility-scale printed circuit heat exchangers under thermohydraulic loads". In: *Journal of Pressure Vessel Technology* (2021).

[4] Andrea Nicolas, Mark Messner, and T.-L. Sham. "A method for predicting failure statistics for steady state elevated temperature components". In: *International Journal of Pressure Vessels and Piping* 192 (2021), p. 104363.

[5] Andrea Rovinelli et al. "Accurate effective stress measures: Predicting creep life for 3D stresses using 2D and 1D creep rupture simulations and data". In: *Integrating Materials and Manufacturing Innovation* (2021).

[6] M. C. Messner. "Convolutional neural network surrogate models for the mechanical properties of periodic structures". In: *Journal of Mechanical Design* 142.2 (2020).

[7] Dileep Singh et al. "One piece ceramic heat exchanger for concentrating solar power electric plants". In: *Renewable Energy* 160 (2020), pp. 1308–1315.

[8] M. C. Messner, V.-T. Phan, and T.-L. Sham. "Evaluating and modeling rate sensitivity in advanced reactor structural materials: 316H, Gr. 91, and A617". In: *International Journal of Pressure Vessels and Piping* 178 (2019), p. 103997.

[9] M. C. Messner et al. "A Method for Including Diffusive Effects in Texture Evolution". In: *Journal of the Mechanics and Physics of Solids* 125 (2019), pp. 785–804.

[10] M. C. Messner et al. "Combined Crystal Plasticity and Grain Boundary Modeling of Creep in Ferritic-Martensitic Steels, Part 2: The Effect of Stress and Temperature on Engineering and Microstructural Properties". In: *Modelling and Simulation in Materials Science and Engineering* 27.7 (2019), p. 075010.

[11] Omar Nassif et al. "Combined Crystal Plasticity and Grain Boundary Modeling of Creep in Ferritic-Martensitic Steels, Part 1: Theory and Implementation". In: *Modelling and Simulation in Materials Science and Engineering* 27.7 (2019), p. 075009.

[12] Julie A Jackson et al. "Field responsive mechanical metamaterials". In: *Science Advances* 4.12 (2018), eaau6419.

[13] H. D. Carlton et al. "Mapping local deformation behavior in single cell metal lattice structures". In: *Acta Materilia* 129 (2017), pp. 239–250.

[14] M. C. Messner et al. "A crystal plasticity model for slip resistance and junction formation in HCP metals". In: *Modelling and Simulation in Materials Science and Engineering* 25.4 (2017), p. 044001.

[15] Mark C Messner. "A fast, efficient direct slicing method for slender member structures". In: *Additive Manufacturing* 18 (2017), pp. 213–220.

[16] J. A. Hawreliak et al. "Dynamic Behavior of Engineered Lattice Materials". In: *Scientific Reports* 6 (2016).

[17] M. C. Messner. "Optimal lattice-structured materials". In: *Journal of the Mechanics and Physics of Solids* 96 (2016), pp. 162–183.

[18] M. C. Messner, A. J. Beaudoin, and R. H. Dodds, Jr. "A grain boundary damage model for delamination". In: *Computational Mechanics* 56 (2015), pp. 1–20.

[19] M. C. Messner, R. H. Dodds, Jr., and A. J. Beaudoin. "Consistent crystal plasticity kinematics and linearization for the implicit finite element method". In: *Engineering Computations* 32.6 (2015), pp. 1526–1548.

[20] M. C. Messner et al. "Wave propagation in equivalent continuums representing truss lattice materials". In: *International Journal of Solids and Structures* 73-74 (2015), pp. 55–66.

[21] M.C. Messner, A. J. Beaudoin, and R. H. Dodds, Jr. "An interface compatibility/equilibrium mechanism for delamination fracture in aluminum-lithium alloys". In: *Engineering Fracture Mechanics* 133 (2015), pp. 70–84.

[22] M.C. Messner, A. J. Beaudoin, and R. H. Dodds, Jr. "Mesoscopic modeling of crack arrestor delamination in Al-Li: Primary crack shielding and T-stress effect". In: *International Journal of Fracture* 188.2 (2014), pp. 229–249.

Pending refereed journal publications

[23] B. Barua et al. "Designing Cladded Components for High Temperature Nuclear Service Part-2: Design Rules". In: *Submitted for publication* (2021).

[24] Holly D. Carlton et al. "Incorporating defects into model predictions of metal lattice-structured materials". In: *Submitted for publication* (2021).

