

Curriculum Vitae

Richard P. Donovan

Assistant Director of Research Development

The Henry Samueli School of Engineering and

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Professional Preparation

University of Wyoming Mechanical Engineering, Ph.D. Theoretical and Applied Mechanics
Mixture Theory Approach to Composite Structural Analysis, Dr. Andrew Hansen (Advisor), 1992

Montana State University Civil Engineering, MS Structural Engineering/Mechanics
Finite Element Analysis of Reinforced Concrete Plates, Dr. Fred Videon (Advisor), 1985

The University of Texas Civil Engineering, BS Structural Engineering emphasis

Appointments

University of California, Irvine	Assistant Director of Research Development	2013-present
Michigan Technological University	Operations Manager	2009-2013
RAVE Technical Development Center	Director	2001-2009
Montana Tech of The University of Montana	Assistant Professor	2001-2009
Montana Tech of The University of Montana	Visiting Professor	1996-2001
NASA-Lewis Research Center	Research Fellow	6/96-8/96
NASA-Langley Research Center	Research Fellow	6/95-8/95
University of Evansville	Assistant Professor	1992-1996
Montana State University	Adjunct Professor	6/93-8/95
University of Wyoming	Graduate Research Assistant	1988-1992
Delapp Engineering	Consulting Structural Engineer	1985-1988

Publications

Breffle, William S., Muralidharan, Daya, Donovan, Richard P., Liu, Fangming, Mukherjee, Amlan, Jin, Yongliang, 2013, "Socioeconomic Evaluation of the Impact of Natural Resource Stressors on Human-Use Services in the Great Lakes Environment: A Lake Michigan Case Study", *Resources Policy*, Vol. 38, no. 2, 152-161.

Shonnard, D.R., Donovan, R.P. 2011. "Life Cycle Assessments of Hydro-Renewable Jet and Diesel from Jatropha Grown in Mexico: Greenhouse Gas Emissions and Fossil Energy Demand," final report submitted to Kuosol, Merida, Mexico, February 12, 2011, 35 pages.

Lucon P, Donovan R. 2007. "An artificial neural network approach to multiphase continua constitutive modeling". *Composites Part B: Engineering*. 38(7-8):817-823.

Emery, M., Paxton, J., Donovan, R. 2005. "Application and Testing of a Cougaar Agent-Based Architecture," *Proceedings of the Fourth IASTED International Conference on Computational Intelligence*, Calgary, Canada, July 4-6.

Lucon, P., Donovan, R. 2004. "An Artificial Neural Network Approach to Multiphase Composite Constitutive Modeling," *Proceedings of the 11th International Conference on Composites Engineering*, Hilton Head Island, South Carolina, August.

Duneman, M., MacLaughlin, Donovan, R. 2003. "Validations of a DDA Block Deformability under Gravity Loading," *Proceedings of the Sixth International Conference on the Analysis of Discontinuous Deformation.* International Committee for Accessible Document Design (ICADD)-6, Oslo, Norway, October 3.

Donovan, R. 1996. "Micro-Mechanics, Piezoelectricity, Mixture Theory, and Advanced Composite Structural Engineering," *Proceedings of the Third International Conference on Composites in Engineering*, New Orleans, LA, July 20-24.

Donovan, R. 1995. "A Modern Mixture Theory Approach to Composite Structural Analysis," *Proceedings of the Second International Conference on Composites in Engineering*, New Orleans, LA, August 21-24.

Hansen, A., Walker, J., Donovan, R. 1994. "A Finite Element Formulation for Composite Structures Based on a Volume Fraction Mixture Theory," *International Journal of Engineering Science*, Vol. 32, No. 1.

Hansen, A., Crane, R., Damson, M., Donovan, R., Horning, D., and Walker, J. 1991. "Some Notes on a Volume Fraction Mixture Theory and a Comparison with Kinetic Theory of Gases," *International Journal of Engineering Science*, Vol. 29, No. 5.

