JEFFREY L. STEIN – Curriculum Vitae

June 2, 2015

Short Biography

Prof. Stein has been on faculty at The University of Michigan since 1983 becoming a Full Professor in 1996. He received his B.S. in premedical studies with a minor in Psychology (1973) from the Univ. of Massachusetts; his S.B. and S.M. (1976) and Ph.D. (1983) all in Mechanical Engineering and from the Massachusetts Institute of Technology. He was the PI in 2014 on a Global Challenges for a Third Century Phase I interdisciplinary project "Sustainable Transportation for a 3rd Century: An Interdisciplinary Approach to Addressing the Last Mile Problem for Enhanced Accessibility". He was also the Director of the recently completed NSF EFRI-RESIN Project "A Multi-Scale Design and Control Framework for Dynamically Coupled Sustainable and Resilient Infrastructures, with Application to Vehicle-to-Grid Integration" and he is a founding member of and former Associate Director of the Automotive Research Center (ARC). He was the Program Chair of the 2012 DSCC (Dynamic Systems and Control Conference) and a former chair of the Executive Committee and the Honors and Award Committee of the Dynamic Systems and Control Division of ASME. He is a Fellow of ASME and is currently the chair of ASME's Energy and Environmental Standards Advisory Board. Finally, he is an Associate Editor of *Simulation Modeling Practice and Theory* and a former Associate Editor of the ASME Transactions: *Journal of Dynamics Systems Measurement and Control*.

Prof. Stein's expertise is in the use of computer based modeling and simulation tools for system design and control with applications to sustainable transportation and advanced manufacturing. He recently completed an NSF EFRI RESIN grant focused on resiliency and sustainability of the power grid and transportation infrastructures as a function of the design of plug-in hybrid electric vehicles. His current work is on sustainable transportation at the nexus of autonomous vehicles, urban planning, public policy and business in solving the last mile problem of public transportation. His contributions include developing a fundamental understanding of the design and control issues for utilizing renewable energy sources for transportation including hybrid electric vehicles. He is also contributing to the control of large, fast moving autonomous vehicles and tele-operated vehicles. In addition he is involved in global concurrent design and manufacturing with a focus on internet distributed hardware in-the-loop simulation technologies.

Prof. Stein's discipline expertise in dynamic systems modeling has lead to the concept of proper models - that is dynamic mathematical models with physical state variables and parameters that have the minimum yet sufficient complexity to meet a given engineering objective. He has also developed algorithms for automating the creation of these types of models. Prof. Stein has also made fundamental contributions to complex systems and concurrent design through his work on internet-distributed hardware in-the-loop simulation and to the state estimation literature through is work on input, state and parameter estimation. His contributions include the following application areas: automotive and truck engineering (alternative energy vehicle propulsion, electric/hybrid vehicles, vehicle mobility, engine in-the-loop simulation, vehicle parameter identification), manufacturing (machine tool cutting force estimation, machine tool

spindle bearing thermal bearing load estimation and reconfigurable machine tool design), bioengineering (design and control of above-knee prostheses). He has authored or co-authored over 185 articles in journals and conference proceedings.

He has received numerous honors and awards including: Two doctoral students (one twice) being selected as Best Student Paper Finalist at the 2009, 2013 and 2014 Dynamic Systems and Control Conferences; Invited Speaker, Congressional Briefing, "The Road to the New Energy Economy: Electric Cars", March 23, 2011, Rayburn Office Bldg., Washington, DC. Invited Plenary Speaker, 2010 International Conference on Bond Graph Modeling, Orlando, FL, DSC ASME DSCD Michael J. Rabins Leadership Award, 2012, ASME Dedicated Service Award (2010), ASME Fellow (2006), Outstanding Teacher, Department of Mechanical Engineering Teacher Incentive Program, (1999-2000), Invited manuscript in the Special 50th Anniversary Issue of the *Journal of Dynamic Systems Measurement and Control* (1993), Presidential Young Investigator Award, National Science Foundation (1987).

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EDUCATION: **Massachusetts Institute of Technology, Cambridge, MA**

        Ph.D.   Mechanical Engineering, 1983

        S.M.   Mechanical Engineering, 1976

        S.B.   Mechanical Engineering, 1976

    University of Massachusetts, Amherst, MA

        B.S.   Premedical Studies with a minor in Psychology, 1973

RESEARCH AND PROFESSIONAL EXPERIENCE:

    University of Michigan, Ann Arbor, MI

2012-   Professor, Design Science Program

    Participating faculty member in the new Ph.D. program in Design Science.

1996-   Professor, Dept. of Mechanical Engineering (name changed 7/00).

    Specializing in areas of algorithms for deducing or reducing proper dynamic system models to design and control resilient and sustainable systems. Model parameter and estimation as well as Optimal Design of Experiments. Applications across many domains some in which include; hybrid and electric vehicles, vehicle to grid integration, design for health conscious battery performance, internet-distributed hardware in-the-loop simulation, resilient and sustainable infrastructures, autonomous vehicles for accessibility, machine design and control, machine monitoring, and high speed precision spindles.

1994-2009   Thrust Area Leader of the Automotive Research Center (ARC)

    Leader of the ARC's Dynamics and Controls of Vehicle and Mobile Robotics Thrust Area

    Research in modeling and simulation of ground vehicles, including hybrid vehicles and batteries.

1988-1996   **University of Michigan, Ann Arbor, MI**

    Associate Professor, Dept. of Mech. Engr. and Applied Mech.

    Research and teaching in system dynamics, control, machine diagnostics, machine design and control, computer-assisted modeling and design, vehicle (including hybrids) dynamics and control and control of artificial limbs.

1983-88   **University of Michigan, Ann Arbor, MI**

    Assistant Professor, Dept. of Mech. Engr. and Applied Mech.

1991-   **Independent Consultant, Ann Arbor, MI**
& 1983-1987   Design analysis of mechanical systems and manufacturing
          machines.
1988-1991   **Failure Analysis Associates, San Francisco, CA**
          <u>Consultant</u>
          Design analysis of mechanical systems and manufacturing
          machines.

SPECIALIZED PROFESSIONAL COMPETENCE:

          Automated Modeling of Dynamic Systems; Proper modeling.
          Modeling, analysis, design and control of mechanical systems.
          Modeling and design of automatic control systems;
          electromechanical, hydraulic and pneumatic servosystems.
          Vehicle Electrification. Design and control of hybrid, Plug-In
          hybrid and electric vehicles. Batter health conscious
          charging. Autonomous vehicle control.
          Internet-Distributed Hardware in-the-Loop Simulation.
          Vehicle (automobiles and trucks) handling, ride, mobility.
          Vehicle suspension and drivetrain design, modeling, control
          and simulation including hybrid and autonomous vehicles.
          Design and control of machine tool systems; machine tool drive
          systems and machine tool diagnostics; sensors, signal
          processing, model based diagnostics techniques; gear
          backlash dynamics, slide friction characteristics, high speed
          spindle bearing design, machine guarding.
          Biomechanics and modeling of human locomotion. Design and
          control of prosthetic devices.

