

FARHANG POURBOGHRAAT

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Dept. of Integrated Systems Eng.
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RESEARCH:

Research Interests Include: Multiscale Computational Modeling of Natural Fiber Reinforced Thermoplastics, Metal Sheet and Tube Hydroforming, FRT Composite Sheet Thermo-Hydroforming, Incremental Sheet Forming, Phenomenological and Crystal Plasticity Modeling of Metals, Solid State Polymer Process Modeling, Temperature Dependent Material Behavior, Forming Limit Diagrams (FLD).

EDUCATION:

Ph.D. Mechanical Engineering - University of Minnesota, 1992
MS Mechanical Engineering - University of Iowa, 1983
BS Mechanical Engineering - University of Iowa, 1981

PROFESSIONAL EXPERIENCES:

The Ohio State University:

Professor and Chair, Integrated Systems Engineering Department (6/2017 - present)
Professor, Integrated Systems Engineering Department (8/2015 - present)
Professor, Mechanical and Aerospace Engineering Department (8/2015 - present)

Michigan State University:

Professor, Mechanical Engineering Department (6/2009-8/2015)
Associate Professor, Mechanical Engineering Department (7/2005-6/2009)

Rice University:

Visiting Associate Professor, Mechanical Engineering and Materials Science Department (1/2005-6/2005)

Michigan State University:

Associate Professor, Mechanical Engineering Department (6/2003-12/2004)
Assistant Professor, Mechanical Engineering Department (1/1998-6/2003)

Alcoa Technical Center:

Staff Scientist (9/1990-12/1997)

University of Minnesota:

Graduate Research and Teaching Assistant (9/1983-9/1990)

TEACHING EXPERIENCES:

The Ohio State University (2015 – present):

- Taught the following graduate course:
ISE 7510: Computational Analysis of Manufacturing Processes

Michigan State University ('98- 2015):

- Taught the following undergraduate and graduate courses:
ME 222: Mechanics of Materials
ME 371: Design of Machinery
ME 471: Fundamentals of Machine Elements
EGR 475: Special Topics in International Engineering
ME 481: Mechanical Engineering Capstone Design
ME 874: Fundamentals of Manufacturing and Metal Forming Processes

University of Minnesota ('84-'90):

- Instructor for *System Control-Analog Concepts* (ME 5273- D4). Responsibilities included lecturing, conducting labs, and preparing homework and exams.
- Teaching assistant for *Engineering Materials and Processing* (ME 5260), *Machine Design* (ME 3205), *System Dynamics* (ME 3201), *Computer Aided Design* (ME 5221), and *Engineering Graphics* (ME 1025).

University of Iowa ('82-'83):

- Teaching assistant for the *Numerical Calculations* class. Responsibilities included grading homework and exams.

EDITORIAL ADVISORY BOARD:

- **NUMISHEET – International Conference and Workshop on Numerical Simulation of 3D Sheet Forming Processes**
- **RECENT PATENTS ON ENGINEERING** – *Bentham Science Publishers* (<http://www.bentham.org/eng/EBM.htm>). (Ended in 2015)

AWARDS/HONORS

- Recipient of the 2015 *USCAR Team Award* – in recognition of contributions and collaboration as a member of the USAMP Third-Generation Advanced High Strength Steel Team.
- Recipient of 2002 *John D. and Dortha J. Withrow Teaching Excellence Award* at MSU.

- ❑ Pourboghraat, F. and Jayaraman, K., 2007, “Modeling and Experimental Characterization of Long-term Performance of Polymeric Liner in Total Hip Joint Replacements” *Intramural Research Grant – New Direction, \$56,625*, at MSU.
- ❑ Pourboghraat, F., 2004, “Manufacturing and Modeling of Multi-Material, Multi-Layered Structures Utilizing Bio-Composites,” *MSU Research Excellence Fund, \$80,000* at MSU.
- ❑ Pourboghraat, F., 2000, "Thermo-hydroforming – A Novel Manufacturing Method for Composites Materials," *MSU Research Excellence Fund, \$30,000* at MSU.
- ❑ Pourboghraat, F., 1998, "Hydroforming of Composite Materials," *MSU Research Excellence Fund, \$10,000* at MSU.

INSTITUTIONAL SERVICES:

The Ohio State University (2015 – present)

- ❑ ISE Strategic Planning Committee (2015 -)
- ❑ OSU/TUD Graduate Certificate in Manufacturing (2015 -)
- ❑ Honda SimCenter Board Member (2015 -)
- ❑ Chair of the P&T committee (2016 -)
- ❑ Chair of the Manufacturing Faculty Search Committee for ISE Dept. (2016)
- ❑ Member of the Manufacturing Faculty Search Committee for ISE Dept. (2015)

Michigan State University ('98 – 2015)

- ❑ Faculty Search Committee for ME Dept. (2015)
- ❑ ME Department – Peer Evaluation Committee (2014)
- ❑ Faculty Search Committee for CEE Dept. (2013)
- ❑ Faculty Search Committee for ME Dept. (2013)
- ❑ Teaching Specialist Search Committee for ME Dept. (2013)
- ❑ ME Department – Peer Evaluation Committee (2013)
- ❑ ME Department – Faculty Promotion Support Team (2013)
- ❑ ME Department – Chair of the Undergraduate Curriculum Committee (2013 -)
- ❑ MSU – University Academic Integrity Hearing Board (2012 -)
- ❑ College of Engineering – Faculty Mentoring Committee (2011 – 2013)
- ❑ ME Department - Strategic Planning Committee (2008 – 2010)
- ❑ Member of the Search Committee for Director of School of Packaging (2008)

- ❑ Chair of the Faculty Search Committee for Composite Vehicle Research Center (2007)
- ❑ Chair of the Award Committee (2007 – 2008)
- ❑ Honors College Advising (2003 – 2005)
- ❑ Graduate Studies Committee (2001 – 2006)
- ❑ Manufacturing Faculty Search Committee (2002 - 2003)
- ❑ ME Senior Manufacturing Faculty Search Committee (2001)
- ❑ ME271 Planning Committee (new manufacturing course) – (1998 – 1999)
- ❑ ABET 2000 Committee (1998 – 1999)
- ❑ Honors Program in Mechanical Engineering (1998 –1999)
- ❑ Manufacturing Faculty Search Committee (1999 - 2000)
- ❑ Design Group Committee (1999 - 2000)
- ❑ ME Manufacturing Faculty Search Committee (1998 - 1999)
- ❑ Manufacturing Engineering & Business Management in Manufacturing Committee (1998 – 2002)

PROFESSIONAL SERVICES:

