

# Bohumir Jelinek

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## CURRENT RESEARCH

Presentations at

- 1) **Ground Vehicle Systems Engineering & Technology Symposium (GVSETS) & Modernization Update**, Novi, Michigan, Aug 2024, *Vehicle-Level Control Systems Framework for Use in CREATE-GV Mercury Simulations*
- 2) **16th European-African Regional Conference of the ISTVS**, Oct 2023, *Tractive Performance of Rigid Wheel in Granular Media Using Coarse-Scale DEM models*
- 3) **Ground Vehicle Systems Engineering and Technology Symposium (GVSETS)**, Novi, Michigan, Aug 2021, *Simulation Study of Light-Weighting Effects on Ride Quality and Mobility*
- 4) **20th International and 9th Americas Conference of the International Society for Terrain-Vehicle Systems (ISTVS)**, Online Event, Sept 2021, *DEM Analysis of Contact Forces and Tractive Performance of Rigid Wheel in Granular Media*
- 5) **Machine-Ground Interaction Consortium (MAGIC)**, University of Wisconsin-Madison, Sept 2019, *Experimental and modeling capabilities for off-road mobility at the Center for Advanced Vehicular Systems, MSU*

Developed **Finite Element model of heat transfer during Direct Laser Deposition** additive manufacturing process using **FEniCS** framework

## EDUCATION

Doctor of Philosophy, **Engineering Physics**; Minor in **Mechanical Engineering**  
Mississippi State University, Mississippi State, MS.  
Dissertation: *Modified embedded atom method potential for Al, Si, Mg, Cu, and Fe alloys*

Master of Science, **Computer Engineering**  
Mississippi State University, Mississippi State, MS.

Software project: **ISIP ASR system**: <http://www.isip.piconepress.com/projects/speech/>

### Job Offers/Scholarships

job offers at Purdue and Ames Lab

research assistantship at Mississippi State University

prestigious European Commission Socrates / Erasmus Scholarship, Ghent, Belgium

## GRANTS AND AWARDS

### Research Funding

U.S. Army Corps of Engineers ERDC, Vicksburg, MS

U.S. Army Research Laboratory

### ♦ Awards

Awarded Extreme Science and Engineering Discovery Environment (XSEDE/ACCESS-CI) startup allocation for *Simulations for 2D and 3D dendrite growth during alloy solidification*

Awarded XSEDE/ACCESS-CI research allocation for *Large scale 3D modeling of microstructural evolution during alloy solidification*