Grants and Contracts

NSF OISE-PIRE: Sustainability, Ecosystem Services, and Bioenergy Development across the Americas (Senior Person, Kathy Halvorsen PI)

This proposal is a direct outgrowth of the NSF RCN-SEES grant described below. The program is funded under the Science, Engineering and Education for Sustainability (SEES) program at NSF and is focused on the impacts biomass based liquid transportation fuel development in the United State, Mexico, Argentina and Brazil. The program seeks to answer the question: “How will biofuel development impact socio-ecological systems and associated ecosystems services and how can those impacts best be measured, modeled and mitigated.” This four year international program will engage research professionals from throughout the US, Mexico, Argentina and Brazil in a dynamic research and education program spanning two continents over a four year period.

NSF RCN-SEES: A Research Coordination Network on Pan American Biofuels and Bioenergy Sustainability (Co-PI, David Shonnard PI)

The goal of this RCN project is to create a network of biofuels / bioenergy researchers and industry / government / NGO practitioners as a core group concerned with sustainable biofuels and bioenergy development across the Americas. The objectives of this project are to **i.** establish and sustain an international research coordination network with a focus on biofuels / bioenergy sustainability and with a geographic context of the Pan American region, **ii.** develop coordinated research programs, and **iii.** create new know-ledge on social, environmental, and economic sustainability implications of large-scale biofuels/bioenergy production from biomass grown in this region. The Pan American Biofuels and Bioenergy Sustainability RCN will consist of researchers at universities and other organizations from North America (United States, Canada and Mexico), Central America, and South America. The main sustainability research themes are: land rights, water/energy nexus issues, biodiversity/ecosystems, energy policy, life cycle environmental assessment, food and other systems, biogeochemical cycles, and biomass supply transportation logistics.

NSF CI-TEAM Demo: Environmental CyberCitizens: Engaging Citizen Scientists in Global Environmental Change through Crowdsensing and Visualization (Co-PI, Alex Mayer PI)

This demonstration project will create and evaluate a set of activities aimed at preparing a diverse science and engineering workforce with cyber-infrastructure knowledge and skills. A multidisciplinary team of faculty and undergraduate students will collaborate with citizen scientist end users to develop and deploy data collection and visualization tools, to monitor the critical ecosystems of Lightfoot Bay in the Upper Peninsula of Michigan. The proposed program will build upon existing educational programs at Michigan Technological University, Keweenaw Bay Ojibwa Community College, several local high schools, and a local land conservancy. Research scientists at International Business Machines who are actively engaged in the development of crowd sensing applications will collaborate with the co-PIs and students.

Life Cycle Assessment of Hydrocarbon-based Fuels from Yucatan Jatropha, KUOSOL, Merida MX (Co-PI, David Shonnard PI)

The goal of this life cycle assessment was to model cradle-to-grave greenhouse gas (GHG) emissions of diesel and jet fuel produced from *jatropha curcas* grown in the Yucatan of Mexico. Several analysis variant cases were investigated in order to better understand the implications of model inputs and assumptions on GHG results. These variants include; fertilizer application intensity, with and without direct land use change (dLUC), allocation method, electricity generation or purchase at the oil extraction stage, jatropha seed productivity, oil content, hydrogen production technology, and carbon stocks of land for dLUC calculation. This study has shown that Yucatan GJ and GD are relatively low GHG intensive hydrocarbon “drop-in” biofuel products with savings from 65% - 99% compared to petroleum jet and diesel depending on LCA assumptions.