- ❑ Research Advisory Board – Center for Design and Manufacturing Excellence (CDME) – Ohio State University (2015 -)
- ❑ Faculty Steering Board – Simulation Innovation and Modeling Center (SIMCenter) – Ohio State University (2015 -)
- ❑ Member of the Steering and Scientific Committee of the 10th International Conference and Workshop on Numerical Simulation of 3D Sheet Forming Processes (Numisheet 2016), Bristol, UK.
- ❑ Member of the Steering and Scientific Committee of the 9th International Conference and Workshop on Numerical Simulation of 3D Sheet Forming Processes (Numisheet 2014), Melbourne, Australia.
- ❑ Member of the Scientific Committee of Numiform 2010, the 10th International Conference on Numerical Methods in Industrial Forming Processes, to be held in Pohang University of Science and Technology, Korea.
- ❑ Member of the International Scientific Committee of the 9th International Conference on Technology of Plasticity (ICTP 2008) held in Gyeongju, Korea.
- ❑ Member of the Steering Committee of the 7th International Conference and Workshop on Numerical Simulation of 3D Sheet Forming Processes (Numisheet 2008) held in Interlaken, Switzerland.
- ❑ Organizer (with Dr. John Carsley of GM, and Prof. Stelios Kyriakides at UT-Austin) of Materials Processing and Manufacturing Symposium at the ASME

Applied Mechanics and Materials Conference (McMAT07), June 3-7, 2007, University of Texas at Austin, Texas.

- Chairman and organizer of the 6th International Conference and Workshop on Numerical Simulation of 3D Sheet Forming Processes (Numisheet 2005) held in Detroit Michigan, USA in 2005. Co-organizers: Drs. Jeong-Whan Yoon (Alcoa), Thomas Stoughton (GM), and Lorenzo Smith (Oakland University).
- Organizer (with Dr. Jeong-Whan Yoon; Alcoa) of a mini-symposia on “Metal Forming: Mechanics and Materials” at the Plasticity05 conference, at Kauai, Hawaii, January 5th, 2005.
- Host of the North American Deep Drawing Research Group (NADDRG) fall meeting at Michigan State University, October 26-28, 2004.
- NSF Review Panel – CMMI, 2016
- NSF Review Panel – CMMI, 2012
- NSF Review Panel – Materials Processing, 2010
- NSF Review Panel – Metal Forming, 2007
- NSF Review Panel – Metal Forming, 2004
- NSF Review Panel – Metal Forming, 2003
- Organizer of a mini-symposia on “Numerical and Experimental Issues in Sheet Metal Forming” at the Numiform 2004 conference, at Ohio State University.
- Organizer of “Instability in Manufacturing Processes” Symposium - 2003 ASME Summer Meeting.
- Served as Member of the International Technical Committee, the 5th International Conference and Workshop on Numerical Simulation of 3D Sheet Forming Processes (Numisheet 2002), 21-25 October 2002, Jeju (Cheju) Island, Korea.
- Served as Member of the International Technical Committee, the 4th International Conference and Workshop on Numerical Simulation of 3D Sheet Forming Processes (Numisheet ‘99), 13-17 September 1999, Besancon, France.
- Session chair at the 5th U.S. National Congress on Computational Mechanics (USNCCM V), August 1999, Boulder, CO.
- Session chair at the 7th International Symposium on Plasticity and Its Current Applications, January 6-13, 1999, Cancun, Mexico.
- Session chair at the 6th International Symposium on Plasticity and Its Current Applications, July 14-18, 1997, Juneau, Alaska.
- Session chair at the 3rd U.S. National Congress on Computational Mechanics (USNCCM III), June 1995, Dallas.
- Session chair at the 2nd U.S. National Congress on Computational Mechanics (USNCCM II), August 1993, Washington D.C.

Reviewer of following journals:

- *International Journal of Plasticity*
- *The ASME Journal of Engineering for Industry*
- *The ASME Journal of Manufacturing Science and Engineering*
- *The ASME Journal of Engineering Materials and Technology*
- *The International Journal of Mechanical Sciences*
- *The International Journal of SOLIDS and STRUCTURES*
- *The International Journal of Machine Tool and Manufacture*
- *The ASME Journal of Vibration and Acoustics*
- *The Society of Automotive Engineers (SAE).*
- *Composites A*
- *Composites B*

PROFESSIONAL SOCIETY MEMBERSHIP:

- Senior member of the American Society of Mechanical Engineers (ASME).
- Member of the *Sigma Xi* technical honor society.
- Member of the ASME Instabilities in Solids and Structures Committee.

PROFESSIONAL CONSULTING:

- Edison Welding Institute, (2015 - 2017)
- Van Dyke, Gardner, Linn & Burkhart, LLP (2003)
- Varnum, Riddering, Schmidt, Howlett, LLP (2004)

ADVISEES:

- **M.S. (with project): 3**
Muhammad Faisal Zafar (12/99)
James Moore (12/07)
Manufacture and Mechanical Testing of Kenaf Fiber Reinforced Polypropylene Composites with Aluminum Sheet Faces
- Mohit Patil (10/09)
Comparison of Numerical and experimental results for Stress-Strain Response of Sandwich Kenaf Fiber Reinforced polypropylene composites with Aluminum Sheet Faces
- **M.S. (with thesis): 15**
Yabo Guan. (12/00)
A Cross Section Analysis Finite Element Code for Tube Hydroforming
- Michael Zampaloni (12/00)
Experimental and Numerical Study of Stamp Hydroforming for Processing Glass Mat Fiber Reinforced Thermoplastic Sheets
- Nader Abedrabbo (5/02)
Experimental and Numerical Investigations of Stamp Hydroforming and Ironing of Wrinkling in Sheet Metal Forming
- Naeem Zafar (8/02) – Co-advised with Prof. Ron Averill (ME Department)

Optimization of Tube Hydroforming Process
 Mainsh Sharma (12/02)
Fourier Series Based Implicit FEM Program for Axisymmetric Analysis of Tube Hydroforming
 Sarita Maheedhara (5/22/03)
Alternative Material for Worm Gears in Windshield Wipers and Power Windows
 Nima Salajegheh (8/16/04)
The Theoretical Derivation and Numerical Implementation of Continuum Damage Based Constitutive Equations
 Stacey Yankovic (11/04)
Experimental and Numerical Analysis of Forming Bio-composite Sandwich Materials
 Barbara Nicole Rodgers (12/04)
Multi-Layered Experimental and Numerical Analysis of Stamp Thermoforming Processing of Natural Fiber Reinforced Polypropylene Sheets,
 Jimmy Issa (10/04)
Forming Limit Diagram for Barlat Yld2000 Yield Function
 Shreyas Nagaraj (12/05)
Numerical and Experimental Study of Sheet Bulging Test at Various Strain Rates and Elevated Temperature
 Senthilkumar Venkatesan (5/09)
Quantitative Comparison of Aluminum Alloy Sheet Forming Processes
 Chad P. Glinsky (12/11)
Control Methods for a Continuously Variable Transmission Wind Turbine
 Nick Kuuttila (6/12-8/1/2014)
Composite Thermo-Hydroforming of Military Ballistic Helmets
 Yumeng Li (8/2016) at OSU
Computational Modeling of Lightweight Composite Structures