AWARDS, HONORS and MEMBERSHIP:

          ASME Energy and Environmental Standards Advisory Board,
          Chair (7/1/15)
          ASME DSCC 2014 Best Student Paper, Finalist (Ph.D. student
          Xin Zhou) " Battery State of Health Monitoring by Side
          Reaction Current Density Estimation via Retrospective-Cost
          Subsystem Identification"
          ASME DSCC 2013 Best Student Paper, Finalist (Ph.D. student
          Xin Zhou) "Battery Health Diagnostics Using Retrospective-
          Cost System Identification: Sensitivity to Noise and
          Initialization Errors"
          ASME DSCD Michael J. Rabins Leadership Award, 2012. "For
          distinguished and steadfast leadership within the Dynamics
          Systems and Control Division, for promoting efficiency and
          integrity in division governance, and for advancing the
          reputation of the division nationally and internationally."
          ASME DSCC 2012 Semi-Plenary Talk based on paper "The
          evolution and future of Internet-distributed hardware-in-the-

loop simulation from a dynamic systems and control perspective" selected as one of six from a total of 350 conference papers.

Invited Speaker, Congressional Briefing, "The Road to the New Energy Economy: Electric Cars", March 23, 2011, Rayburn Office Bldg., Washington, DC.

ASME Dedicated Service Award, 2010. For "unusual dedicated voluntary service to the ASME marked by outstanding performance, demonstrated effective leadership, prolonged and committed service, devotion, enthusiasm and faithfulness".

Invited Plenary Speaker, 2010 International Conference on Bond Graph Modeling, Orlando, FL.

Invited Panelist and Speaker for "Toward Green Mobility: Integrating Electric Drive Vehicles and Smart Grid Technology " sponsored by the American Association for the Advancement of Science, 2010.

The most downloaded article of the month, *Journal of Dynamic Systems Measurement and Control*, for the manuscript "A Review of Proper Modeling Techniques" (Oct 2008)

Guest Editor of a Special Issue, ASME Transactions: *Journal of Dynamic Systems Measurement and Control* on Physical System Modeling, 2010

ASME DSCC 2009 Best Student Paper, Finalist (Ph.D. student Scott Moura), "Control of Film Growth in Lithium Ion Battery Packs via Switches"

Associate Editor Modeling *Simulation Modeling Practice and Theory,* International Journal of the Federation of European Simulation Societies, 2009-2011

Area Editor of *Simulation*: Transactions of The Society for Modeling and Simulation International, (2007-9).

ASME – Fellow, named by the Board of Governors of ASME, September, 2005

Outstanding Teacher, Department of Mechanical Engineering Teacher Incentive Program, 1999-2000.

Invited manuscript in the Special 50th Anniversary Issue of the *Journal of Dynamic Systems Measurement and Control,* 1993

Named one of the "125 Alumni to Watch" by the University of Massachusetts, Amherst, 1988.

Presidential Young Investigator Award, National Science Foundation, 1987

Research Incentive Award, Exxon Foundation Faculty Assistance Program, 1984

Chair, Executive Committee, Dynamics Systems and Control Division of American Society of Mechanical Engineers (ASME), 2001- 2002

Past Associate Editor of the ASME *Journal of Dynamic Systems Measurement and Control* (1991- 1996)

Member of the National Society of Professional Engineers, ASME, Past Chairman of the Modeling and Identification; Biomechanical Systems; and Manufacturing Systems Technical Panels of the Dynamic Systems and Control Division of ASME, Society of Manufacturing Engineers, Society of Automotive Engineers, American Society of Engineering Educators, The Society for Computer Simulation and honorary societies; Phi Beta Kappa, Pi Tau Sigma, Phi Kappa Phi and Sigma Xi.

PROFESSIONAL:

1990 -   Registered Professional Engineer, #36154, State of Michigan

REFERENCES:

Available upon request

PUBLICATIONS:

Books/Chapters

B1. Loucas, L.S., Rideout, D.G., Ersal T., Stein, J.L. (2011) "Energy-Based Bond Graph Model Reduction" Chapter 2 in Book *Bond Graph Modelling of Engineering Systems*, Springer Science+Business Media, LLC 2011, Ed. Wolfgang Borutzky.

Archival Journals[1]

J1) Stein, J. L. and Hedrick, J. K., 1980 "Influence of Fifth Wheel Location on Truck Ride Quality", *Transportation Research Record* 774, pp. 31-39, National Academy of Sciences.

J2) Stein, J. L. and Flowers, W. C., 1987 "Stance Phase Control of Above-Knee Prostheses: Knee Control Versus SACH Foot Design," Journal of Biomechanics, Vol. 20, No. 1, pp. 19-28. (Also appeared in the Proceedings of the 1987 ASME Biomechanics Symposium).

J3) Stein, J. L., Colvin, D ., Clever, G. and Wang, C.-H., 1986 "Evaluation of DC Servo Machine Tool Feed Drives As Force Sensors" *Journal of Dynamic Systems Measurement and Control,* Vol. 108, No. 4., pp. 279-288, Dec. (Also appeared in the 1984 *Proceeding of the Symposium on Sensors and Controls for Automated Manufacturing and Robotics*, ASME Winter Annual Meeting).

J4) Stein, J. L., and Shin K.-C.,1986 "Current Monitoring on Field Controlled DC Spindle Drives", *Journal of Dynamic Systems Measurement and Control,* Vol. 108, No. 4, pp. 289-295, Dec. (Also appeared in the Proceeding of the 1985 Symposium on *Sensors and Controls for Manufacturing*, ASME Winter Annual Meeting).

J5) Stein, J.L. and Park, Y., 1988 "Measurement Signal Selection and a Simultaneous State and Input Observer", *Journal of Dynamic Systems Measurement and Control.* Vol. 110, No. 2, June. (Also appeared in the Proceedings *of the 1987 American Control Conference*).

J6) Stein, J. L., Flowers, W. C. and Yigit, A., 1987 "Modeling Prosthetic Gait", *Journal of Biomechanics,* (accepted for publication). (Also appeared in the *Proceedings of the 1987 ASME Biomechanics Symposium*).

J7) Stein, J.L., and Park, Y., 1988 "Closed Loop Simultaneous Input and State Observer", *International Journal of Control*, Vol. 48, No. 3, pp. 1121-36. (Also appeared in the Symposium on *Sensors For Manufacturing*, 1987 ASME Winter Annual Meeting.)

J8) Stein, J.L. and Park, Y. "Modeling and Sensing Issues for Machine Diagnostics", *IEEE Control Systems* (accepted for publication but not published). (also appeared in the 1988 *Proceedings of the American Control Conference*).

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[1] [1] It is common practice in the field of Mechanical Engineering to present and publish research results at professional meetings (conferences). Often these results are also published in archival journals as either similar or revised papers. The relationship between papers published in different venues is indicated in some but not all places in this publication list.

J9) Stein, J.L. and Park, Y., 1989 "Steady-State, Optimal State and Input Observer for Discrete Stochastic Systems", *Journal of Dynamic Systems Measurement and Control* Vol. 111, pp. 121-127, June. (Also appeared as "Steady-State, Optimal State and Input Observer" in the Symposium on *Expert Systems and Intelligent Control*, 1987 ASME Winter Annual Meeting).

J10) Stein, J. L., Wang, C.-H., 1990 "Analysis of Power Monitoring on AC Induction Drive Systems", *Journal of Dynamic Systems, Measurement and Control*, Vol. 112, No. 2, pp. 239--248, June. (Also appeared in the 1986 Symposium on *Sensors and Controls for Manufacturing*, Proceedings of the 1986 ASME Winter Annual Meeting).

J11) Stein, J.L. 1993 "Modeling And State Estimator Design Issues for Model-Based Monitoring Systems" Special 50th Anniversary Issue of the *Journal of Dynamic Systems Measurement and Control*, Vol. 115, No. 2(B) June. (This paper was solicited by the editorial board of the 50th Anniversary Issue and reviewed anonymously.)