Rocky Mountain Agile Virtual Enterprise Technical Development Center (RAVE TDC), National Science Foundation Partnership for Innovation

The RAVE TDC was formed under Montana University System (MUS) Board of Regents charter to act as a catalyst for the establishment of collaborations between elements of the MUS and private business. Initially funded by the National Science Foundation (NSF) Partnership for Innovation, the RAVE TDC has focused on a variety of topics including precision fabrication, homeland security and composite materials modeling. The RAVE TDC successfully competed for a variety of other grants and contracts detailed below. It is important to consider that in addition to graduate student engagement, essentially every project detailed below involved significant contributions from undergraduate science, engineering and technology students in every aspect of the projects including, design, fabrication, project management and business development

The RAVE Creativity Forge

The Creativity Forge was established under the PFI program to provide a precision fabrication facility:

- For area entrepreneurs and manufacturers to research manufacturing strategies in order to make strategic business decisions and overcome production bottlenecks;
- To provide training to technology and engineering students in next-generation manufacturing, design, and business practices;
- Development of intelligent control methodologies for precision fabrication; and
- For development of programs and processes through which area businesses directly interface with students of the Montana University System and assist in curriculum development.

The facility was utilized by businesses and university programs across the state to fabricate everything from cattle brands to satellite parts. The facility supported research into friction stir welding, noise abatement and autonomous sensor networks. When fully operational the facility was the most sophisticated precision fabrication facility in the state capable of holding demonstrated tolerances of +/- 0.0005 inch with a host of precision fabrication equipment including: robotic welding, CNC lathe, four and five axis milling and state of the art concurrent engineering software.

Manufacturing Masters Classes, National Science Foundation Partnership for Innovation

The RAVE TDC was awarded supplemental funding to offer a “Manufacturing Masters Class” during the summer of 2004. The program brought together industry experts and high school teachers for a two-week hands-on course incorporating design and fabrication elements. The focus of this initial offering was the design and manufacture of custom bike frames. The Manufacturing Masters Class Summer 2004 included:

- Design and analysis of parts and fixtures in advanced solid modeling applications;
- Programming and operation of a Lincoln Electric 120iLT robotic welding cell;
- Programming and operation of Computer Numerically Controlled (CNC) lathes and mills; and
- Hands-on experience with manufacturing/prototyping processes.

RAVE TDC, Montana Legislative Appropriation

The RAVE TDC was funded to continue the programs initially funded by the NSF-PFI. This state appropriation funded RAVE TDC staff, the Creativity Forge, and student workers. In addition, it has provided support and expertise to local businesses and entities working on economic development through collaboration.

RAVE TDC, National Science Foundation Course, Curriculum, Laboratory Improvement (CCLI) Award

The National Science Foundation awarded the RAVE TDC a CCLI grant to develop a series of lab courses directed at providing engineering students with training in the use of CNC milling centers, CNC turning centers and robotic welding systems. This project was designed to support Montana’s light manufacturing industry with innovative educational programs; to improve STEM education by developing ‘experiential learning’ programs; to place students’ education in the context of ‘real-world’ projects, and to overcome engineering ‘competency gaps’ identified by the Society of Manufacturing Engineers and others.

Haas Entrustment of VF5-XT Vertical Milling Center, Haas Automation

The RAVE Creativity Forge was designated a regional Haas Technical Education Center (HTEC). This designation qualified the Creativity Forge to apply for and receive a Haas entrustment of a Haas VF5-XT five-axis vertical milling center. This system was utilized by undergraduate engineering students to produce precision parts ranging from wild grass seed harvester drums to precision satellite parts.

RAVE Creativity Forge Affiliate Program, Inland Northwest Space Alliance (INSA)

The RAVE TDC partnered with INSA to provide funding to Helena Capital High School and the Industrial Technology Teacher Education Program at The University of Montana-Western. The funds were used to purchase tool room CNC milling machines for these schools in support of a statewide initiative geared toward developing statewide competencies in precision fabrication. A match of \$70,000 was provided by Helena Capital, UM-Western, and Haas Automation.

NASA Workforce Development Grants, Montana Space Grant Consortium

Grants were provided to support the fabrication of precision satellite parts for the Montana State University Space Science Engineering Laboratory. Funds were used to pay undergraduate students, and to purchase tooling and materials to fabricate cube-sat satellites.