□ **Ph.D. Graduated: 10**

Rasoul Mohammad Esmailpour (12/18) – OSU
Applying 3D Yield Functions for Finite Element Simulation of Single Point Incremental Forming (SPIF) Using CPFEM and 3D RVE
 Bassam Mohammed (12/17) – MSU
Characterization and Multiscale Crystal Plasticity Modeling of Multiphase Advanced High Strength
 Aboozar Mapar (6/17) - MSU
Crystal Plasticity Modeling of Deformation of BCC Iron and Niobium Single Crystals
 Azadeh Sheidaei (6/15) - MSU
Multi-scale modeling of graphene nano-platelet composites
 Payam Darbandi (06/14) - MSU
Crystal Plasticity Finite Element Analysis of Deformation Behavior in SAC305 solder joint
 Sanjeev Singh (5/09) – Co-advisor A. Mohanty (School of Packaging) - MSU

Green Hybrid Bio-Composites from Polyhydroxy-butyrate-co-valerate (PHBV) Wood Fiber and Talc

Zamiri, Amirreza (8/07) - MSU

Multi Scale Characterization and Modeling of Ductility Limiting Interfacial Damage for Computational Material Design

Abedrabbo, E. Nader (8/05) - MSU

Forming of Aluminum Alloys at Elevated Temperatures

Yabo Guan (5/03) - MSU

Constitutive Modeling for Polycrystalline Aluminum Alloy Extrusions and Application to Hydroforming of Thin-Walled Tubes

Michael Zampaloni (1/03) - MSU

A Multi-Preferred Fiber Orientation Constitutive Model for Continuous Fiber Mat Reinforced Thermoplastics with a Random Orientation Applied to the Stamp Thermo-Hydroforming Process

□ **Ph.D. Candidates: 3**

Madhura Athale (Expected Graduation: 12/2023) - OSU

Amir Asgharzadeh (Expected Graduation: 12/2022) - OSU

Sobhan Nazari Tiji (Expected Graduation: 12/2022) - OSU

□ **Post-Doctoral Researchers and Research Scholars Supervised: 8**

Prof. Woong-Ryeol Yu (1/1/01 – 7/30/03)

Non-orthogonal Constitutive Models for Hydroforming of FRT Composites (Associate Professor at School of Materials Science and Engineering, Seoul National University, Seoul, Korea)

Prof. Sang-Wook Lee (8/15/03 – 8/15/04)

Punchless Piercing of Sheet Metals (Assistant Professor: Department of Mechanical Engineering, Soonchunhyang University, Asan, Choongnam, Korea)

Prof. Michael Zampaloni (6/1/03 - 8/15/07)

Hydroforming of Manifold Sleeve Inserts for Cylinder Heads (Eaton Corporation)

Design and Engineering of Green Composites From Bio-Fibers and Bioplastics (NSF-PREMISE II)

Quantitative Comparison of Aluminum Alloy Sheet Forming Methods (GM Research Lab)

Dr. Amir Zamiri (8/15/07 - 9/03/08)

Viscoelastic material modeling of thermoplastic composite materials (NSF-PREMISE II)

Prof. Mihaela Banu (1/1/11 - 7/01/11)

Enhancement of barrier and mechanical properties of nanoplatelets reinforced biofilms – experimental and computational approach (Professor and Head: Department of Manufacturing, Robotics and Welding Engineering, Dunarea De Jos University of Galati, Romania)

Dr. Taejoon Park (10/1/13 - present) - OSU

Austenite to Martensite Transformation and Crystal plasticity modeling of the third-generation advanced high strength steel (DOE)

Dr. Hyunki Kim (07/1/16 - present) - OSU

Agile Fabrication of Sheet Metal Components with Assured Properties
(DOD/ONR/LIFT)

Dr. Hyunchul Ahn (09/1/16 - present) - OSU

Composite manufacturing and modeling
(Honda R&D)

BOOKS & BOOK CHAPTERS: (2)

1. Computationally efficient crystal plasticity models for polycrystalline materials, Amir Reza Zamiri & Farhang Pourboghtr, ISBN:1243595973, 2011.
2. Effects of elastic modulus on deformation and recrystallization of high purity Nb, D. Baars, H. Jiang, T.R. Bieler, A. Zamiri, F. Pourboghtr, and C. Compton, Applications of Texture Analysis, Ceramic Transactions, American Ceramic Society, Westerville, OH, Vol. 201, June 2008, p. 391–398.

JOURNAL PUBLICATIONS: (74)

1. Taejoon Park, Edmundo Corona, Sharlotte L. Kramer, Benjamin Reedlunn, Farhang Pourboghtr, Hojun Lim “Investigating effects of heterogeneous initial dislocation densities in evolution of plastic anisotropy,” (to be submitted).
2. Taejoon Park, Nicole Aragon, Cuong Nguyen, Pourboghtr, F., and Ill Ryu, “Multiscale Modeling of Plasticity via Defect Dynamics Element Method,” *Modelling and Simulation in Materials Science and Engineering* (in review).
3. R. Esmaeilpour, H. Kim, Asgharzadeh, A., Nazari, S. A. T., and F. Pourboghtr, “Experimental Validation of Using Yld2004-18P Yield Function, Crystal Plasticity Model with Non-Associated Flow Rule for Simulation of Single Point Incremental Forming,” (in review).
4. Ahn, H., Gingerich, M. B., Hahnen, R., Dapino, M. J., and Pourboghtr, F., “Optimization and Mechanical Properties of Reinforced Aluminum Hat Sections for Automotive Applications,” *Journal of Materials Processing Technology*, (in review).
5. Nazari, S. A. T, Asgharzadeh, A., Park, T., Kim, Jihoon, and **Pourboghtr, F.** “Characterization of yield stress surface and strain-rate potential for Tubular Materials using multiaxial tube expansion test method,” *International Journal of Plasticity*, Volume 133, October 2020, 102838.
6. Asgharzadeh, A., Nazari, S. A. T, Park, T., Kim, Jihoon, and **Pourboghtr, F.** “Cellular automaton modeling of the kinetics of static recrystallization in a hydroformed steel tube,” *Journal of Materials Science*, Vol. 55, No. 18, Pages 7938-757 (2020).
7. R. Esmaeilpour, H. Kim, T. Park, **F. Pourboghtr**, A. Agha, F. Abu-Farha, “Effect of hardening law and process parameters on finite element simulation of single point incremental forming (SPIF) of 7075 aluminum alloy sheet,” *Mechanics & Industry* 21, 302 (2020).