J12) Stein, J.L. and Tu, J.F. 1994 "A State Space Model for Monitoring Thermally-Induced Preload in Anti-Friction Spindle Bearings of High Speed Machine Tools" *Journal of Dynamic Systems Measurement and Control*, Vol. 11, No. 3, September, pp. 372-386. (Also appeared in the Symposium on *Control of Manufacturing Processes*, Proceedings of the 1991 ASME Winter Annual Meeting.)

J13) Huh, K. and Stein J.L. 1994 "A Quantitative Performance Index for Observer-Based Monitoring Systems" *Journal of Dynamic Systems Measurement and Control*, Vol. 11, No. 3, September, pp. 487-497. (Also appeared in the *Proceedings of the 1993 American Control Conference on Automatic Control*.)

J14) Tu, J.F. and Stein, J.L. 1995 "On-line Preload Monitoring for Anti-Friction Spindle Bearings of High-Speed Machine Tools" *Journal of Dynamic Systems Measurement and Control*) Vol. 117, No. 1, March, pp. 43-53. (Also appeared in the *Proceedings of the 1992 American Control Conference*. Awarded Best Paper of the Technical Session)

J15) Huh, K. and Stein J.L. 1995 "Well-Conditioned Observer Design for Observer-Based Monitoring Systems" *Journal of Dynamic Systems Measurement and Control* Vol. 117, No. 4, December, pp. 592-599. (Also appeared in the *Proceedings of the 1993 American Control Conference on Automatic Control*, Nominated for O. Hugo Schuck, Best Paper of Conference.)

J16) Stein J.L and Wilson, B.H. 1995 "An Algorithm for Obtaining Proper Models of Distributed and Discrete Systems" *Journal of Dynamic Systems Measurement and Control* Vol 117, No. 4, December, pp. 534-540. (An earlier version also appeared in 1992 Symposium on *Automated Modeling, Proceedings of the 1992 ASME Winter Annual Meeting*.)

J17) Tu, J.F. and Stein, J.L. 1996 "Active Thermal Preload Regulation for Machine Tool Spindles with Rolling Element Bearings" ASME Transactions: *Journal of Manufacturing Science and Engineering*. Vol. 118, No. 4, pp. 499-505, November. (An earlier version appeared in the Symposium on *Mechatronics in Manufacturing,* Proceedings of the 1994 ASME Winter Annual Meeting, Chicago, IL.)

J18) Stein, J.L. and Wang, C.W. 1996 "Automatic Detection of Clearance in Mechanical Systems: Experimental Validation", *Journal of Mechanical Systems and Signal Processing*. Vol. 10, No. 4, pp. 395-412, July. (Also appeared as Stein, J.L. and Wang, C.W., 1990 "Automatic Detection of Clearance in Mechanical Systems: Experimental Validation" Proceedings of the USA/Japan Symposium on Flexible Automation, July, Kyoto, Japan.)

J19) Tu, J.F. and Stein, J.L. 1996 "Model Error Compensation for Bearing Temperature and Preload Estimation" ASME Transactions: *Journal of Dynamic Systems Measurement and Control* , Vol. 118, No. 3, pp. 580-585, Sept.

J20) Ohl, G., Stein, J.L. and Smith E. 1996 "Fundamental Factors in the Design of a Fast Responding Methanol to Hydrogen Steam Reformer for Transportation Applications" Transactions of the *ASME: Journal of Energy Resources Technology*, Vol. 118, No. 2, June.

J21) Stein, J.L. and L.S. Louca, 1996. "A Template-Based Modeling Approach for System Design: Theory and Implementation". *Transactions of the Society for Computer Simulation International*, Vol. 13, No. 2, pp.87–101. Published by the Society for Computer Simulation, ISSN 0740-6797, San Diego, CA. (Also appeared as Stein, J.L. and Louca, L.S. 1995 "A Component-Based Modeling Approach for System Design: Theory and Implementation" Proceedings of the 1995 International Conference on Bond Graph Modeling, pp. 109-115, Las Vegas, NV.)

J22) Huh, K. and Stein J.L. 1997 "A Non-Normality Measure of The Condition Number For Monitoring And Control" *Journal of Dynamic Systems Measurement and Control*, Vol. 119, No. 2, pp 217-222, June,

J23) Stein, J.L., and Wang C.W. 1998 "Estimation of Gear Backlash: Theory And Simulation", *Journal of Dynamic Systems Measurement and Control*., Vol. 120, No. 1, pp. 74-82. (Revised version of Stein, J.L., and Wang C.W., "Automatic Detection Of Clearance In Mechanical Systems: Theory And Simulation", *Proceedings of the 1995 American Control Conference on Automatic Control* , Seattle, WA.)

J24) Tu, J.F. and Stein, J.L., 1998, "Model Error Compensation for Observer Design" *International Journal of Control*, Vol. 69, No. 2, pp. 329 - 345.

J25) Ferris, J., Stein, J.L. and Bernitsas, M. 1998 "Development Of Proper Models of Hybrid Systems" *Journal of Dynamic Systems Measurement and Control*, Vol. 120, No. 3, pp. 328 – 333. (Also appeared as Ferris, J., Stein, J.L. and Bernitsas, M. 1994 "Development Of Proper Models of Hybrid Systems" 1994 ASME WAM Symposium on Automated Modeling, Chicago, IL.)

J26) Park, Y.P. and Stein, J.L., 1999 "Recursive Optimal State and Input Observer for Discrete Time-Variant Systems" *Transaction on Control, Automation and Systems Engineering* Vol. 1, No. 2, December, published by the Institute of Control, Automation and Systems Engineering, Korea. (This is a revision of what appeared in the proceedings of the 1989 ASME Winter Annual Meeting).

J27) Ferris, J. B., M. M. Bernitsas and J. L. Stein, 2000, "Redesigning the Dynamics of Complex Structural Systems," AIAA Journal, Vol. 38, No. 1, pp. 147-154.

J28) Walker, D.G., Stein, J.L. and Ulsoy A.G. 2000 "An input-Output Criterion for Linear Model Deduction" *Journal of Dynamic Systems Measurement and Control*, Vol. 122, No. 3, pp. 507-513. (Also appeared as Walker, D.G., Stein, J.L. and Ulsoy A.G. 1996 "An input-Output Criterion for Linear Model Deduction" <u>Proceedings of the Dynamic Systems and Control Division</u>, 1996 ASME IMECE, Atlanta, GA.).

J29) Assanis, D.N., Z.S. Filipi, S. Gravante, D. Grohnke, X. Gui, L.S. Louca, G.D. Rideout, J.L. Stein, Y. Wang, 2000. "Validation and Use of SIMULINK Integrated, High Fidelity, Engine-In-Vehicle Simulation of the International Class VI Truck". *2000 SAE Transactions – Journal of Engines*. Published by the Society of Automotive Engineers, ISBN 0-7680-0842-5, Warrendale, PA. Also presented at the *SAE 2000 World Congress*, Paper 2000−01−0288.

J30) Michelena, N.F., L.S. Louca, M. Kokkolaras, Chan-Chiao Lin, Dohoy Jung, Z.S. Filipi, D.N. Assanis, P.Y. Papalambros, H. Peng and J.L. Stein, 2001. "Design of an Advanced Heavy Tactical Truck: A Target Cascading Case Study". *2001 SAE Transactions – Journal of Commercial Vehicles*. Published by the Society of Automotive Engineers, Warrendale, PA. Also presented at the *2001 SAE International Truck and Bus Meeting and Exposition*, Paper 2001-01-2793.