[25] M. C. Messner et al. "Designing Cladded Components for High Temperature Nuclear Service Part-1: Analysis Method". In: *Submitted for publication* (2021).

[26] Mark Messner, Guosheng Ye, and T.-L. Sham. "A Structural Design Approach Tailored for the Rapid, Preliminary Design of Microreactor Components". In: *Submitted for publication* (2021).

Refereed conference publications

[27] B. Barua, R. I. Jetter, and T.-L. Sham. "Simplified Criteria with Reduced Testing Effort for Selecting Clad Materials for High Temperature Reactor Structural Components". In: *ASME 2021 Pressure Vessels and Piping Conference*. American Society of Mechanical Engineers. 2021.

[28] Bipul Barua and Mark Messner. "Fast Heuristics for Receiver Life Estimation and Design". In: *27th SolarPACES Conference*. 2021.

[29] David Dewees et al. "Comparison of candidate steady loading elevated temperature design-by-analysis methods". In: *ASME 2021 Pressure Vessels and Piping Conference*. American Society of Mechanical Engineers. 2021.

[30] Michael McMurtrey and M. Messner. "Qualification Challenges for Additive Manufacturing in High Temperature Nuclear Applications". In: *ASME 2021 Pressure Vessels and Piping Conference*. American Society of Mechanical Engineers. 2021.

[31] M. C. Messner and T.-L. Sham. "A Viscoplastic Model for Alloy 617 for use with the ASME Section III, Division 5 Design by Inelastic Analysis Rules". In: *ASME 2021 Pressure Vessels and Piping Conference*. American Society of Mechanical Engineers. 2021.

[32] Andrea Nicolas, Mark Messner, and T.-L. Sham. "A Probabilistic Margin Assessment of the ASME Section III, Division 5 Primary Load Design Rules for Class A Components". In: *ASME 2021 Pressure Vessels and Piping Conference*. American Society of Mechanical Engineers. 2021.

[33] Andrea Rovinelli, Mark Messner, and T.-L. Sham. "A Comprehensive Comparison between Different Multiaxial Cycle Counting Procedures". In: *ASME 2021 Pressure Vessels and Piping Conference*. American Society of Mechanical Engineers. 2021.

[34] B. Barua et al. "Acceptance Criteria for the Mechanical Integrity of Clad/Base Metal Interface for High Temperature Nuclear Reactor Cladded Components". In: *ASME 2020 Pressure Vessels and Piping Conference*. American Society of Mechanical Engineers. 2020.

[35] B. Barua et al. "Development of Design Method for High Temperature Nuclear Reactor Cladded Component". In: *ASME 2020 Pressure Vessels and Piping Conference*. American Society of Mechanical Engineers. 2020.

[36] B. Barua et al. "Selection Criteria for Clad Materials to Use with a 316H Base Material for High Temperature Nuclear Reactor Cladded Components". In: *ASME 2020 Pressure Vessels and Piping Conference*. American Society of Mechanical Engineers. 2020.

[37] Bipul Barua, Mark Messner, and Dileep Singh. "Assessment of Ti3SiC2 MAX Phase as a Structural Material for High Temperature Receivers". In: *26th SolarPACES Conference*. 2020.

[38] Aritra Chakraborty, M. C. Messner, and T.-L. Sham. "Uncertainty quantification of viscoplastic parameters for Grade 91 steel through Bayesian analysis". In: *ASME 2020 Pressure Vessels and Piping Conference*. American Society of Mechanical Engineers. 2020.

[39] M. C. Messner, R.I. Jetter, and T.-L. Sham. "A High Temperature Primary Load Design Method Based on Elastic Perfect-Plasticity and Simplified Inelastic Analysis". In: *ASME 2020 Pressure Vessels and Piping Conference*. American Society of Mechanical Engineers. 2020.

[40] Mark Messner and Bipul Barua. "A Fast Tool for Receiver Life Estimation and Design". In: *26th SolarPACES Conference*. 2020.

[41] Mark Messner, Bipul Barua, and Dileep Singh. "Towards a Design Framework for Nonmetallic Concentrating Solar Power Components". In: *26th SolarPACES Conference*. 2020.

[42] A. Rovinelli, M. C. Messner, and T.-L. Sham. "Investigating the Correlation Between Different Effective Stress Measures and the Service Life of Actual High Temperature Structural Components". In: *ASME 2020 Pressure Vessels and Piping Conference*. American Society of Mechanical Engineers. 2020.