8. Asgharzadeh, A., Nazari, S. A. T, Esmailpour, R., and **Pourboghrat, F.** “Prediction of the Flow Behavior in Tubular Aluminum Alloys from Single Hardness Measurement and Developed Empirical Models,” *International Journal of Advanced Manufacturing Technology*, 106(1-2):1-17 (2019).
9. Ahn, H., Kuuttila, E. N. and **Pourboghrat, F.**, “Effects of Pressure, Boundary Conditions, and Cutoff Reliefs in Thermo-Hydroforming of a Fiber-Reinforced Thermoplastic Composite Helmet,” *Journal of Thermoplastic Composite Materials*, (2019).
10. Park, T., Abu-Farha, F., and **Pourboghrat, F.**, “An Evolutionary Yield Function Model Based on Plastic Work and Non-Associated Flow Rule,” *Metals* 2019, 9(5), 611.
11. Park, T., Hector, L. G. Jr., Hu, X., Kim, H., Abu-Farha, F., Esmailpour, R., Fellingner, M. R., **Pourboghrat, F.**, “Crystal Plasticity Modeling of 3rd Generation Multi-phase AHSS with Martensitic Transformation”, *Int. J. of Plasticity*, Volume 120, September 2019, Pages 1-46.
12. Esmailpour, R., Kim, H., Park, T., **Pourboghrat, F.**, Xu, Z., Bassam, A. M. and Abu-Farha, F., “Calibration of Barlat Yld2004-18P Yield Function Using CPFEM and 3D RVE for the Simulation of Single Point Incremental Forming (SPIF) of 7075-O Aluminum Sheet,” *Int. J. of Mechanical Sciences*, 145 (2018) 24-41.
13. Ahn, H., Kuuttila, E. N. and **Pourboghrat, F.**, “Mechanical Analysis of Thermo-Hydroforming of a Fiber-Reinforced Thermoplastic Composite Helmet Using Preferred Fiber Orientation Model,” *Journal of Composite Materials*, 2018, Vol. 52(23) 3183-3198.
14. Bassam, A. M., Park, T., **Pourboghrat, F.**, Esmailpour, R., Abu-Farha, F., “Multiscale Crystal Plasticity Modeling of Multiphase Advanced High Strength Steel,” *Int. J. of Solids and Structures*, 151 (2018) 57-75.
15. Bassam, A. M., Park, T., Kim, H., **Pourboghrat, F.**, Esmailpour, R., “The Forming Limit Curve for Multiphase Advanced High Strength Steels Based on Crystal Plasticity Finite Element Modeling,” *Materials Science and Engineering: A*, Volume 725, 16 May 2018, Pages 250-266.
16. Esmailpour, R., Kim, H., Park, T., **Pourboghrat, F.** and Bassam, A. M., “Comparison of 3D Yield Functions for Finite Element Simulation of Single Point Incremental Forming (SPIF) of Aluminum 7075,” *Int. J. of Mechanical Sciences*, Volume 133, November 2017, Pages 544-554.
17. Mapar, A., Ghassemi-Armaki, H., **Pourboghrat, F.**, and Kumar, S.C., “Differential-Exponential Hardening Law for Non-Schmid Crystal Plasticity Finite Element Modeling of Ferrite Single Crystals,” *Int. J. Plasticity*, 91 (2017) 268-299.
18. M. Safaei, A. Sheidaei, M. Baniassadi, S. Ahzi, M. Mosavi Mashhadi, **F. Pourboghrat**, “An interfacial debonding-induced damage model for graphite nanoplatelet polymer nanocomposite,” *Computational Materials Science* 01/2015; 96:191–199.

19. Darbandi, P., Bieler, T., **Pourboghtrah, F.**, Lee, T.K., "The Effect of Cooling Rate on the Grain Orientation and Misorientation of SAC105 Solder Joints Before and After Impact Drop Tests," *Journal of Electronic Materials*, Vol. 43, No. 7, 2014, Pages 2521-2529.
20. Darbandi, P., Lee, T.K., Bieler, T., **Pourboghtrah, F.**, "Crystal Plasticity Finite Element Study of Deformation Behavior in Commonly Observed Microstructures in Lead Free Solder Joints," *Computational Materials Science*, 85 (2014) 236-243.
21. Amani Hamedani, H., Baniassadi, M., Sheidaei, A., **Pourboghtrah, F.**, Remond, Y., Khaleel, M., and Garmestani, H., "Three Dimensional Reconstruction and Microstructure Modeling of Porosity-Graded Cathode Using Focused Ion Beam and Homogenization Techniques," *Fuel Cells*, Volume 14, Issue 1, Pages 91-95, February, 2014.
22. **Pourboghtrah, F.**, Venkatesan, S., Carsley, J. E., "LDR and Hydroforming Limit for Deep Drawing of AA5754 Aluminum Sheet," *J. of Manufacturing Processes*, Volume 15, Issue 4, Oct. 2013, Pages 600-615.
23. Tabei, S.A., Sheidaei, A., Baniassadi, M., **Pourboghtrah, F.**, Garmestani, H., "Microstructure Reconstruction and Homogenization of Porous Ni-YSZ Composites," *J. of Power Sources*, Volume 235, 1 August 2013, Pages 74–80.
24. Sheidaei, A., Baniassadi, M., Banu, M., Askeland, P., Kuuttila, N., **Pourboghtrah, F.**, Drzal, L.T., Garmestani, H., "Mechanical characterization of polymer clay halloysite polymer composite using real microstructure and statistical models," *Composite Science and Technology*, Volume 80, 17 May 2013, Pages 47–54.
25. Darbandi, P., Bieler, T., **Pourboghtrah, F.**, Lee, T.K., "Crystal Plasticity Finite Element Analysis of Deformation Behavior in Multiple-Grained Lead-Free Solder Joints," *Journal of Electronic Materials*, February 2013, Volume 42, Issue 2, pp 201-214.
26. Bieler, T.R., Zhou, B., Blair, L., Zamiri, A., Darbandi, P., **Pourboghtrah, F.**, Lee, T.K., Liu, K.C., 2012, "The Role of Elastic and Plastic Anisotropy of Sn in Recrystallization and Damage Evolution During Thermal Cycling in SAC305 Solder Joints," *Journal of Electronic Materials*, 41(2), 283-301, 2012.
27. Bieler, T.R., Wright, N. T., **Pourboghtrah, F.**, Compton, C., Hartwig, K. T., Baars, D., Zamiri, A., Chandrasekaran, S., Darbandi, P., Jiang, H., Skoug, E., Balachandran, S., Ice, G. E., Liu, W., 2010, "Physical and mechanical metallurgy of high purity Nb for accelerator cavities," *Physical Review Special Topics – Accelerators and Beams*, Vol. 13, 031002 (2010).
28. Zamiri, A., **Pourboghtrah, F.**, 2010, "A novel yield function for single crystals based on combined constraints optimization," *Int. J. Plasticity*, Vol. 26, Issue 5, (2010) 731-746.
29. Zamiri, A., Bieler, T. R., and **Pourboghtrah, F.**, 2009, "Anisotropic crystal plasticity finite element modeling of the effect of crystal orientation and

solder joint geometry on deformation after a temperature change,” *Journal of Electronic Materials*, Vol. 38, No. 2, February.