J31) Huh, K., Jung, J. and Stein J.L., 2001 "Discrete-time Well-conditioned State Observer Design and Evaluation" ASME Transactions: *Journal of Dynamic Systems Measurement and Control* Special Issue on the Identification of Mechanical Systems, Vol. 123, Dec., pp. 615-622.

J32) Stein, J.L. and Huh, K. 2002 "Monitoring Cutting Forces In Turning: A Model-Based Approach" ASME *Transactions: Journal of Manufacturing Science and Engineering, Vol. 124, Feb., pp. 26-31.*(Revised version of Stein, J.L. and Huh, K., 1991 "A Design Procedure for Model-Based Monitoring Systems: Cutting Force Estimation as a Case Study" 1991 ASME WAM, Symposium on Control of Manufacturing processes, Dec., Atlanta, GA.)

J33) Louca, L.S. and J.L. Stein, 2002. "Ideal Physical Element Representation from Reduced Bond Graphs". *Journal of Systems and Control Engineering: Special Issue on Bond Graphs*, Vol. 216, No. 1, pp. 73-83. Published by the Professional Engineering Publishing, ISSN 0959-6518, Suffolk, United Kingdom.

J34) Kim, H.M. Kokkolaras, M., Louca, L.S., Delagrammatikas, G.J. Michelena, N.F., Filipi, Z.S., Papalambros, P.Y., Stein, J.L. and Assanis, D.N. 2002 "Target Cascading in Vehicle resdesign: a Class VI Truck Study" International Journal of Vehicle Design, Vol. 29, No. 3. Published by Interscience Enterprises Ltd., ISSN 0143–3369, St. Helier, United Kingdom

J35) Kim, H.M., Rideout, D.G., Papalambros, P.Y., Stein, J.L. (2003) "Analytical Target Cascading in Automotive Vehicle Design." Journal of Mechanical Design, Vol. 125 / 1, September, American Society of Mechanical Engineers, New York, NY. (Also presented as "Analytical Target Cascading in Automotive Vehicle Design." Proceeding of the DETC 2001, 27th Design Automation Conference, September 9-12, 2001, Pittsburgh, Pennsylvania.)

J36) Filipi, Z.S., L.S. Louca, B. Daran, Chan-Chiao Lin, U. Yildir, B. Wu, M. Kokkolaras, D.N. Assanis, H. Peng, P.Y. Papalambros, and J.L. Stein, 2003. "Combined Optimization of Design and Power Management of the Hydraulic Hybrid Propulsion System for the 6x6 Medium Truck". *Special Issue on Advanced Vehicle Design and Simulation of the International Journal of Heavy Vehicle Systems*, Vol. 11, No.3/4 pp. 372 - 402. Published by Inderscience Enterprises Ltd., ISSN 1744232X, St. Helier, United Kingdom.

J37) Louca, L.S., D.G. Rideout, J.L. Stein, and G.M. Hulbert, 2003. "Generating Proper Dynamic Models for Truck Mobility and Handling". *Special Issue on Advanced Vehicle Design and Simulation of the International Journal of Heavy Vehicle Systems*, Vol. 11, No.3/4 pp. 209 - 236. Published by Inderscience Enterprises Ltd., ISSN 1744232X, St. Helier, United Kingdom.

J38) Lin, Chan-Chiao, Z. Filipi, L.S. Louca, H. Peng, D.N. Assanis and J.L. Stein, 2003. "Modeling and Control for a Medium-Duty Hybrid Electric Truck". *Special Issue on Advanced Vehicle Design and Simulation of the International Journal of Heavy Vehicle Systems*, Vol. 11, No.3/4 pp. 349 - 371. Published by Inderscience Enterprises Ltd., ISSN 1744232X, St. Helier, United Kingdom.

J39) Kokkolaras, M., L.S. Louca, G.J. Delagrammatikas, N.F. Michelena, Z.S. Filipi, P.Y. Papalambros, J.L. Stein, and D.N. Assanis, 2003. "Simulation-Based Optimal Design of Heavy Trucks by Model-Based Decomposition: An Extensive Analytical Target Cascading Case Study". *Special Issue on Advanced Vehicle Design and Simulation of the International Journal of Heavy Vehicle Systems*, Vol. 11, No.3/4 pp. 403 - 433. Published by Inderscience Enterprises Ltd., ISSN 1744232X, St. Helier, United Kingdom.

J40) Ohl, G., Stein, J.L. and Smith, E. (2004) "A Dynamic Model for the Design of Methanol to Hydrogen Steam Reformers for Transportation Applications" ASME Transaction: Journal of Energy Resources Technology, Vol. 126 No. 2, June.

J41) Huh, K., Hong, D., Stein, J.L. (2005) "Development of a Lane Departure Monitoring and Control System" *Journal of Mechanical Science and Technology*, KSME Int. J., Vol. 19, No. 11, pp. 1998-2006.

J42) Rideout, D.G., Stein, J.L. and Louca, L.S. (2007) "Systematic Identification of Decoupling in Dynamic System Models", ASME Transaction: *Journal of Dynamic Systems, Measurement and Control* Vol. 129, Issue 4, pp. 503-13, July, American Society of Mechanical Engineers, New York, NY.

J43) Filipi, Z., Fathy, H., Hagena, J., Knafl, A., Ahlawat, R., Liu, J., Jung, D., Assanis, D.N., Peng, H., and J. Stein, (2007) "Engine-in-the-Loop Testing for Evaluating Hybrid Propulsion Concepts and Transient Emissions: A HMMWV Case Study" SAE Transactions, *Journal of Commercial Vehicles*. Paper No. 2006-01-0443, March. (Also published as SAE Paper 2006-01-0443, SP-2008, 2006 SAE Congress, Detroit, MI, April 3-6, 2006.)

J44) Rideout, D.G., Stein, J.L. and Louca, L. (2007) "Extension and Application of an Algorithm for Systematic Identification of Weak Coupling and Partitions in Dynamic System Models" International Journal of the Federation of European Simulation Societies: *Simulation Modelling Practice and Theory*, doi:10.1016/j.simpart.2007.10.004, Published by Elsevier (in press (available on-line).

J45) Rideout, D.G., Stein, J.L., and Louca, L.S. (2008) "Systematic Assessment of Rigid Internal Combustion Engine Dynamic Coupling" ASME Transactions: *J. Eng. for Gas Turbines and Power,* Volume 130, Issue 2 (March), 022804 (12 pages), ASME, New York, NY.

J46) Hoffman, R.C., Stein, J.L., Loucas L.S., and Kunsoo, H. (2008) "Using the Milliken Moment Method and Dynamic Simulation to Evaluate Vehicle Stability and Controllability" *International Journal of Vehicle Design*, Vol. 48, Nos. 1/2, pp. 132-148, Inderscience Enterprises Ltd.

J47) Tulga Ersal, Hosam K. Fathy, Loucas S. Louca, D. Geoff Rideout, and Jeffrey L. Stein (2008) "A Review Of Proper Modeling Techniques ", ASME Transactions: *Journal of Dynamic Systems Measurement and Control* **130**(6), doi:10.1115/1.2977484. Also: Proceedings of the 2007 ASME International Mechanical Engineering Congress and Exposition, Seattle, WA, USA, Nov. 10-16.