- RESEARCH INTERESTS
- Additive Manufacturing: Implemented [2D thermal model](#) of directed energy deposition additive manufacturing process ([animations](#)) in Python using [FEniCS](#) framework matching pyrometer measurement of melt pool length, presented at [FEniCS'19](#) with [article in Journal of Manufacturing Processes](#).
- HPC: Parallelized [2D](#) and [3D](#) solidification codes with excellent [speed up](#) and [scale up](#).
- Molecular dynamics and ab-initio simulations: developed, [tested](#), and published the [MEAM potential for Al-Si-Mg-Cu-Fe alloys](#), second largest atomistic potential in the [National Institute of Standards and Technology \(NIST\) database](#).
- Speech recognition using hidden Markov models, AI search: [ISIP ASR C++](#) package.
- Numerical methods for electromagnetic field: [Yagi-logper](#) and [Antennavis](#) projects.
- Vehicle Dynamics: Presented at [Computing in Engineering Forum, Machine-Ground Interaction Consortium](#), University of Wisconsin-Madison, participated International Symposium on Agile Ground Vehicle Dynamics, Energy Efficiency, and Performance in Severe Environments, Birmingham, AL
- RESEARCH EXPERIENCE
- ◇ **Assistant Research Professor, Center for Advanced Vehicular Systems (CAVS)**, Mississippi State University, Mississippi State, MS (May 2013 – present)
  - ◇ **Postdoctoral Fellow, Center for Advanced Vehicular Systems (CAVS)**, Mississippi State University, Mississippi State, MS (May 2011 – April 2013)
    - Parallelized [3D lattice-Boltzmann code](#), [coupled it with Discrete Element method](#). The work earned a mention in [HPCwire 2016](#) and in 2017 brochure of [The Coalition for Academic Scientific Computation](#), pp. 17.
    - Parallelized [2D/3D lattice Boltzmann-cellular automaton alloys solidification codes](#), resulting in a [simulation](#) of 11 million [dendrites](#), in 17.28 cm × 8.64 cm domain with 165 billion grid cells utilizing 41472 cores of the Kraken supercomputer, featured in the MSU Research Windows magazine. Implemented [parallel HDF5](#) output with [XDMF](#) descriptors and dendrite tip tracking.
    - Performed Ab-initio simulations of alloys and crystalline defects. Implemented and published [Python routines](#) utilizing [ASE](#) for testing of classical atomistic potentials,
  - ◇ **Postdoctoral Fellow, Geotechnical and Structures Laboratory of the Engineer Research and Development Center, U.S. Army Corps of Engineers**, Vicksburg, MS
    - Modeled electro-osmotic transport in concrete. Revealed [effects of surface charge density, distribution, and related changes in viscosity on the nanochannel electro-osmotic flow](#).
  - ◇ **Research Assistant, Center for Advanced Vehicular Systems (CAVS)**, Mississippi State University, Mississippi State, MS
    - Estimated elastic properties of crystals for the development of [MEAM potential for Al, Si, Mg, O, H, Cu, Fe alloys](#) using [VASP](#). Modified MEAM in [LAMMPS](#) to match [Dynamo](#) results. Contributed ([1](#), [2](#), [3](#)) to [LAMMPS](#). Implemented linked list and XML parser in Fortran 90 and XML parser in C++.
  - ◇ **Research Assistant, Institute for Signal and Information Processing (ISIP)**, Mississippi State University, Mississippi State, MS
    - Developed, documented and tested [ISIP C++ public domain automatic speech recognition system](#) over two-year period. Implemented speaker adaptation, stack decoding and support vector machine class in ISIP system.
  - ◇ **Research Assistant, ELIS Speech Lab**, Ghent University, Ghent, Belgium
    - Performed training and decoding of the DARPA 1000-word resource management speech database by the ISIP ASR system, sponsored by a prestigious European Commission Socrates / Erasmus Scholarship.
  - ◇ **BEST Summer Course participant, Danish Technical University**, Copenhagen, Denmark (Summer 1996)
    - Completed Board of European Students of Technology (BEST) summer course Physics and electronics of cryogenic temperatures.

**Jelinek, B.**, B., Card, A., Mason, G. L., Grebner, K., Dickerson, A., Skorupa, T., Cole, M., Priddy, J. D., “Tractive Performance of Rigid Wheel in Granular Media Using Coarse-scale DEM Models” *Journal of Terramechanics*. Elsevier, 117, 101016-101022, February 2025

**Jelinek, B.**, Young, W. J., Dantin, M., Furr, W., Doude, H., Priddy, M. W., “Two-dimensional Thermal Finite Element Model of Directed Energy Deposition: Matching Melt Pool Temperature Profile to Pyrometer Measurement,” *Journal of Manufacturing Processes*, Elsevier, 57, 187-195, September 2020

Peters, J. F., **Jelinek, B.**, Goodman, C. C., Vahedifard, F., Mason, G. L., “Large Scale Discrete Element Modeling for Engineering Analysis: A Case Study for the Mobility Cone Penetrometer,” *Journal of Geotechnical and Geoenvironmental Engineering*, ASCE, 145(12), 2019

Johnson, D., Vahedifard, F., **Jelinek, B.**, Peters, J. F., “Micromechanics of Undrained Response of Dilative Granular Media Using a Coupled DEM-LBM Model: A Case of Biaxial Test,” *Computers and Geotechnics*, 89, 103-112, 2017