30. Baars, D., Jiang, H., Bieler, T.R., Zamiri, A., **Pourboghrat, F.** and C. Compton, 2008, “Effects of Elastic Modulus on Deformation and Recrystallization of High Purity Nb,” *Applications of Texture Analysis*, (2008) 391-398.
31. Zamiri, Z., **Pourboghrat, F.**, Bieler, T.R., 2008, “A Quantitative Study of Surface Texture on Plasticity Induced Surface Roughness and Dislocation Density of Crystalline Materials,” *Journal of Applied Physics*, 104, 084904 (2008).
32. Zamiri, A., Jiang, H., Bieler, T. R., and **Pourboghrat, F.**, 2008, “Applying Evolutionary Yield Function to Predicting the Deformation of Microstructure-Sensitive High-RRR Niobium,” *JOM*, July 2008, pp. 70-75.
33. Guan, Y., **Pourboghrat, F.**, and Barlat, F., 2008, “Finite element analysis of aluminum tube hydroforming based on non-quadratic yield function,” *International Journal of Manufacturing Technology and Management*, Vol. 14, pp. 84-99 (2008).
34. Guan, Y., **Pourboghrat, F.**, 2008, “Fourier Series based Finite Element Analysis of Tube Hydroforming - Generalized Plane Strain Model,” *Journal of Materials Processing Technology*, 197 (2008) 379-392.
35. Jinag, H., Baars, D., Zamiri, A., Antonie, C., Bauer, Bieler, T. R., **Pourboghrat, F.**, Compton, C., and Grimm, T. L., 2007, “Mechanical Properties of High RRR Niobium with Different Texture,” *IEEE Transactions on Applied Superconductivity*, Vol. 17, No. 2, June 2007, 1291-1294.
36. Zamiri, A., and **Pourboghrat, F.**, 2007, “Characterization and Development of an Evolutionary Yield Function for Superconducting Niobium Sheets,” *Int. J. Solids and Structures*, 44 (2007) 8627-8647.
37. Telang, A. U., Bieler, T. R., Zamiri, A., **Pourboghrat, F.**, 2007, “Incremental Recrystallization/Grain Growth Driven by Elastic Strain Energy Release in a Thermomechanically Fatigued Lead-Free Solder Joint,” *Acta Materialia*, 55 (2007) 2265-2277.
38. Zampaloni, M., **Pourboghrat, F.**, Yankovich, S. A., Rodgers, B. N., James Moore, Misra, M., Mohanty, A. K., and Drzal, L. T., 2007, “Kenaf Natural Fiber Reinforced Polypropylene Composites: A Discussion on Manufacturing Problems and Solutions”, *Composites – Part A: Applied Science and Manufacturing*, Volume 38, Issue 6, June 2007, Pages 1569-1580.
39. Zamiri, A., **Pourboghrat, F.**, and Barlat, F., 2007, “An Effective Computational Algorithm for Rate-Independent Crystal Plasticity Based on a Single Crystal Yield Surface with an Application to Tube Hydroforming,” *Int. J. Plasticity*, 23 (2007) 1126-1147.
40. Abedrabbo, N., **Pourboghrat, F.** and Carsley, J., 2007, “Forming of AA5182-O and AA5754-O at Elevated Temperatures using Coupled Thermo-Mechanical Finite Element Models,” *Int. J. Plasticity*, 23 (2007) 841-875.

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96. Hunter, D. E. and Pourboghrat, F., 1993, "Elastic Recovery in Extrusion Bending - Predicting Die Contours to Produce Net Shape Parts Using FEM," *Proc. Near Net Shape Manufacturing Conference*, Pittsburgh, PA, USA, 27-29 September.
97. Pourboghrat, F., Chandorkar, K., 1992, "Springback Calculation for Plane Strain Sheet Forming Using Finite Element Membrane Solution," Presented at the *Symposium on Numerical Methods for Simulation of Industrial Metal Forming Processes*, ASME WAM, Anaheim, November 8-13.
98. Pourboghrat, F., Stelson, K. A., 1988, "Bend Allowance Calculation in a Flexibly Automated Sheet Metal Fabrication System," *Proc. U.S.A-JAPAN Symposium on Flexible Automation*, July 18-20, Minneapolis, Minnesota.

CONFERENCE PRESENTATIONS (WITHOUT PROCEEDINGS):

1. Application of Cellular Automaton model in simulation of static recrystallization, Amir Asgharzadeh, Sobhan Nazari, Farhang Pourboghrat, Oral presentation at ISE manufacturing meeting-OSU- Sep 2019.
2. Simulation of static recrystallization kinetics using cellular automata model, Amir Asgharzadeh, Sobhan Nazari, Farhang Pourboghrat, Poster presentation at ISE research day-OSU- Dec 2018.
3. Pourboghrat, F., "Thermo-hydroforming – A Novel Process For Manufacturing Lightweight Structures With Fiber-Reinforced Thermoplastic Composites," 2016 OSU Materials Week – Developing New Ways to Manufacture Light, High Performance Structures Session, May 10-13, 2016 – The Ohio State University.
4. Pourboghrat, F., "Application of Crystal Plasticity and Evolutionary Yield Functions for Modeling of Forming Processes," presented at the Numerical Simulation of Sheet Metal Forming Processes (Numisheet 2014) conference, Melbourne, Australia, January 5-10, 2014.
5. Venkatesan, S., Zamiri, A., Pourboghrat, F., "Determination of wear in artificial hip implants," Symposium on Computational Methods in Orthopedic Biomechanics (pre-ORS), March 2008.
6. Zamiri, A. and F. Pourboghrat, 2005, "Simulation of Tube Hydroforming with an elasto-plastic, rate-independent, polycrystalline model," The 6th International Conference and Workshop on Numerical Simulation of 3D Sheet Forming Processes (Numisheet 2005), Detroit, MI, August 15-19, 2005.
7. Abedrabbo, N., Zampaloni, M. A., Pourboghrat, F., 2002, "The Effect of Hydrostatic Pressure on Tearing and Wrinkling Behavior of Aluminum Sheets," Sponsored by the Committee on Instabilities in Solids and Structures of the Applied Mechanics Division, 2002 International Mechanical Engineering Congress and R&D Expo, New Orleans, LA, November 17-22.