J48) Ersal, T., Fathy, H. K., and Stein (2009), J. L., "Orienting Body Coordinate Frames Using Karhunen-Loève Expansion for More Effective Structural Simplification", Simulation Modelling Practice and Theory **17**(1), pp. 197‑210, doi: 10.1016/j.simpat.2007.08.002. (See also T. Ersal, H. K. Fathy, and J. L. Stein, "Orienting Body Reference Frames Using Proper Orthogonal Decomposition for More Effective Structural Simplification," ASME Paper IMECE2006-14572, Proc. IMECE 2006, Dynamic Systems and Controls Division, Chicago, IL, 2006

J49) Ersal, T., Fathy, H. and Stein, J. L. (2009) "Structural simplification of modular bond-graph models based on junction inactivity" International Journal of the Federation of European Simulation Societies: *Simulation Modelling Practice and Theory*, 17(1), pp.175-196, Published by Elsevier (online: doi: 10.1016/j.simpat.2008.02.010). (also appeared as Ersal, T., Fathy, H. K., Stein, J. L., 2006, "Structural simplification of modular bond-graph models based on junction inactivity", *Proceedings of the 2006 ASME International Mechanical Engineering Congress and Exposition (*ASME Paper IMECE2006-14567), Chicago, IL USA.

J50) Ersal, T., Fathy, H. K., and Stein, J. L., 2009, "Realization-Preserving Structure and Order Reduction of Nonlinear Energetic System Models Using Energy Trajectory Correlations", Journal of Dynamic Systems Measurement and Control, 131(3), pp. 031004 (8p), doi: 10.1115/1.3072128. (also Ersal, T., Fathy, H. K., and Stein, J. L., 2007, "Realization-preserving structure and order reduction of nonlinear energetic system models using energy trajectory correlations", *Proceedings of the 2007 ASME International Mechanical Engineering Congress and Exposition*, Seattle, WA USA, IMECE2007-42041).

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C113) .... Forman, J., Stein, J.L. and Fathy, H. 2013 "Optimization of Dynamic Battery Parameter Characterization Experiments via Differential Evolution" Proceedings of the American Control Conference, Washington, DC, June 17-19, 2013.

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C121) .... X. Ge, M. Brudnak, P. Jayakumar, J.L. Stein, T. Ersal (2015) "A Model-Free Observer Framework for Tele-Operated Vehicles" Proceedings of the 2015 American Control Conference.

Other:

1) Stein, J. L., Hsu, W. L., and Lele, P. P., 1976 "Ultrasonic Intensity-Insonation Duration Thresholds for Morphological Damage to Mammalian C.N.S. in Vivo," Abstract in the *Proceedings of the 91st Annual Meeting of the Acoustical Society of America*, Washington, D.C., April.

2) Hedrick, J. K., Wormley, D. N., Coverstone, R., Stein, J. L., and Hurt, T. B. 1977 "The Influence of Fifth Wheel Location and Braking Characteristics on Articulated Vehicle Motion." Final Report prepared for the US. Department of Transportation, National Highway Safety Administration, Contract DOT-HS-6-0l343, Washington D.C., November.

3) Stein, J. L. and Flowers, W. C., 1981 "Quantitative Design of Stance Phase Controllers for Above-Knee Prostheses", abstract accepted for presentation at the VIIth International Symposium on External Control of Human Extremities, Dubrovnik, Yugoslavia, September.

4) Stein, J. L. and Colvin, D., 1983 "Adaptive And Sensor Based Control Of Machine Tools", Technical Report No. UM-MEAM-83-19, Dept. of Mechanical Engineering and Applied Mechanics, Univ. of Michigan, Ann Arbor, Michigan Sept.

5) Stein, J. L., 1983 "Design Issues In The Stance Phase Control of Above-Knee Prostheses", Ph.D. Thesis, Dept. of Mechanical Engineering, M.I.T., Cambridge, MA., February.

6) Park, Y. and Stein, J.L. 1986 "Order Reduction Procedure of the Linear Differential Algebraic Equation," UM-MEAM-86-40.

7) Stein, J.L., and Park Y., 1987 "Modeling and Sensing Issues for Machine Diagnostics", Proceedings of the 14th Conference on Production Research and Technology, *Manufacturing Processes, Systems and Machines*, sponsored by NSF, and published by SME, October.

8) Stein, J.L., 1989 "Model-Based Machine Diagnostics Using Remote Sensing" Proceedings of the 15th Conference on Production Research and Technology *Advances in Manufacturing Systems Integration and Processes*, Publ. by SME, Dearborn, MI, January.

9) Stein, J.L., 1990 "Model-Based Machine Diagnostics Using Remote Sensing and Design and Control of Servo Systems" Proceedings of the 16th Conference on Production Research and Technology *Advances in Manufacturing Systems Integration and Processes*, Publ. by SME, Dearborn, MI, January.

10) Huh, K. and Stein J.L.1994 "Upper Bounds of the Condition Numbers for Non-normal Matrices" Technical Brief *MEAM Technical Report NO.-94-10,* Department of Mechanical Engineering and Applied Mechanics, The University of Michigan, Ann Arbor, MI.

11) Stein, J.L. and Huh K. 1994 "Well-Conditioned Observers for High-Performance Low-Cost Monitoring Systems" *Proceedings of the 1994 NSF Design and Manufacturing Grantees Conference*, pp. 473-4, SME Publication, Dearborn, MI. ISBN:0-87263-441-8.

12) Stein, J.L. and Tu, J. 1994 "Model-Based Preload Monitoring for Machine Tool Spindle Bearings" *Proceedings of the 1994 NSF Design and Manufacturing Grantees Conference*, pp. 475-6, SME Publication, Dearborn, MI. ISBN:0-87263-441-8.

13) Wilson, B.H. and Stein, J.L. 1994 "Model-Building Assistant: An Automated Modeling Tool for Machine-Tool Drive-Trains" *Proceedings of the 1994 NSF Design and Manufacturing Grantees Conference*, p 493, SME Publication, Dearborn, MI. ISBN:0-87263-441-8.

14) Gibson, A.O., Stein J.L. and Tu J.F. 1997 "A Thermomechanical Model of High Speed Spindle Bearing Dynamics", Abstract accepted for presentation at the STLE 52 Annual Meeting, May 18-22, 1997, Kansas City, Missouri.

1)   Patents and Disclosures

1) Invention Disclosure: Description – Robust Online Vehicle Mass Estimation Using Recursive Least Squares with Multilevel Supervisory Data Extraction (2007)

TEACHING

New Courses Introduced

ME 560   Modeling Dynamic Systems (Graduate level)
A unified approach to the modeling, analysis and simulation of energetic dynamic systems. Emphasis on analytical and graphical descriptions of state-determined systems using Bond Graph language. Analysis using interactive computer simulation programs. Applications to the control and design of dynamic systems such as robots, machine tools and artificial limbs.

ME 790   Mechanical Sciences Seminar (Graduate level)
Every PhD student in the field of mechanical sciences is requested to present a one-hour seminar about his/her research and lead a one-hour follow-up discussion. Active participation in the discussions that follow the presentations is also required for a grade. In addition, each student will participate as a panelist in a panel that discusses the future trends in his/her field. Course grade is reported Satisfactory/Unsatisfactory. (with A.G. Ulsoy, and Y. Koren)

ME 516   Advanced System Dynamics (Graduate level)
A modified version of ME560 developed for and taught at General Motors Technical Center for GM engineers.

GM Seminar (3 day)   **MODELING and SIMULATION of DYNAMIC SYSTEMS**
To develop, analyze and simulate lumped parameter models of multi-energy domain systems using bond graphs as the modeling language and Enport as the computer simulation software in order to design and evaluate engineering systems.