[43] B. Barua, M. C. Messner, and M. McMurtrey. "Comparison and Assessment of the Creep-fatigue Design Methods for a Reference Gen3 Molten Salt Concentrated Solar Power Receiver". In: *ASME 2019 Pressure Vessels and Piping Conference*. American Society of Mechanical Engineers. 2019.

[44] B. Barua et al. "Design Methodologies for High Temperature Reactor Structural Components Cladded with Noncompliant Materials". In: *ASME 2019 Pressure Vessels and Piping Conference*. American Society of Mechanical Engineers. 2019.

[45] M. C. Messner, R. I. Jetter, and T.-L. Sham. "A Method for Directly Assessing Elastic Follow up in 3D Finite Element Calculations". In: *ASME 2019 Pressure Vessels and Piping Conference*. American Society of Mechanical Engineers. 2019.

[46] M. C. Messner and T.-L. Sham. "Isochronous Stress-Strain Curves for Alloy 617". In: *ASME 2019 Pressure Vessels and Piping Conference*. American Society of Mechanical Engineers. 2019.

[47] V.-T. Phan, M. C. Messner, and T.-L. Sham. "A Unified Engineering Inelastic Model for 316H Stainless Steel". In: *ASME 2019 Pressure Vessels and Piping Conference*. American Society of Mechanical Engineers. 2019.

[48] Y. Wang et al. “Development of Simplified Model Test Methods for Creep Fatigue Interaction”. In: *ASME 2019 Pressure Vessels and Piping Conference*. American Society of Mechanical Engineers. 2019.

[49] M. C. Messner, R. I. Jetter, and T.-L. Sham. “Establishing Temperature Upper Limits for the ASME Section III, Division 5 Design by Elastic Analysis Methods”. In: *ASME 2018 Pressure Vessels and Piping Conference*. American Society of Mechanical Engineers. 2018.

[50] M. C. Messner, V.-T. Phan, and T.-L. Sham. “A Unified Inelastic Constitutive Model for the Average Engineering Response of Grade 91 Steel”. In: *ASME 2018 Pressure Vessels and Piping Conference*. American Society of Mechanical Engineers. 2018.

[51] M. C. Messner and T.-L. Sham. “Detection of Ratcheting in Finite Element Calculations”. In: *ASME 2018 Pressure Vessels and Piping Conference*. American Society of Mechanical Engineers. 2018.

[52] M. C. Messner, T.-L. Sham, and Yanli Wang. “N-bar Problems as Approximations to the Bree Problem”. In: *ASME 2018 Pressure Vessels and Piping Conference*. American Society of Mechanical Engineers. 2018.

[53] M. C. Messner et al. “A Basis for Applying Elastic Perfectly-Plastic Design Methods to Cyclic Softening Materials”. In: *ASME 2018 Pressure Vessels and Piping Conference*. American Society of Mechanical Engineers. 2018.

[54] M. C. Messner et al. “Assessment of Passively Actuated In-Situ Cyclic Surveillance Test Specimens for Advanced Non-Light Water Reactors”. In: *ASME 2018 Pressure Vessels and Piping Conference*. American Society of Mechanical Engineers. 2018.

[55] M. C. Messner et al. “The Mechanical Interaction of Clad and Base Metal for Molten Salt Reactor Structural Components”. In: *ASME 2018 Pressure Vessels and Piping Conference*. American Society of Mechanical Engineers. 2018.

[56] M. C. Messner et al. “The Role of Material Modeling on Strain Range Evaluation for Elevated Temperature Cyclic Life Evaluation”. In: *ASME 2018 Pressure Vessels and Piping Conference*. American Society of Mechanical Engineers. 2018.

[57] M. C. Messner, T.-L. Sham, and R. I. Jetter. “Verification of the EPP code case for strain limits evaluations by inelastic analysis method”. In: *Proceedings of the ASME 2017 Pressure Vessels and Piping Conference*. Vol. PVP2017-65418. 2017, pp. 1–10.

[58] M. C. Messner et al. “Modeling shocks in periodic lattice materials”. In: *AIP Conference Proceedings*. 1793. 2017, p. 080012.

[59] Y. Wang et al. “Combined load and displacement controlled testing to support development of simplified component design rules for elevated temperature service”. In: *Proceedings of the ASME 2017 Pressure Vessels and Piping Conference*. PVP2017-65455. 2017, pp. 1–6.

Patents

[60] Julie A Jackson et al. “Systems and methods for additive manufacturing to encapsulate transformative colloidal suspensions”. 10,661,549 (United States). 2020.