8. Zamaplioni, M., Abedrabbo, N. and Pourboghtr, F., 2001, "Experimental and Numerical Study of Stamp Hydroforming for Aluminum parts," 6th USNCCM, Dearborn, MI.
9. Yu, W. R., Zampaloni, M. A. and Pourboghtr, F., 2001, "Sheet Hydroforming for Woven Fabric Reinforced Thermoplastic Composites," 6th USNCCM, Dearborn, MI.
10. Guan, Y. and Pourboghtr, F., 2000, "An Efficient Analysis Tool for Aluminum Tube Hydroforming", The ASME, IMECE conference, November 5-10, Orlando, Florida.

INVITED SEMINARS GIVEN AT UNIVERSITIES:

1. Pourboghtr, F. "*Finite Element Modeling of Phase Transforming 3G AHSS*," University of Texas - Dallas, ME Departmental Seminar, March 9, 2020.
2. Pourboghtr, F. "*Composite Thermo-Hydroforming – A Novel Process for Manufacturing Lightweight Structures*," Polish American Conference on Science and Technology, April 16, 2019, The Ohio State University, Columbus, Ohio.
3. Pourboghtr, F. "*Multiscale Modeling of Third Generation Advanced High Strength Steel (3G AHSS)*," University of Houston – Industrial Engineering Department seminar, February 8, 2019, Houston, Texas.
4. Pourboghtr, F. "*Constitutive Modeling of Lightweight Materials*," The Ohio State University, MAE Departmental Seminar, ME 8888, March 4, 2016.
5. Pourboghtr, F. "*Forming Simulation of Lightweight Materials*," *Institute of Forming Technology and Lightweight Materials*," Technical University of Dortmund, Germany, February 9, 2016.
6. Pourboghtr, F. "*Constitutive Modeling and Hydroforming of Lightweight Metals and Polymer Composites*," The Ohio State University, October 24, 2014.
7. Pourboghtr, F. "*Application of Rate-Independent Crystal Plasticity Model for the Forming Simulation of Lightweight Metals*," POSTECH, Pohang, South Korea, August 19, 2014.
8. Pourboghtr, F. "*Application of Rate-Independent Crystal Plasticity Model for the Forming Simulation of Lightweight Metals*," Seoul National University, Seoul, South Korea, August 13, 2014.
9. Pourboghtr, F. "*Phenomenological and CPFEM Modeling of Polycrystalline Nb Sheet and Tube*," Texas A&M University, College Station, TX, May 28, 2013.
10. Pourboghtr, F. "*Crystal Plasticity and Evolutionary Yield Functions for Modeling of Forming and Failure of Sheet Metals*," Brown University, Providence, RI, December 10, 2012.

11. Pourboghrat, F., “*Phenomenological Yield Functions with Evolving Parameters for Simulation of Materials with Strong Property Variations*,” Oakland University, MI, April 15, 2012.
12. Pourboghrat, F., “*Rate-Independent CPFEM for Metals and Multi-scale Modeling of Nanocomposites*,” Clemson University, South Carolina, USA, March 8, 2012.
13. Pourboghrat, F., “*Bio-Fiber Reinforced Thermoplastic Composites: A Discussion on Manufacturing Method, Thermo-Hydroforming, and Constitutive Modeling*,” University of Windsor, Ontario, Canada, November 6, 2009.
14. Pourboghrat, F., “*Constitutive Modeling for Forming and Failure Analysis of Materials with ABAQUS*,” Rice University, Houston, TX, March 2, 2005.
15. Pourboghrat, F., “*Constitutive Modeling for Forming and Failure Analysis of Metals*,” University of Houston, Houston, TX, April 20, 2005.
16. Pourboghrat, F., “*Experimental and Numerical Study of Sheet Thermoforming and Tube Hydroforming Processes*,” University of Texas, Austin, TX, May 20, 2005.
17. Pourboghrat, F., “*A Constitutive Equation for Fabric Reinforced Thermoplastic Composites*,” Seoul National University, Seoul, South Korea, February 28, 2002.
18. Pourboghrat, F., “*Constitutive Modeling for FRT Composites and Aluminum Alloys with Application to Sheet and Tube Hydroforming*” Mechanical Engineering Department, Southern Methodist University, January 21, 2002.
19. Pourboghrat, F., “*Forming of Thin-Walled Structures: Analysis, Design, and Materials Issues*” Mechanical Engineering Department, Kettering University, Michigan, September 11, 2000.
20. Pourboghrat, F., “*A Hybrid Membrane/Shell Method for Predicting the Springback of Anisotropic Sheet Metals*,” Aerospace & Mechanical Engineering Department at Notre Dame University, Indiana, March 17, 1998.

INVITED SEMINARS GIVEN AT INDUSTRIES AND LABORATORIES:

1. Pourboghrat, F. “*Multiscale Computational Modeling of FRT Composites and Polymer Nanocomposites*,” Air Force Research Laboratory, March 6, 2019, Dayton, Ohio.
2. Pourboghrat, F. “*Finite Element Modeling of GEN3 AHSS*,” EWI Forming Center Workshop – Advanced Sheet Metal Forming Technology, October 10, 2018, Columbus, Ohio.
3. Pourboghrat, F. “*Integrated Computational Materials Engineering Approach for Multiphase Advanced High Strength Steels Based on Crystal Plasticity*,” AK Steel Research Lab, Middletown, OH, June 2, 2017.

4. Pourboghlat, F. "Forming Simulation of Lightweight Metals and Composites," Edison Welding Institute, Columbus, OH, November 2015.
5. Pourboghlat, F. "Forming Simulation of Lightweight Metals and Composites," Honda R&D, Marion, OH, October 15, 2015.
6. Pourboghlat, F., and Kuuttila, N., "*Multi-Scale Modeling and Thermo-hydroforming of Polymer Composites*," Presented at the Dow Chemicals, Midland, MI, November 14, 2013.
7. Pourboghlat, F., Zampaloni, M. and Yu, W.R., "*Numerical and Experimental Study of Stamp Thermo-Hydroforming Applied to Shaping of Woven Fiber and Glass-Mat Reinforced Thermoplastic Composites*," Presented at the General Motors Research Lab, August 6th, 2003.
8. Abedrabbo, N., and Pourboghlat, F., "*Thermo-hydroforming of Aluminum – 2nd Report*," General Motors Research Lab (GMR), October 21, 2003.
9. Pourboghlat, F., Abedrabbo, N., and Zampaloni, M., "*Stamp Thermo-Hydroforming of Aluminum and Composite Sheets for Automotive Application*," Presented at the Alcoa Technical Center, October 24, 2003.
10. Pourboghlat, F., and Guan, Y., "*Constitutive Modeling for Polycrystalline Aluminum Alloy Extrusions and Application to Hydroforming of Thin-Walled Tubes*," Presented at the Alcoa Technical Center, October 24, 2003.