Creativity Forge Consulting Engineering Projects, Various Businesses

The RAVE Creativity Forge contracted for and completed nearly \$100,000 worth of other projects too numerous to detail. These projects ranged from cylinder head covers to cattle brands and satellite parts. The Creativity Forge program also assisted numerous small businesses in developing and executing manufacturing plans and new business start-ups.

Montana Institute for Simulation Technologies (MIST), Montana State Department of Administration

The RAVE TDC led the effort for through which Montana Tech was awarded a state appropriation to support the purchase of a 3 teraflop cluster computer in support of the Montana Institute for Simulation Technology initiative. This appropriation was combined with other grant funding awarded by the Office of the Commissioner of Higher Education to establish High Performance Computing and other related cyber infrastructure for the state of Montana.

MIST, Montana State Department of Administration Information Technologies Division

The RAVE TDC contracted with the Department of Administration to develop a business plan for the Montana Institute for Simulation Technology (MIST). MIST was to become an umbrella organization for High Performance Computing and Cyber Infrastructure for the Montana University System and other educational enterprises in Montana. The business plan laid out a structure focused in the broad areas of: Natural Resource Management, Aerospace/Aeronautics Research, Life Sciences and Complex Systems.

Montana Institute for Simulation Technologies Affiliate Program, Office of the Commissioner of Higher Education

The RAVE MIST program competed for and won a Montana University System Board of Regents grant to purchase and install a 2-3 teraflop cluster computer in support of a statewide initiative in High Performance Computing focused on aerospace engineering research, biomedical modeling and engineering, and natural resource management. In addition, the funding was to be used to purchase and install voice/video collaboration hardware and software to connect affiliate institutions into a distance education/research network.

Analysis, Design, and Fabrication of APXI Ultra-High Pressure Waterjet Cutting Pump, Montana Board of Research Commercialization and Technology

The RAVE TDC led the development of a grant that was competitively awarded to assist a new precision fabrication business in Bozeman MT. Apex Technologies, Inc. of Bozeman, MT, developed a cutting-edge design for pumps that power Computer Numerically Controlled (CNC) waterjet cutting systems. The RAVE Creativity Forge fabricated high precision for three of these systems that included: five axis milling to less than +/- .005 inch tolerance and well as welding heavy industrial frames to within +/- 0.005 parallel. Dynamic machine models were developed to assess vibration characteristics and overall program management was provided to APEX.

Secure Area Access Control System (SAACS), Helena Regional Airport Authority, Helena, MT

The RAVE TDC, in partnership with Industrial Automation Consulting (Three Forks, MT), G5 Technologies, (Cherry Hill, NJ), and Sarnoff Corporation (Princeton, NJ), was awarded an

Airport Improvement Grant to develop a baseline smart sensor network security system for the Helena Regional Airport Authority, which served as a precursor for a larger airport-wide system.

Distributed Ad-Hoc Intelligent Sensor Intrusion-Detection System, Transportation Security Administration

The RAVE TDC, in partnership with Industrial Automation Consulting (Three Forks, MT), GCS Research (Missoula, MT), G5 Technologies (Cherry Hill, NJ), Sarnoff Corporation (Princeton, NJ), and Helena Regional Airport Authority (Helena MT), was awarded one of sixteen grants in a nationwide competition to pilot innovative approaches for airport security in the post 9/11 environment. RAVE TDC developed the team and associated proposal that was ultimately submitted by the Helena Regional Airport Authority (HRAA). The RAVE TDC technical role was:

- Develop an Intelligent Software Agent system to control access to airport secure areas;
- Develop an Intelligent Software Agent system to gather “meta data” associated with airport personnel; and
- Develop algorithms to perform uncooperative tracking of RFID tagged personnel throughout the secure areas of the airport;
- Develop the Test and Evaluation program for the overall project; and
- Provide overall technical supervision to the project.