[61] Mark Christian Messner. “A fast, efficient direct slicing method for lattice structures”. 10,723,079 (United States). 2020.

Non-refereed publications

[62] B. Barua et al. *Draft Rules for Alloy 617 Creep-Fatigue Design using an EPP+SMT Approach*. Tech. rep. ANL-ART-227. Argonne National Laboratory, 2021.

[63] M. Messner and T.-L. Sham. *Preliminary Procedures and Acceptance Criteria for in situ Structural Materials Surveillance for MSR*. Tech. rep. ANL-ART-229. Argonne National Laboratory, 2021.

[64] M. Messner and T.-L. Sham. *Reference constitutive model for Alloy 617 and 316H stainless steel for use with the ASME Division 5 design by inelastic analysis rules*. Tech. rep. ANL-ART-225. Argonne National Laboratory, 2021.

[65] M. Messner et al. *Microstructural Model for Creep-Fatigue Interaction in Grade 91 Steel*. Tech. rep. ANL-ART-218. Argonne National Laboratory, 2021.

[66] Mark Messner, Ting-Leung Sham, and Bipul Barua. *Identifying Limitations of ASME Section III Division 5 for Advanced SMR Designs*. Tech. rep. ANL-21/27. Argonne National Laboratory, 2021.

[67] Mark Messner et al. *Fabrication and Testing of Two Passively Actuated Creep-Fatigue Surveillance Test Articles*. Tech. rep. ANL-ART-228. Argonne National Laboratory, 2021.

[68] A. Nicolas, M. Messner, and T.-L. Sham. *Comprehensive Margin Assessment of the ASME Section III, Division 5, Class A Primary Load Design Rules*. Tech. rep. ANL-ART-226. Argonne National Laboratory, 2021.

[69] A. Rovinelli, A. Venkataraman, and M. Messner. *Initial framework for engineering-scale statistical creep-fatigue modeling*. Tech. rep. ANL-21/33. Argonne National Laboratory, 2021.

[70] A. Venkataraman and Messner M. *An initial framework for the rapid qualification of long-term creep rupture strength via microstructural modeling*. Tech. rep. ANL-21/34. Argonne National Laboratory, 2021.

[71] Guosheng Ye and Mark Messner. *Assessing the ASME Section III, Division 5, Class A Primary Load Design Rules against Creep Notch Effects*. Tech. rep. ANL-21/25. Argonne National Laboratory, 2021.

[72] Nicolas Andrea et al. *Survey of Modeling and Simulation Techniques for Predicting Initial Microstructures for Advanced Manufacturing Technologies*. Tech. rep. ANL-20/21. Argonne National Laboratory, 2020.

[73] B. Barua et al. *Preliminary description of a new creep-fatigue design method that reduces over conservatism and simplifies the high temperature design process*. Tech. rep. ANL-ART-194. Argonne National Laboratory, Sept. 2020.

[74] Bipul Barua et al. *Design Guidance for High Temperature Concentrating Solar Power Components*. Tech. rep. ANL-20/03. Argonne National Laboratory, 2020.

[75] Aritra Chakraborty, M. Messner, and T.-L. Sham. *Initial development of a method for correlating indentation test results to damage accumulation in high temperature structural materials*. Tech. rep. ANL-ART-199. Argonne National Laboratory, Aug. 2020.

[76] M. Messner and T.-L. Sham. *An Initial Assessment of the Design Margins of Different ASME Section III, Division 5 Design Rules*. Tech. rep. 2020. Argonne National Laboratory, Sept. 2020.

[77] M. Messner and T.-L. Sham. *Initial High Temperature Inelastic Constitutive Model for Alloy 617*. Tech. rep. ANL-ART-195. Argonne National Laboratory, Aug. 2020.

[78] Mark Messner and T.-L. Sham. *Initial development and verification of a primary load design method based on elastic-perfectly plastic analysis*. Tech. rep. ANL-ART-201. Argonne National Laboratory, July 2020.

[79] Mark Messner et al. *Initial development of an in-situ, passive material surveillance test article for monitoring high temperature reactor structural components*. Tech. rep. ANL-ART-198. Argonne National Laboratory, Sept. 2020.

[80] Lynn Brendon Munday et al. *Multiscale-Informed Modeling of High Temperature Component Response with Uncertainty Quantification*. Tech. rep. INL/EXT-20-59795. Idaho National Laboratory, Sept. 2020.