US PATENTS:

1. Farhang Pourboghlat, "Method for Determining the Radius of a Bending Die for Use With a Bending Machine for Bending a Part and an Associate Apparatus", Patent No. 5,508,935, April 16, 1996.
2. Farhang Pourboghlat, "An Improved Bending Machine and A Method for Bending A Part", Patent No. 5,519,623, May 21, 1996.
3. Farhang Pourboghlat, Zampaloni, M., and Benard, A., "Hydroforming of Composite Materials", Patent No. 6,631,630, October 14, 2003.
4. Dave Genise, Suzanne Zampaloni, Andrew Harman, Michael Zampaloni and Farhang Pourboghlat, "Hydroformed Port Liner", Patent No. 2007,0022,982. Feb. 1, 2007.
5. Farhang Pourboghlat and Nick Kuuttila, "Apparatus and Methods for Thermo-hydroforming", Patent No. 10,160,156., May 12, 2016.

FUNDED RESEARCH PROPOSALS:

1. Kyriakides, S. and Pourboghlat, F. (co-PI) "Stretch Forming of Aluminum Extruded Tubes for Automotive Applications", Funded by NSF, Division of Design, Manufacture, & Industrial Innovation (Proposal No. DMI-9522774), March 1995 – March 1998, **\$103,202**.

2. Pourboghrat, F. (PI) "Developing Design Capability for Aluminum Tube Hydroforming", Funded by Aluminum Company of America (ALCOA), **\$67,000** (open ended).
3. Pourboghrat, F. (PI) "Development of PC-Based Analysis Tool for Hydroforming of Thin-Walled Hollow Extrusions," Funded by Manufacturing Research Consortium (MRC) at MSU, **\$29,602**, August 1998 – August 1999.
4. Pourboghrat, F. (PI) and Benard, A, "Hydroforming of Composite Materials," Research Excellence Fund (REF), **\$9,500**, September 1998 - September 1999.
5. Averill, R. and Pourboghrat, F. (co-PI), "Microstructural Evolution During Stamping of Textile Preforms," Research Excellence Fund (REF), **\$29,156**, September 1998 - September 1999.
6. Averill, R. and Pourboghrat, F. (co-PI), "Microstructural Evolution During Stamping of Textile Preforms," Research Excellence Fund (REF), **\$23,500**, September 1999 - September 2000.
7. Pourboghrat, F. (PI) "Development of PC-Based Analysis Tool for Hydroforming of Thin-Walled Hollow Extrusions," Funded by Manufacturing Research Consortium (MRC), **\$15,000**, August 1999 – August 2000.
8. Pourboghrat, F. (PI) and Benard, A, "Hydroforming of Composite Materials," Research Excellence Fund (REF), **\$29,000** September 1999 - September 2000.
9. Pourboghrat, F. (PI) "A Micro-mechanics (Polycrystalline) Model of Tube Hydroforming," Funded by Manufacturing Research Consortium (MRC), **\$40,500**, August 1999 – August 2000.
10. Averill, R. and Pourboghrat, F. (co-PI), "Microstructural Evolution During Stamping of Textile Preforms," Research Excellence Fund (REF), **\$20,800**, July 1, 2000 – Dec. 31, 2000.
11. Pourboghrat, F. (PI) and Benard, A, "Hydroforming of Composite Materials," submitted to Research Excellence Fund (REF), **\$27,300**, July 1 – Dec. 2000.
12. Pourboghrat, F. (PI) "An Experimental and Numerical Study of Thermo-Hydroforming (Fluid Forming) of Aluminum Sheet Alloys," Funded by Manufacturing Research Consortium (MRC), **\$35,000**, August 2000 – August 2001.
13. Pourboghrat, F. (PI), "NSF-GOALI: Constitutive Modeling for Polycrystalline Aluminum Alloy Extrusions and Application to Hydroforming of Thin-Walled Tubes," Funded by National Science Foundation, **\$227,738**, 9/1/00 – 8/31/03.
14. Pourboghrat, F. (PI), "NSF-GOALI: Constitutive Modeling for Polycrystalline Aluminum Alloy Extrusions and Application to Hydroforming of Thin-Walled Tubes," Funded by Aluminum Company of America (ALCOA), **\$45,000**, 9/1/00 – 8/31/03.
15. (UTPA: Chen, J.G., Bose, S.C., Freeman, R.A., Gonzalez, M.A., LeMaster, E.) and (MSU: Lloyd, J.R., Chung, M.J., Goodman, E.D., Kwon, P., Pourboghrat, F.), "Rapid Product Development in International Production,"

Funded by National Science Foundation – Partnerships for Innovation (NSF-PFI), MSU partnership with the University of Texas – Pan American, **\$589,216**, (MSU: \$289,215 and UTPA: \$300,001), 01/01/01 – 01/01/03.

16. Pourboghraat, F. (PI), "An Experimental and Numerical Study of Hydroforming (Fluid Forming) of Aluminum Sheet Alloys," Manufacturing Research Consortium (MRC), **\$33,600**, August 2001 – August 2002.
17. Pourboghraat, F. (PI), "Thermo-hydroforming of Aluminum Sheet Alloys," GM R&D - **\$239,194**, 1/1/02 – 8/31/05.
18. Pourboghraat, F. (PI), "3D Simulation of Sheet Hydroforming of Complex Aluminum Automotive Parts," Manufacturing Research Consortium (MRC), **\$30,000**, August 2002 – August 2003.
19. Pourboghraat, F. (PI), "Accurate Yield Functions for Finite Element Analysis of Hydroforming of Seamless Aluminum Tubes," Manufacturing Research Consortium (MRC), **\$30,000**, August 2002 – August 2003.
20. Pourboghraat, F. (PI), NSF-GOALI: Constitutive Modeling for Polycrystalline Aluminum Alloy Extrusions and Application to Hydroforming of Thin-Walled Tubes," **\$12,000**, 9/1/02 – 8/31/03.
21. Pourboghraat, F. (PI), "Hydroforming of Manifold Sleeve Inserts for Diesel Cylinder," **\$82,000**, Eaton Corporation, 9/1/03 – 5/30/04.
22. Pourboghraat, F. (PI), "Manufacturing and Modeling of Multi-Material Layered Structures Utilizing Bio-Composites," **\$84,561**, REF, 1/1/04 – 12/30/04.
23. Pourboghraat, F. (PI), "International Conference and Workshop on Numerical Simulation of 3D Sheet Forming Processes (Numisheet 2005)," Proposal to GM, Ford, Daimler-Chrysler, and AISI to provide **\$80,000** for the organization of the Numisheet 2005 conference and benchmark experiments, 1/1/04 – 8/31/05.
24. Drzal, L., Mohanty, A. K., Misra, M., Dale, B. E., Pourboghraat, F. (co-PI), "Design and Engineering of Green Composites From Bio-Fibers and Bioplastics," **\$599,172**, 5/15/04 – 5/14/08, NSF- PREMISE (Product Realization and Environmental Manufacturing Innovative Systems)-PHASE II.
25. Pourboghraat, F. (PI), "Quantitative Comparison of Aluminum Alloy Sheet Forming Methods," GM R&D - **\$199,737**, 3/1/06 – 2/28/08.
26. Pourboghraat, F. (PI), "Micromechanical Modeling of Fracture at Grain Boundaries in Aluminum Alloys," Alcoa Research Lab - **\$20,000**, 9/1/06 – 8/31/08.
27. Pourboghraat, F. (PI), Drzal, L., Mohanty, A. K., Misra, M., Loose, A., "NSF-MRI: Acquisition of a Thermo-hydroforming Stamping Press for Research and Education in Forming of Multifunctional Nanocomposite and Biocomposite Polymer Structures," NSF, **\$457,000**, 9/15/07 – 9/14/11.