The RAVE TDC technical team consisted of four undergraduate engineering and computer science students from Montana Tech (Butte MT) and one MS graduate student (Computer Science) from Montana State University. The RAVE TDC team, consisting primarily of undergraduate students, was the only technical team to deliver on their scope of work on time and under budget.

Vehicular Identification Smart Sensor Web (VISSW), Transportation Security Administration

The RAVE TDC, in partnership with Industrial Automation Consulting (Three Forks, MT), MSE Technology Applications (Butte, MT), Imagination Engines Incorporated (St. Louis, MO), BBN Technologies (Arlington, VA), and the Bert Mooney Airport Authority (Butte, MT), was awarded one of sixteen grants in a nationwide competition to pilot innovative approaches for airport security in the post 9/11 environment. The goal of the project was to develop an autonomous system to identify and track anomalous vehicular traffic at small regional airports. The RAVE TDC team consisted of undergraduate electrical engineering, information technology, mechanical engineering, welding engineering students as well as college of technology students. This technical project team was responsible for:

- Integration of ultra wide band radar tracking, intelligent video tracking, weigh in motion vehicle sensors and RFID systems;
- Integration of associated software suites; and
- Electronic packaging of all weather sensor systems.

The RAVE TDC technical team consisted of three undergraduate engineering and computer science students from Montana Tech (Butte MT) who led the development of this system in collaboration with Imagination Engines Inc., BBN Technologies, and Industrial Automation Consulting.

Multi-phase Continuum Finite Element Approach to Electro-Optical Composites, Department of Energy Experimental Program to Stimulate Competitive Research (co-PI)

This funding resulted in the development of innovative computational models for calculating material properties of advanced composite materials. These models utilize artificial neural networks to numerically analyze the performance of continuous media and predict material properties. The approach holds significant promise in solving the inverse problem of determining the required composition and microstructure for a desired set of material properties. This funding also established significant computational resources on the Montana Tech campus and provided the impetus for the MIST project previously described.

Presentations

Breffle, William S., Muralidharan, Daya, Donovan, Richard P., Liu, Fangming, Mukherjee, Amlan, Yongliang, Jin, 2012, Socioeconomic Evaluation of the Impact of Natural Resource Stressors on Human-Use Services in the Great Lakes Environment: A Lake Michigan Case Study, Pathways to Success: Integrating Human Dimensions into Fisheries and Wildlife Management Conference, Colorado State University, Breckenridge, Colorado.

Mayer, Audrey L., Donovan, Richard P., Pawlowski, Christopher W., 2012, Information and entropy theory for the sustainability of Combined Human And Natural Systems (CHANS), 2012 US-IALE meeting, US-International Association for Landscape Ecology, Newport, RI, April 9, 2012 - August 11, 2012.

Mayer, Audrey L., Donovan, Richard P., Pawlowski, Christopher W., 2012, Information as a measure of sustainability, 2012 TransAtlantic Research and Development In Sustainability (TARDIS) workshop, USEPA, Austrian Federal Ministry of Science and Research, Leibnitz, Austria, April 22, 2012 - April 25, 2012.

“Commercialization Pathways for Forest Based Biofuels, Bioenergy and Bioproducts.” IN2WOOD Final Conference (<http://www.in2wood.eu/>), Strbske Pleso, Slovakia. (Invited presentation). 2012

“Wood-to-Wheels and Sustainable Bioenergy Pathways.” Association of Consulting Foresters National Convention, Grand Rapids MI. (Invited presentation). 2012

“Prediction of Hypervelocity Impact of Nanocomposite Materials using Hybrid Artificial Intelligence and Physics Based Modeling.” Sept. 2008. 59th International Astronautical Congress. Glasgow UK.

“Vehicle Identification Smart Sensor Web: An AI Approach to Screening for Intent.” May 2007. IEEE Conference on Technologies for Homeland Security: Enhancing Critical Infrastructure Dependability.