[81] Andrea Nicolas, Mark Messner, and T.-L. Sham. *Initial development of a high temperature life prediction method directly accounting for variability in material properties*. Tech. rep. 2020. Argonne National Laboratory, Sept. 2020.

[82] Andrea Nicolas, Mark Messner, and T.-L. Sham. *Preliminary design analysis workflow for Division 5 HHA-3200 requirements for graphite core components*. Tech. rep. ANL-ART-197. Argonne National Laboratory, Aug. 2020.

[83] Andrea Nicolas, Noah Paulson, and Mark Messner. *Survey of Methods for Predicting Material Performance from Material Microstructure for Advanced Manufacturing Technologies*. Tech. rep. ANL-20/40. Argonne National Laboratory, Aug. 2020.

[84] A. Rovinelli and M. Messner. *Identify the influence of microstructure on mesoscale creep and fatigue damage*. Tech. rep. ANL-20/49. Argonne National Laboratory, Sept. 2020.

[85] A. Rovinelli, M. Messner, and T.-L. Sham. *Initial microstructural model for creepfatigue damage in Grade 91 steel*. Tech. rep. ANL-ART-202. Argonne National Laboratory, Sept. 2020.

[86] Guosheng Ye, Mark Messner, and T.-L. Sham. *Example Evaluation of a Representative Heat Pipe Test Article Design for Structural Acceptability using ASME Design Rules*. Tech. rep. ANL-ART-200. Argonne National Laboratory, Sept. 2020.

[87] Guosheng Ye, Mark Messner, and T.-L. Sham. *Sample problems for Section III, Division 5 design by inelastic analysis of Grade 91 components*. Tech. rep. ANL-ART-204. Argonne National Laboratory, Sept. 2020.

[88] Robert I. Jetter et al. *Background Information for Addressing Adequacy or Optimization of ASME Section III, Division 5 Rules for Metallic Components*. American Society of Mechanical Engineers, 2019.

[89] Robert I. Jetter et al. *Gap Analysis for Addressing Adequacy or Optimization of ASME Section III, Division 5 Rules for Metallic Components*. American Society of Mechanical Engineers, 2019.

[90] M. C. Messner, V.-T. Phan, and T.-L. Sham. *Development of the Technical Basis of a Unified Viscoplastic Model of 316H Stainless Steel for Incorporation into ASME Division 5*. Tech. rep. ANL-ART-166. Argonne National Laboratory, 2019.

[91] M. C. Messner and T.-L. Sham. *Development of a Multiaxial Deformation Measure and Creep-Fatigue Damage Summation for Multiple Load Cycle Types in Support of an Improved Creep-Fatigue Design Methods*. Tech. rep. ANL-ART-164. Argonne National Laboratory, 2019.

[92] M. C. Messner and T.-L. Sham. *Draft ASME Section III Division 5 Code Cases to Extend EPP Strain Limits and Creep-Fatigue Design Methods to Grade 91*. Tech. rep. ANL-ART-165. Argonne National Laboratory, 2019.

[93] M. C. Messner and T.-L. Sham. *Inelastic Analysis Procedure based on the Grade 91 Unified Viscoplastic Constitutive Model for ASME Implementation*. Tech. rep. ANL-ART-167. Argonne National Laboratory, 2019.

[94] M. C. Messner et al. *Initial Development of an Improved Creep-Fatigue Design Method that Avoids the Separate Evaluation of Creep and Fatigue Damage and Eliminates the Requirement for Stress Classification*. Tech. rep. ANL-ART-168. Argonne National Laboratory, 2019.

[95] A. Rovinelli et al. *Initial Study of Notch Sensitivity of Grade 91 using Mechanisms Motivated Crystal Plasticity Finite Element Method*. Tech. rep. ANL-ART-171. Argonne National Laboratory, 2019.

[96] Y. Wang et al. *Report on FY19 Testing in Support of Grade 91 Core Block Code Case*. Tech. rep. ORNL/TM-2019/1280. Oak Ridge National Laboratory, 2019.

[97] M. C. Messner, V.-T. Phan, and T.-L. Sham. *Development of Grade 91 inelastic model for incorporation in ASME Division 5*. Tech. rep. ANL-ART-137. Argonne National Laboratory, 2018.

[98] M. C. Messner and T.-L. Sham. *Development of ASME Division 5 Code proposal on temperature limits for simplified design methods*. Tech. rep. ANL-ART-132. Argonne National Laboratory, 2018.