Courses Significantly Modified

ME 360   Modeling, Analysis and Control of Dynamic Systems (Junior level)
Prof. Stein modified a mechanical systems and vibrations course into a unified approach to abstracting real mechanical, fluid, and electrical systems into proper models in graphical and state equation form to meet engineering design and control system objectives. Introduction to system analysis (eigenvalues, time and frequency response) and linear feedback control. Synthesis and analysis by analytical and computer methods. Three lectures plus laboratory until approximately 2000. Currently four lectures per week.

ME 360Lab   Modeling, Analysis and Control of Dynamic Systems Laboratory (Junior level)
Prof. Stein replaced two of the four existing experiments in this lab to reflect the significant change in the lecture part of the course as described above. The two experiments included the modeling and validation of a pneumatic torque converter and modeling of a DC motor driving a compliant load and validation through frequency response techniques.

Other Course Taught
VM 360   Modeling, Analysis and Control of Dynamic Systems (Junior level)
Prof. Stein taught a course similar to ME360 above at Shanghai Jiao Tong University, Shanghai, Chine, May – June 2010.

ME 240   Introduction to Dynamics and Vibrations (Sophomore level)
Introduction to Newtonian Mechanics, Dynamics of particles, systems of particles and rigid bodies. Principles of energy conservation and conservation of momentum. Applications include: impact, central force motion, and forced and free vibrations. Lecture.

ME 350   Mechanical Design II (Junior Level)
The second of a three course required design and manufacturing sequence. The goal of this course is to give each student an understanding of the basic engineering principles behind mechanical and electromechanical machines and teach them how to integrate their engineering knowledge to synthesize and analyze simple mechanical systems and components. The course requires the completion of semester long design project

ME 450   Mechanical Design II (Senior level)
Capstone design course in Mechanical Engineering. A mechanical engineering design project by which the student is exposed to the design process from concept through analysis to layout and report. Projects are proposed from the different areas of study within mechanical engineering and reflect the expertise of instructing faculty. Two hours of lecture and two laboratories.

ME 461   Automatic Control (Senior level)
Feedback control design and analysis for linear dynamic systems with emphasis on mechanical engineering applications; transient and frequency response; stability; system performance; control modes; state space techniques; digital control systems. Lecture.

ME 465 (488, original number)   Microcomputer Applications in Manufacturing (Senior level)
Simulation, data acquisition, data analysis and control in real-time using interrupts. Manufacturing case studies for forming machining, stepping motor control and DC servo motor control.   Lecture and lab.

Student Course Evaluation Scores (1989 – present)
Scale: 5 = strongly agree, 4 = agree, 3 = neither agree or disagree, 2 = disagree, 1 = strongly disagree

COURSE	TERM	#REPLIES/ Enrollemnt	Question 1	Question 2
240	F03	62	3.57	3.8
240	F05	64/89	3.52	3.81
240	F06	76/106	3.7	3.93
240	F07	47/~60	3.97	4.17
240	W10	38/79	3.5	3.69
240	W11	40/82	3.31	3.65
Average			**3.6**	**3.8**
360	W90	75	3.79	3.94
360	W91	69	3.75	3.73
360	W92	51	4.13	4.43
360	W93	52	3.74	3.83
360	W94	107	3.37	3.93
360	W95	37	3.59	3.95
360	W95	30	3.6	3.89
360	W96	52	3.95	4.11
360	W97	55	4.07	4.08
360	W98	65	3.73	4.03
360	F98	38	3.32	3.83
360	F99	59	4	4.52
360	F00	50	3.4	3.65
360	F01	45	3.15	3.64
360	F02	54	3.53	4.16
360	F04	51	3.59	3.63
360	F12	14/54	4.5	4.3
360	F13	28/46	3.86	3.86
360 (1)	F14	21/65	4.44	4.75
360 (2)	F14	4.56	4.67	4.56
Average			**3.8**	**4.0**
350	F12	32/91	4.5	4.2
350	**F12**	**59/163**	**4.1**	**3.5**
Average			**4.3**	**3.8**
560	F89	43	4.21	4.36
560	F91	28	4.25	4.13
560	F92	28	4.12	4.04

560	F93	26	4.08	4.1
560	F94	41	4.03	3.8
560	F95	25	3.85	4
560	F96	20	4.5	4.67
560	F97	27	4.12	4.33
560	W99	25	4.28	4.7
560	W00	18	4.39	4.3
560	W02	25	4.32	4.72
560	W03	15	4.25	4.42
560	W04	15	4.4	4.4
560	W05	39	4.18	4.16
560	W06	30	4.32	4.41
560	W07	30/33	4.08	4.13
560	F08	15/18	4.67	4.82
560	F09	16/22	4.38	4.7
560	F10	20/25	4.23	4.59
560	F11	26/36	4.78	4.85
560	F13	15/28	4.56	4.88
560	F14	29/44	4.53	4.59
Average			**4.3**	**4.4**
790	F92	4	4.83	4.83
790	F93	9	4.6	4.75
790	F97	11	4.11	4.7
Average			**4.5**	**4.8**
VM360	**S10**	**22**	**na**	**na**
Average of averages (unWeighted)				**4.18**

Ph.D. Thesis Committees Chaired

1) Zheng, Yingshi 2018 expected "Delay Mitigation in Teleoperated Vehicles" (co-Chair with Tulga Ersal).

2) Febbo, Huckleberry 2018 expect "Simultaneous Design and Control of Hybrid Electric Vehicles" (co-chair with Tulga Ersal).

3) Ge, Xinyi 2016 expected "Iterative Learning Control of Internet-Distributed Hardware in the Loop Simulation Systems" (co-chair with Tulga Ersal).

4) Zhou, Xin 2016 expected "Data-Based Methods for Lithium Ion Battery Health Estimation" (co-chair with Tulga Ersal and Dennis Bernstein (Aerospace).

5) Liu, Jiechao, 2015, expected, "Design of Vehicle Dynamic Conscious Obstacle Avoidance Controllers for Autonomous Vehicles" (co-chair with Tulga Ersal).

6) Forman, Joel October, 2012 "Minimally Invasive Characterization of Lithium Iron Phosphate Battery Electrochemical and Health Models using Fisher Information and Optimal Experimental Design" (co-chair with Prof. Hosam Fathy) Associate, Materials and Corrosion Practice, Exponent, Inc., Boston MA.

7) Ahlawat, Rahul May, 2011 "Development of a Simulation based Powertrain Design Framework for Evaluation of Transient Soot Emissions from Diesel Engine Vehicles" (co-chair with Prof. Hosam Fathy) (May 16, 2011), Senior Control Algorithms Engineer, Cymer, LLC, San Diego, CA.

8) Moura, Scott April, 2011 "Techniques for Battery Health Conscious Power Management via Electrochemical Modeling and Optimal Control. (co-chair with Dr. Hosam Fathy), Assist. Prof. of Civil and Environmental Engineering, University of California, Berkeley. University of California President's Postdoctoral Fellow, Post doctoral position with Prof. Miroslav Krstic at UC San Diego.

9) Pence, Ben April, 2011 "Recursive Parameter Estimation using Polynomial Chaos Theory Applied to Vehicle Mass Estimation for Rough Terrain" (co-chair with Dr. Hosam Fathy), Fuel Cell Modeling and Research Engineer, Ford Motor Company.