Johnson, D. H., Vahedifard, F., **Jelinek, B.**, Peters, J. F., “Micromechanical modeling of discontinuous shear thickening in granular media-fluid suspension,” *Journal of Rheology*, AIP, 61(2), 265-277, 2017

Eshraghi, M., **Jelinek, B.**, Felicelli, S. D., “Large-Scale Three-Dimensional Simulation of Dendritic Solidification Using Lattice Boltzmann Method,” *JOM*, Springer, 67(8), 1786-1792, May 2015

**Jelinek, B.**, Eshraghi, M., Felicelli, S. D., Peters, J. F., “Large-scale Parallel Lattice Boltzmann - Cellular Automaton Model of Two-dimensional Dendritic Growth,” *Computer Physics Communications*, 185(3), 939-947, March 2014

**Jelinek, B.**, Solanki, K., Peters, J., Felicelli, S., “Investigating Robustness of Interatomic Potentials with Universal Interface,” *Journal of Physics: Conference Series*, 402, 012006, December 2012

Eshraghi, M., Felicelli, S. D., **Jelinek, B.**, “Three dimensional simulation of solutal dendrite growth using lattice Boltzmann and cellular automaton methods,” *Journal of Crystal Growth*, 354(1), 129-134, June 2012

**Jelinek, B.**, Groh, S., Moitra, A., Horstemeyer, M., Houze, J., Kim, S.-G., Wagner, G., Baskes, M., “Modified embedded atom method potential for Al, Si, Mg, Cu, and Fe alloys,” *Physical Review B*, 85(24), 245102, June 2012.

**Jelinek, B.**, Felicelli, S., Mlakar, P., and Peters, J., “Effects of surface charge density and distribution on the nanochannel electro-osmotic flow,” *International Journal of Theoretical and Applied Multiscale Mechanics (IJTAMM)*, 2(2), 165–183, October 2011.

Kim, S.-G., Horstemeyer, M., Baskes, M., Rais-Rohani, M., Kim, S., **Jelinek, B.**, Houze, J., Moitra, A., and Liyanage L., “Semi-Empirical Potential Methods for Atomistic Simulations of Metals and Their Construction Procedures,” *Journal of Engineering Materials and Technology*, 131(4), 041210, October 2009.

Moitra, A., Kim, S., Houze, J., **Jelinek, B.**, Kim, S.-G., Park, S.J., German, R., and Horstemeyer, M., “Melting tungsten nanoparticles: a molecular dynamics study,” *Journal of Physics D: Applied Physics*, 41(18), 185406, September 2008.

Chandler, M., Horstemeyer, M., Baskes, M., Wagner, G., Gullett, P., and **Jelinek, B.**, “Hydrogen effects on nanovoid nucleation at nickel grain boundaries,” *Acta Materialia*, 56(3), 619–631, February 2008.

Chandler, M., Horstemeyer, M., Baskes, M., Gullett, P., Wagner, G., and **Jelinek, B.**, “Hydrogen effects on nanovoid nucleation in face-centered cubic single-crystals,” *Acta Materialia*, 56(1), 95–104, January 2008.

**Jelinek, B.**, Houze, J., Kim, S., Horstemeyer, M., Baskes, M., and Kim, S.-G., “Modified embedded-atom method interatomic potentials for the Mg-Al alloy system,” *Physical Review B*, 75(5), 054106, February 2007.

Potirniche, G., Horstemeyer, M., Gullett P., and **Jelinek, B.**, “Atomistic modelling of fatigue crack growth and dislocation structuring in FCC crystals,” *Proceedings of the Royal Society A*, 462(2076), 3707–3731, December 2006.

Potirniche, G., Horstemeyer, M., **Jelinek, B.**, and Wagner, G., “Fatigue damage in nickel and copper single crystals at nanoscale,” *International Journal of Fatigue*, 27(10–12), 1179–1185, October–December 2005.