“Extreme Programming Practices Applied to Small Lot Manufacturing: Curriculum Development at Montana Tech of The University of Montana.” Second Annual Conference on Small Lot Intelligent Manufacturing (SLIM), Santa Fe, NM, September 13-14, 2005.

“Application and Testing of a Cougar Agent-Based Architecture.” Fourth IASTED International Conference on Computational Intelligence, Calgary, Alberta, Canada, July 4-6, 2005.

“Smart Sensor Networks and Site Security.” Montana Homeland Security Task Force, October 2004.

“An Artificial Neural Network Approach to Multiphase Composite Constitutive Modeling.” Presented by Mr. Peter Lucon (graduate student), 11th International Conference on Composites Engineering, Hilton Head IS, South Carolina, August 2004. (peer reviewed)

“Aerospace Manufacturing.” Breakout Session organizer and Moderator, First Annual Montana Aerospace Conference, Fairmont Hot Springs, February 22-23, 2004.

“Sensor Networks.” Invited Speaker, Montana Airport Managers Association annual Conference, 2003, Helena, MT.

“Site Security and Smart Sensor Technology.” Invited Speaker, Domestic Terrorism Training sponsored by the United State Attorney and the Anti-Terrorism Task Force, September 25-26, 2003.

“Rocky Mountain Agile Virtual Enterprise Technical Development Center.” Invited Speaker, Montana Department of Forest Products, SBIR Conference, 2003, Hamilton, MT.

“Rocky Mountain Agile Virtual Enterprise.” Invited Speaker, Southwest Montana Technology Network, 2002, Butte, MT.

“Collaborative Commerce.” Invited Speaker, Montana State University-Northern Tech Expo, 2002, Havre, MT.

“Collaborative Commerce.” Session Organizer and Keynote Speaker, Wyoming Gro-Biz Government Procurement Conference, Cody, WY.

“Rocky Mountain Agile Virtual Enterprise.” Montana University System Outreach Tour, 2002, visited far-flung towns in Montana: Shelby, Havre, Malta, Glasgow, Wolf Point, Sidney, and Glendive.

“Ensuring that Montana’s Educational System is Tech Savvy.” Invited Speaker, Senator Max Baucus Economic Development Summit 2001, Great Falls, MT.

“Rocky Mountain Agile Virtual Enterprise and Collaborative Commerce.” Invited Speaker, Missoulian Career and Tech Expo Conference, 2001, Missoula, MT.

“Rocky Mountain Agile Virtual Enterprise and Collaborative Commerce.” Invited Speaker, Big Sky Economic Development Authority Small Business Opportunities 2001 Conference, Billings, MT.

Institutional and Professional Service

- Faculty Senate, Montana Tech of the University of Montana (Montana Tech)
- Chief Advisor to Tau Beta Pi, Montana Tech
- Affiliate Representative to the Montana Space Grant Consortium, Montana Tech
- Northwestern Energy Customer Advisory Panel, Butte MT
- Montana Science and Technology Subcommittee to the Montana Homeland Security Task Force, Chair
- Extensive community engagement via the Rocky Mountain Agile Virtual Enterprises program (see previous descriptions)

Topics Taught

- **Engineering Mechanics Courses:**
 - Statics
 - Dynamics
 - Mechanics of Materials
 - Advanced Mechanics of Materials (graduate)
 - Continuum Mechanics (graduate)
 - Theory of Elasticity (graduate)
 - Fluid Mechanics
 - Fluid Mechanics Lab
 - Advanced Thermodynamics (graduate)
 - Vibrations
 - Advanced Vibrations (graduate)
 - Intro to Engineering Applications – Concurrent Engineering
 - Advanced Engineering Applications – Concurrent Engineering
 - Introduction to Material Science
- **Physics Courses:**
 - Kinematics
 - Heat, Sound and Light
 - Electricity and Magnetism
- **Engineering Mathematics Courses:**
 - Numerical Methods
 - Finite Element Analysis
 - Advanced Finite Element Analysis (graduate)