10) Sohns, Bryon, (thesis incomplete, left for medical reasons) "Parameterization of Large Dynamic Models through the use of Model Reduction and Optimization Techniques, Reliability Engineer, P&H Mining Equipment, Inc. (co-chair with Dr. Hosam Fathy)

11) Kang, DongSoo (expected 2014) "Robust Vehicle Inertial Parameter Estimation for Improving Active Safety Control System", Research Engineer, Samsung Corp. (Korea) (co-chair with Dr. Hosam Fathy)

12) Kittirungsi, Burit, 2007 "An Innovative Scaling Methodology for Dynamics Systems: Quantification of Approximate Similitude and Use in Multi-objective Design", Technical Specialist, Systems Performance Group, Cummins Technical Center, Cummins Diesel Inc. (co-chair with Dr. Hosam Fathy)

13) Ersal, Tulga, 2007 "Realization-Preserving Simplification And Reduction Of Dynamic System Models At The Graph Level", Assistant Research Scientist, University of Michigan.

14) Rideout, Geoff, 2004 "System Partitioning and Physical-Domain Proper Modeling Through Assessment of Power-Conserving Model Structure", Associate Prof., Faculty of Engineering and Applied Science, Memorial Univ., Newfoundland, Canada.

15) Harder, John, 2004 "Controlling Thermally Induced Bearing Loads To Improve Spindle Performance", Control Systems Engineer, Northrop Grumman Corporation, Redondo Beach, CA.

16) Sendur, Polat 2002 "Proper Models for Design: Algorithms for Assessing Model Quality" Vehicle Engineering group in Product Development, Ford, Turkey (Istanbul) (co-Chair with Prof. Peng).

17) Riley, Steven 2000 "Model Reduction of Multibody Systems by the Removal of Generalized Forces of Inertia", Senior Development Engineer, Motion Development, Adams Solver Group, MSC Software, Ann Arbor, MI.

18) Gibson, Alex 1999 "Modeling and Estimation of Thermally Induced Bearing Loads in Machine Tool Spindles", Research Engineer with Ford Scientific Research Labs, Ford Motor Co., Dearborn, MI.

19) Loucas, Louca 1998 "An Energy-Based Model Reduction Methodology for Automated Modeling", Assistant Professor of Mechanical and Manufacture Engineering, University of Cyprus.

20) Ferris, John 1995 "Proper models and Redesign of Structural Systems", Associate Prof., Mechanical Engineering Dept., Virginia Tech. Previously, Senior Technical Specialist, Advanced Chassis Development, ZF Technologies, Northville, MI (co-chair with Prof. Bernitsas).

21) Ohl, Greg 1995 "Dynamic Analyses of a Methanol to Hydrogen Steam Reformer for Transportation Applications" Chief Engineer - Systems / Controls / Hybrid / Electrification AVL North America, Inc., Plymouth, MI. Formerly R&D Powertrain Control Engineer, DaimlerChrysler Corporation, Auburn Hills, MI (co-Chair with Prof. Smith).

22) Lee, Seung-Hi 1994 "A Study on Robust Control and Estimation for Systems with Real Parameter Uncertainties", Controls Engineer, Samsung Advanced Institute of Technology, Korea (co-chair with P. Khargonekar).

23) Atik, Engin 1993 "Disturbance Transmissibility of Normal and Prosthetic Gait", Unknown, (co-chair with R. Fijan).

24) Wilson, Bruce 1992 "Model-Building assistant: An Automated Modeling Tool for Machine Tool Drive Trains" General Engineer, Volpe National Transportation Systems Center, Research and Innovative Technology Administration, US Dept. of Transportation.

25) Huh, Kunsoo 1992 "Design of Model-Based Monitoring Systems For Machine Monitoring" Professor, Department of Automotive Engineering, Hanyang Univ., Seoul, Korea.

26) Tu, J.F. 1991 "On-Line Preload Monitoring For High-Speed Anti-Friction Spindle bearings Using Robust State Observers." Full Professor, Mechanical and Aerospace Engineering, North Carolina State Univ., Raleigh, NC.

27) Tseng, Yih-Tun 1991 "The Automation of Physical System Modeling: Modeling Strategies and an AI Implementation" Professor, Dept. of Mechanical and Electro-Mechanical Engineering, National Sun Yat Sen University, Kaoshiung, Taiwan.

28) Tomovic, Mileta 1991 "Artificial Knee Stability", Professor and Chair, Engineering Technology Department, Batten College of Engineering and Technology, Old Dominion University, Norfolk, VA. Formerly, Professor, Purdue Univ., West Lafayette, IN..

29) Wang, Churn-Hway, 1990 "Automated Detection of Clearance in Mechanical Systems", Supervisor, Small car and Mustang Vehicle Noise, Vibration and Harshness, Ford Motor Co. Dearborn, MI.

30) Park, Youngjin, 1987 "State and Input Observers for Model-Based Machine Diagnostics", Professor of Mechanical Engineering, KAIST, Seoul, Korea.

Current Positions of former Ph.D. Students

Academic Positions
1) Scott Moura, Assistant Prof. of Civil Engineering, UC Berkeley.
2) Ersal, Tulga, "Realization-Preserving Simplification And Reduction Of Dynamic System Models At The Graph Level", Assistant Research Scientist, University of Michigan
3) Geoff Rideout, Associate Prof., Memorial University, Newfoundland, Canada.
4) Loucas Louca, Assistant Professor of Mechanical Engineering, University of Cyprus.
5) John Ferris, Associate Prof., Mechanical Engineering Dept., Virginia Tech.
6) Bruce Wilson, Former Assistant Prof., Mechanical Engineering Dept. Northeastern Univ; currently working for the Massachusetts Dept. of Transportation
7) Kunsoo Huh, Professor, Hanyang Univ., Seoul, Korea
8) Jay F. Tu, Professor, North Carolina State Univ., Raleigh, NC.
9) Yih-Tun Tseng, Professor, Dept. of Mechanical and Electro-Mechanical Engineering, National Sun Yat Sen University, Kaoshiung, Taiwan.
10) Mileta Tomovic, Dept. Chair and Professor, Department of Engineering Technology, Old Dominion University, Norfolk, VA formerly the W.C. Furnas Professor of Enterprise Excellence and Head, Dept. of Mechanical Engineering Technology, Purdue University, W. Lafayette, IN.
11) Youngjin Park, Professor, KAIST, Seoul, Korea.

Non Academic Positions
1) Joel Forman, Associate, Materials and Corrosion Practice, Exponent, Inc., Boston MA.
2) Rahul Ahlawat, Senior Control Algorithms Engineer, Cymer, LLC, San Diego, CA.
3) Ben Price, Fuel Cell Modeling and Research Engineer, Ford Motor Company, Dearborn, MI

4) Burit Kittirungsi, Technical Specialist, Systems Performance Group, Cummins Technical Center, Cummins Diesel Inc.
5) John Harder, Control Systems Engineer, Northrop Grumman Corporation, Redondo Beach, CA.
6) Polat Sendur, Vehicle Engineering group in Product Development, Ford, Turkey (Istanbul).
7) Steven Riley, Senior Development Engineer, Motion Development, Adams Solver Group, MSC Software, Ann Arbor, MI.
8) Alex Gibson, Research Engineer with Ford Scientific Research Labs, Ford Motor Co., Dearborn, MI
9) Greg Ohl, Chief Engineer - Systems / Controls / Hybrid / Electrification AVL North America, Inc., Plymouth, MI.
10) Seung-Hi Lee, Controls Engineer, Samsung Advanced Institute of Technology, Korea
11) Engin Atik, Unknown company, Istanbul, Turkey.
12) Bruce Wilson "Model-Building assistant: An Automated Modeling Tool for Machine Tool Drive Trains" General Engineer, Volpe National Transportation Systems Center, Research and Innovative Technology Administration, US Dept. of Transportation
13) Churn-Hway Wang, Supervisor, Small car and Mustang Vehicle Noise, Vibration and Harshness, Ford Motor Co. Dearborn, MI.