CONFERENCE  
ARTICLES

**Jelinek, B.**, Salmon, E., Mason, G., Gibson, M., Hannis, T., Pachel, N., Jarrell, W., Towne, B., “SIMULATION STUDY OF LIGHT-WEIGHTING EFFECTS ON RIDE QUALITY AND MOBILITY,” NDIA Michigan GVSETS 2021 Novi, Michigan, August 8-12, 2021.

**Jelinek, B.**, Mason, G., Peters, J., Vahedifard, F., Priddy, J., “DEM Analysis of Contact Forces and Tractive Performance of Rigid Wheel in Granular Media,” 20th International and 9th Americas Conference of the ISTVS Online Event, September 27-29, 2021.

Johnson, D., Vahedifard, F., **Jelinek, B.**, Peters, J. F., “Using DEM-LBM for Micro-Scale Modeling of Coupled Hydro-Mechanical Processes in Geomechanics,” *Sixth Biot Conference on Poromechanics*. 6, 238-245 Paris, France, July 9-13, 2017.

**Jelinek, B.**, Johnson, D., Fili, J., Allen, J., Carrillo, A., Hodo, W., and Peters, J., “Coupled DEM-LBM model of loading response of saturated granular media,” *Proceedings of the 21st International Scientific Conference on Armament and Technics of Land Forces 2015*, Liptovsky Mikulas, Slovakia, November 12–13, 2015.

**Jelinek, B.**, Felicelli, S., Mlakar, P., and Peters, J., “Molecular dynamics study of temperature effects on electrokinetic transport in Si nanochannel,” *Proceedings of the ASME International Mechanical Engineering Congress & Exposition*, 10-8, Lake Buena Vista, USA, November 13–19, 2009.

Stone, T., **Jelinek, B.**, Kim, S.-G., Gullett, P., and Horstemeyer, M., “Molecular Dynamics Simulations of the Compressive Behavior of  $\alpha$ -Fe and Fe-Cu Nanocrystalline Materials,” *Proceedings of the 2007 International Conference On Powder Metallurgy & Particulate Materials*, 1.15–1.24, Denver, Colorado, USA, May 13–16, 2007.

**Jelinek, B.**, Zheng, F., Parihar, N., Hamaker, J., and Picone, J., “Generalized Hierarchical Search in the ISIP ASR System,” *Proceedings of the Thirty-Fifth Asilomar Conference on Signals, Systems, and Computers*, 2, 1553–1556, Pacific Grove, California, USA, November 2001.

**Jelinek, B.**, “Numerical Calculations of Planar Symmetric Arrays of Cylindrical Dipoles,” *RADIOELETRONICA 99, 9th International Czech-Slovak Scientific Conference*, 313–316, Brno, Czech Republic, April 27–28, 1999.

REPORTS

Allen, J., Hodo, W., Walizer, L., McInnis, D., Carrillo, A., **Jelinek, B.**, Johnson, D., Peters, J., and Felicelli, S. D., “Comparison/Validation Study of Lattice Boltzmann and Navier-Stokes for Various Benchmark Applications,” *U.S. Army Corps of Engineers ERDC*, September 2014.

PRESENTATIONS

**Jelinek, B.**, “Experimental and Modeling Capabilities for Off-road Mobility at CAVS, Mississippi State University,” *Computing in Engineering Forum, Machine-Ground Interaction Consortium*, University of Wisconsin-Madison, 2019.