28. Pourboghrat, F. (PI), Jayaraman, K., “Modeling and Experimental Characterization of Long-term Performance of Polymeric Liner in Total Hip Joint Replacements,” IRGP, **\$56,625**, 1/1/08 – 6/30/09.
29. Pourboghrat, F. (PI), “A Survey of Emerging Biocomposite Materials,” General Dynamic Land System - **\$25,000**, 5/1/09 – 5/30/10.
30. Drzal, L., and Pourboghrat, F. (co-PI), “Replacement of Glass fibers with Natural fibers in PP/GF Structural Parts,” Faurecia Interior Systems - **\$50,000**, 5/1/10 – 12/30/10.
31. Bieler, T., and Pourboghrat, F. (co-PI), “NSF-GOALI: Microstructural evolution and damage nucleation mechanisms during thermomechanical cycling in the Sn phase of lead-free solder joints,” NSF, **\$419,979**, 8/1/10 – 9/30/13.
32. Pourboghrat, F. (PI), “Thermo-hydroforming of graphene nano-platelet polymer composite,” TARDEC/Army Research Lab – through Composite Vehicle Research Center, **\$323,841**, 06/20/2011-09/01/2013.
33. Pourboghrat, F. (PI), “Combined theoretical/experimental development of a constitutive model for steels with the transformation induced plasticity effect,” GM R&D, **\$90,000**, 1/1/2012 – 12/30-2012.
34. Bieler, T., Pourboghrat, F., Wright, N.T., and Compton, C., “The Cost of Grain Boundaries on the Performance of Superconducting Cavities,” DOE, **\$600,000**, 09/01/2013 – 08/31/2016.
35. Pourboghrat, F. (PI), “Thermo-hydroforming of Thermoplastic Helmets,” BAE Systems, **\$32,061**, 02/01/2013 – 05/31/2014.
36. Bieler, T., Pourboghrat, F., “Seamless Nb Tubes for SRF Cavities,” Shear Form Inc., DOE, **\$60,000**, 03/01/2013 – 03/31/2015.
37. Pourboghrat, F. (PI), Loos, A., and Gianaris, N., “Development of Fiber-reinforced, Polymeric Resin, Pre-pregged Blanks for Manufacturing Composite Structures by the Thermo-hydroforming Process,” Mott Community College, Army US Dept. of, **\$258,356**, 08/16/2013 – 06/30/2014.
38. National Network of Manufacturing Institutes (NNMI) - The American Lightweight Materials Manufacturing Innovation Institute (ALMMII) – Total funding of **\$148,000,000** (ONR: **\$70M** + Industry: **\$78M**) is distributed between 50 companies and universities to develop and deploy advanced lightweight materials (metals) manufacturing technologies. Prof. Farhang Pourboghrat represented Michigan State University. Funding duration: 02/01/2014 – 01/30/2019.
39. National Network of Manufacturing Institutes (NNMI) - Institute for Advanced Composites Manufacturing Innovation (IACMI) – Total funding (DOE: **\$70M** + Industry: **\$120M**). MSU team: Drzal, L., (PI) and Pourboghrat, F. (co-PI). Funding duration: 08/01/2015 – 07/30/2020.
40. Pourboghrat, F. (PI), “Integrated Computational Approach to Development of Lightweight Third Generation AHSS Vehicle Sub-Assembly,” DOE funding

of **\$6,000,000** (plus **\$3M** industry match) distributed between 5 universities and one national lab (Pourboghrat's share: **\$641,597**), 02/2013 – 01/31/17.

41. (MSU: Bieler, T., Eisenlohr, P., Wright, N., Compton C.), (ASU: Solnaki, K.), (OSU: Pourboghrat, F.), " The Effect of Process History on Grain Boundaries and Dislocation Substructures on Functional Properties of Nb for SRF Cavities: Plastic Formability and Microstructure Evolution" DOE-Office of High Energy Physics. Total Funding: **\$1.3M** (Pourboghrat's share: **\$300,000**). Funding Duration: June 1, 2016 – May 31, 2019
42. Pourboghrat, F. (PI), and Daehn, G., "Agile Fabrication of Sheet Metal Components with Assured Properties," DOD/ONR/ALMMII/LIFT, **\$770,184**). Funding Duration: 6/1/16 – 5/30/2018.
43. Pourboghrat, F. (PI), "Friction Stir Extrusion," DOD/ONR/ALMMII/LIFT, **\$779,412**). Funding Duration: 7/15/16 – 12/30/2018.
44. Pourboghrat, F. (PI), "Finite Element Modeling of Lightweight UAM Reinforced Structures," Honda R&D, **\$112,630**. Funding Duration: 1/1/17 – 05/30/2018.
45. Ames, N., Pourboghrat, F., and Benatar "Ultrasonic Pre-Consolidation of Armor," DOD Office of Naval Research, **\$100,000**. Funding Duration: 6/1/16 – 03/30/2017.
46. Krishnaswamy, S. and Daehn, G. (US senior personnel: Niezgoda, S., Cao, L., and Pourboghrat, F.; TUD German senior Personnel: Tekkaya, E., Stommel, M., Walther, F., and Menzel, A.) "NSF-IRES: Forming and Manufacturing Research in Germany," NSF, **\$249,974**. Funding Duration: 2/01/17 – 1/30/2020 (*pending*).
47. National Network of Manufacturing Institutes - NNMI: REMADE Institute on Metal and Composite Recycling – Total DOE Funding: **\$140M** (OSU Share: **\$8M**).
48. Pourboghrat, F. (PI), "Finite Element Analysis of Low-Cost Agile Tooling," Honda R&D, **\$360,000**. Funding Duration: 9/30/19 – 10/01/2021.
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