[99] M. C. Messner and T.-L. Sham. *Initial development and extension of EPP methods to Grade 91*. Tech. rep. ANL-ART-133. Argonne National Laboratory, 2018.

[100] M. C. Messner and Y. Yu. "Multiphysics Simulation of Thermal Striping for Determining Creep-Fatigue Life". In: *Transactions of the American Nuclear Society* 118 (2018), pp. 1439–1441.

[101] M. C. Messner, X. Zhang, and T.-L. Sham. *Report on the completion of the development of processing map from as-cast Alloy 709 materials*. Tech. rep. ANL-ART-142. Argonne National Laboratory, 2018.

[102] M. C. Messner et al. *Evaluation of methods to determine strain ranges for use in SMT design curves*. Tech. rep. ANL-ART-138. Argonne National Laboratory, 2018.

[103] M. C. Messner et al. *Evaluation of statistical variation of microstructural properties and temperature effects on creep fracture of Grade 91*. Tech. rep. ANL-ART-143. Argonne National Laboratory, 2018.

[104] M. C. Messner et al. *Finite element analysis of compliant cladding and base metal systems*. Tech. rep. ANL-ART-134. Argonne National Laboratory, 2018.

[105] R. I. Jetter et al. *Report on an Assessment of the Application of EPP Results from the Strain Limit Evaluation Procedure to the Prediction of Cyclic Life Based on the SMT Methodology*. Tech. rep. ANL-ART-96. Argonne National Laboratory, 2017.

[106] M. C. Messner, V. T. Phan, and T.-L. Sham. *FY17 Status Report on the Initial Development of a Constitutive Model for Grade 91 Steel*. Tech. rep. ANL-ART-93. Argonne National Laboratory, 2017.

[107] M. C. Messner and T.-L. Sham. *FY17 Status Report on the Initial EPP Finite Element Analysis of Grade 91 Steel*. Tech. rep. ANL-ART-94. Argonne National Laboratory, 2017.

[108] M. C. Messner et al. *FY17 Status Report on the Micromechanical Finite Element Modeling of Creep Fracture of Grade 91 Steel*. Tech. rep. ANL-ART-95. Argonne National Laboratory, 2017.

[109] Y. Wang, M. C. Messner, and T.-L. Sham. *FY17 Status Report on Testing Supporting the Inclusion of Grade 91 Steel as an Acceptable Material for Application of the EPP Methodology*. Tech. rep. ORNL/TM2017/388. Oak Ridge National Laboratory, 2017.

[110] Brian Healy et al. *WARP3D release 17.0: 3-D dynamic nonlinear fracture analyses of solids using parallel computers*. Civil Engineering Studies Structural Research Series No. 607. University of Illinois at Urbana-Champaign, 2011.

Invited talks

[111] M. C. Messner. "High Temperature Receiver Design and Analysis Package". In: *DOE Gen 3 CSP Summit*. 2021.

[112] M. C. Messner. "Simulating high temperature structural failure in NEML". In: *Air Force Research Laboratory Seminar*. 2021.

[113] M. C. Messner. "Rapid qualification of high temperature reactor structural materials". In: *Nuclear Regulatory Commission Standards Forum*. 2020.

[114] M. C. Messner. "Rapid Qualification of New Materials Using Modeling and Simulation". In: *Nuclear Regulatory Commission Workshop on Advanced Manufacturing Technologies for Nuclear Applications*. 2020.

[115] M. C. Messner. "Structural challenges for high temperature receivers". In: *Next Generation Receivers Workshop*. 2020.

[116] M. C. Messner. "The interaction of environmental effects and mechanical damage in high temperature structural components". In: *NRC Advanced Non-Light Water Reactors – Materials and Component Integrity Workshop*. 2019.

[117] M. C. Messner. "Predicting long-term properties of nuclear reactor structural materials using physically-based models". In: *University of Wisconsin Applied Materials Division Seminar Series*. 2018.

[118] M. C. Messner. "The mechanics of lattice-structured materials". In: *ASME 2017 International Mechanical Engineering Congress & Exposition*. 2017.

[119] M. C. Messner. "Understanding the link between processing, structure, and performance in additively manufactured lattice materials". In: *New Industrial and Scientific Opportunities for Structural Materials: Data, Modeling, Manufacturing*. 2016.

[120] M. C. Messner, A. J. Beaudoin, and R. H. Dodds, Jr. "A multiscale model for delamination fracture in Al-Li alloys". In: *IUTAM Symposium on Ductile Fracture and Localization*. 2015.

Numerous conference presentations