**Jelinek, B.**, Young, W. J., II, Dantin, M., Furr, W., Doude, H., Priddy, M. W. (2019). “Two-dimensional Thermal Finite Element Model of Directed Energy Deposition,” *FE-iCS’19*, Washington DC, 2019

- Jelinek, B.**, “Development of a coupled LBM-DEM model for off-road mobility,” [3rd International Symposium on Advanced Vehicle Technology \(ISAVT\)](#), Illertissen, Germany, 2018.
- Jelinek, B.**, Eshraghi, M., Felicelli, S., “[Large Scale Parallel Lattice Boltzmann Model of Dendritic Growth](#),” TMS Annual Meeting & Exhibition, [Symposium on Modeling of Multi-Scale Phenomena in Materials Processing - III](#), San Antonio, TX, 2013.
- Eshraghi, M., **Jelinek, B.**, Felicelli, S., “A Three-Dimensional Lattice Boltzmann-Cellular Automaton Model for Dendritic Solidification under Convection,” TMS Annual Meeting & Exhibition, [Symposium on Frontiers in Solidification Science](#), San Antonio, TX, 2013.
- Jelinek, B.**, Felicelli, S., Peters, J., Solanki, K., “[Routines for Basic Tests of Atomistic Potentials with Universal Interface](#),” [2011 Conference on Computational Physics](#), Gatlinburg, TN, 2011.
- Jelinek, B.**, Felicelli, S., Mlakar, P., Peters, J., “[Effects of Surface Charge Density and Distribution on the Nanochannel Electro-Osmotic Flow](#),” [2011 LAMMPS Users' Workshop and Symposium](#), Albuquerque, NM, 2011.
- Jelinek, B.**, “[The Universal Interface for Testing Atomistic Potentials](#),” [2011 NIST Workshop on Atomistic Simulations for Industrial Needs](#), Gaithersburg, MD, 2011.
- Baskes, M., **Jelinek, B.**, Groh, S., Moitra, A., Horstemeyer, M., Houze, J., Kim, S., Wagner, G., “[New MEAM potentials for the Al, Si, Mg, Cu, and Fe alloy system](#),” [2011 NIST Workshop on Atomistic Simulations for Industrial Needs](#), Gaithersburg, MD, 2011.
- Jelinek, B.**, Felicelli, S., Mlakar, P., Peters, J., “[Temperature and Viscosity Effects on the Velocity Profile of a Nanochannel Electro-Osmotic Flow](#),” [63rd Annual Meeting of the APS Division of Fluid Dynamics](#), Long Beach, CA, 2010.
- Jelinek, B.**, Houze, J., Groh, S., Kim, S., Horstemeyer, M., Wagner, G., Baskes, M., “[MEAM Potential for Al, Si, Mg, Cu, and Fe Alloys](#),” [77th Annual Meeting of the Southeastern Section of the APS](#), Baton Rouge, LA, 2010.
- Jelinek, B.**, Felicelli, S., Mlakar, P., Peters, J., “[Temperature and Viscosity Effects on the Velocity Profile of a Nanochannel Electro-Osmotic Flow](#),” [77th Annual Meeting of the Southeastern Section of the APS](#), Baton Rouge, LA, 2010.
- Jelinek, B.**, Felicelli, S., Mlakar, P., “[Molecular Dynamics Parametric Study of Electrokinetic Transport in Silicon Nanochannel](#).” [USACE Research and Development Conference](#), Memphis, TN, 2009.
- Jelinek, B.**, Houze, J., Kim, S., Moitra, A., Liyagne, L., Horstemeyer, M., and Kim, S.-G., “[Development of the EAM Potential for Fe-C Alloy Systems](#),” [Annual APS March Meeting](#), New Orleans, LA, 2008.
- Jelinek, B.**, Kim, S.-G., Houze, J., Kim, S., Horstemeyer, M., and Baskes, M., “[Development and Testing of MEAM Potential for Al-Mg Alloys](#),” [TMS Annual Meeting & Exhibition, Symposium on Advances in Computational Materials Science and Engineering Methods](#), Orlando, FL, 2007.
- Jelinek, B.**, Houze, J., Kim, S.-G., Horstemeyer, M., and Baskes, M., “[MEAM Potentials for Al-Mg Alloy: Application to Defects](#),” [Annual APS March Meeting](#), Baltimore, MD, 2006.
- Jelinek, B.**, Kim, S., Houze, J., Kim, S.-G., Horstemeyer, M., and Baskes, M., “[Development and Testing of MEAM Potential for Al-Mg Alloys](#),” [73rd Annual Meeting of the Southeastern Section of the APS](#), Williamsburg, VA, 2006.
- Jelinek, B.**, Houze, J., Kim, S.-G., Horstemeyer, M., “[Potentials for Al and Mg Alloys and Interfaces](#),” [72nd Annual Meeting of the Southeastern Section of the APS](#), Gainesville, FL, 2005.

**Jelinek, B.**, Horstemeyer, M., Kim, S.-G., Baskes, M., Potirniche, G., “MEAM Potential Simulations of Void Formation on Al, Si, Mg, Cu and Fe Interfaces,” 8th US National Congress on Computational Mechanics, Austin, TX, 2005.

**Jelinek, B.**, Potirniche, G., Kim, S.-G. Horstemeyer, M., and Baskes, M., “Ab-initio Calculations for MEAM Potential of Al, Si, Mg, H, O and Cu Alloys,” Annual APS March Meeting, Los Angeles, CA, 2005.

**Jelinek, B.**, Potirniche, G., Kim, S.-G. Horstemeyer, M., and Baskes, M., “Ab-initio Calculations for MEAM Potential of Al, Si, Mg, H, and O Alloys,” Annual APS March Meeting, Montreal, Canada, 2004.

INVITED TALKS **Jelinek, B.**, “Development and Testing of (M)EAM Potentials for Elements and Alloys,” MIT Department of Material Science and Engineering, Boston, MA, 2008.

**Jelinek, B.**, “Development and Testing of (M)EAM Potentials for Elements and Alloys,” Delft University of Technology, Delft, NL, 2008

POSTERS **Jelinek, B.**, Mason, G., Peters, J., Johnson, D., Brumfield, M., Carrillo, A., Goodman, C., Vahedifard, F., “Large Scale MPI-Parallelization of LBM and DEM Systems: Accelerating Research by Using HPC,” SC18, The International Conference for High Performance Computing, Networking, Storage, and Analysis, Dallas, TX, 2018.

Johnson, D., **Jelinek, B.**, Felicelli, S. D., Walizer, L., Hodo, W. “Loading Response of Densely Packed Particle Assemblies in Fluid,” National Center for Intermodal Transportation for Economic Competitiveness Annual Conference, Mississippi State University, 2013.

SOFTWARE PRODUCTS **2d-heat-ded**, 2D thermal model of LENS® process in Python using **FEniCS**, Python routines using **ASE** for testing of classical atomistic potentials, C++ (earlier version in Pascal) program to calculate directivity and gain of Yagi-Uda antennas: *Numerical Calculations of Planar Symmetric Arrays of Cylindrical Dipoles*

AFFILIATIONS International Society for Terrain-Vehicle Systems

EXPERTISE ♦ **FEniCS** (2D thermal model of LENS® process **2d-heat-ded**)  
 ♦ **HPCToolkit**, **TAU**, **PerfExpert**  
 ♦ **ASE** (contributed 1, 2, 3), **LAMMPS** (contributed 1, 2, 3), **VASP**, **GROMACS**, **Antennavis**  
 ♦ Matlab, Simulink, Modelica  
 ♦ C, C++, Fortran 77, 95, Pascal, MPI, **Maxima** (contributed)  
 ♦ Gnuplot, Grace, **libX11**, **OpenDX**, CEI Enight, HDF5, **dxhdf5**, IDL/gdl, ParaView, VisIt, **Moose**, **FEniCS**  
 ♦ Bash, Python, Perl, AWK, GIT, CVS, Subversion, MySQL, HTML, XML, **XDMF**, HTML  
 ♦ Emacs, Jupyter Notebook, **L<sup>A</sup>T<sub>E</sub>X**, Microsoft Word, PowerPoint, Excel  
 ♦ GNU/Linux (Gentoo), Ubuntu, Microsoft Windows  
 ♦ fluent in English, Slovak, Czech