M.S. Thesis Committees Chaired

1) Joel Forman "Lithium Ion Battery Modeling", March, 2010

2) Moura, Scott "Plug-in Hybrid Electric Vehicle Power Management: Optimal Control and Battery Sizing", December 8, 2008. (for current position see Ph.D. list above).

3) Ahlawat, Rahul ""Modeling & Simulation of DCT (Dual Clutch Transmission) Vehicle to Analyze the Effect of Pump Selection on Fuel Economy", Nov. 6, 2008 (for current position see Ph.D. list above).

4) Hoffman, Robert 2004 "Using the Milliken Moment Method and Dynamic Simulation for Evaluating Vehicle Handling", Test Development Engineer, Suspension Modules Department – Signal X Technologies, AnnArbor, MI.

5) Sohns, Bryon 2004 "Determining Model Accuracy as a Function of Inputs and System Parameters" current position unknown.

6) Ersal, Tulga 2003 "A Modular Modeling System For Reconfigurable Machine Tools", (for current position see Ph.D. list above).

7) Yildir, B. Umut 2002 "Sensitivity Functions for Output Specific Model Reduction", Engineer, MEGA Electronics" Istanbul, Turkey.

8) Harder, John 2000 "Control of Thermal Induced Bearing Load in Reconfigurable Spindles", (for current position see Ph.D. list above)

9) Glodich, Jeff 2000 "Actuator Design Tool for Controlling Thermal Induced Load in Reconfigurable Spindles" Unknown.

10) Hogland, Derek 2000 "A Parametric Model to Generate Subsystem Constitutive Laws for a Vehicle Ride Model" Research Engineer, General Motors, Warren, MI.

11) Christensen, Bjorn "A Global Design Metric for Dynamic Systems", August, 1999. Engineer, Harley-Davidson Motor Co., Wauwatosa, WI.

12) Walker, Doug 1996 "Proper Models for Active Suspension Systems" Senior Engineer, Intellipack, Inc., Oxford, CT.

13) Kaung, Larry 1995 "Dynamic Analysis of revolute machine tool drive systems", Engineer, TRW, Los Angeles, CA.

14) Louca, Loucas 1996 "A Template-Based Modeling Approach for System Design: Theory and Implementation" (for current position see Ph.D. list above).

15) Altermatt, Gene 1995 "An Investigation In The Design Space Of High Stiffness Belt Drives For Precision Machine Tools" Engineer, General Motors, Warren, MI (co-chair with Prof. Ward).

16) Riley, Stephen 1995 "A Finite Segment Representation of A Cantilevered Beam", (for current position see Ph.D. list above).

17) Rohlfs, Thomas 1994 "A Preliminary Design and Study of a New Class of Machine Tools" unknown (co-chair with Prof. Ward).

18) Bolt, Richard 1991 "Initial Design of a Class of CNC Milling Machines Utilizing Rotation Mechanisms for Tool Translation" unknown (co-chair with Prof. Ward).

19) Wu, Wei, 1989 "Automated Detection of Stick/Slip in Machine Tool Slides" Vice-President of his own Ann Arbor Based Company.

20) Mooradian, Mark 1988 "Design and Use of a Test Fixture for Prosthetic Feet" unknown.

Post Doctoral Researchers and Visiting Scholars Supervised and Hosted

1) Ersal, Tulga, Assistant Research Scientist, Associate Directory Automated Modeling Laboratory, "Model and Simulation of Interdisciplinary Systems" 1/1/11-present.

2) Ersal, Tulga, Post Doctoral Fellow, Assistant Directory Automated Modeling Laboratory, "Model and Simulation of Interdisciplinary Systems" 6/07-12/10.

3) Fathy, Hosam, Assistant Research Scientist, Associate Director, Automated Modeling Laboratory, "Design and Control Issue in Vehicle Dynamics" 9/04 – 8/10.

4) Liu, Yuqing, Visiting Scholar "Optimal Modular Robot Configuration Design Using Genetic Algorithms And Genetic Programming" 9/04 – 10/05.

5) Jung, Jongchul Visiting Student Intern Research Apprenticeship "Robust Observer Design for Monitoring Vehicle Dynamics" 9/04 – 8/05.

6)   Geoff Rideout, Post Doctoral Fellow, Interim Assistant Director, Automated Modeling Laboratory 5/04 - 12/04.

7)   Kunsoo Huh, Visiting Scholar "Closed-Loop Performance Evaluation of Vehicle Handling" 9/03 – 7/04.

8)   Loucas Louca, Assistant Research Scientist, Assistant Director, Automated Modeling Laboratory, "Proper Modeling for Vehicle Systems" 9/98 – 1/04.

9)   Park, Youngjin, Post Doctoral Fellow "Input Estimators for Machine Tool Monitoring" 4/87 – 8/87.

Student Projects Supervised

Masters Level Projects

1)   Liu, Jingxuan "Tire Parameters Estimation For Vehicle Mobility" (started Fall 2014)

2)   Mudgal, Girish "Terrain Characterization", May 2002.

3)   Badarinarayan,   Harsha "Design and Analysis of Truck Air Brake Systems", December 2002

4)   Dunn, James "Bond graph modeling of Internal Combustion Engines", May 2002.

5)   McGrew, Rebecca "Design and Analysis of Electric Park Brakes",

6)   Buchman, Fred "Modeling and Control of Spindle Bearing Load.

7)   Zachariou, Nicolas "Computer-Based Design of Experiments Applied to Active Safety Conflict Models", May 1996

8)   Berg, Ted Vanden "Model and Design of a Uniform tension Spindle Winding Machine for Rectangular Coils", ME590 Fall 1994

9)   Athans, Tim "Dynamic Systems Analysis", ME990 Summer 1991

10)   Medepalli, Sudhakar, "Optimal Control for Machine Diagnostics", Summer 88.

11)   Braunstein, Ken, "Dynamic Modeling of Actively Controlled Above-Knee Prostheses", Spring 87.

12)   Hu, Shixin, "Finite Element Model of a SACH foot", Winter 87.

13)   Hickman, Peter, "Design of a DC Servo Power Train Test System.", Spring 87.

14)   Kesh, John, "AI techniques for Robot Program Generation", Summer86.

15)   Yigit, Ahmet, "Dynamic Modeling of Prosthetic Gait", Summer 86.

16)   Essen, Dave Van, "Design of a Current Monitoring Automatic Test System.", Winter 86.

17)   Teodorovic, Milivoj, "Implementation of CSS on the IBM-PC with Enhanced Graphics", Fall 85.

18)   Colvin, Daniel, "Current Monitoring on DC Servo Feed Drives", Fall 84.

19)   Clever, Glenn E., "Quantification of Dynamic Mechanical Components Of The Spindle System on the Jones and Lamson Numerical Controlled Lathe", Spring 84.

Bachelor Degree Projects

1)   Zheng, Yingshi, Fall 2012, Winter 2013 "Capturing driver-to-driver and within driver variability of driving behavior and its impact on fuel consumption".

2)   McCallister Dan, "Design of a Thermal Actuator System for Controlling Spindle Bearing Loads". December 2000. With John Harder, Ph.D. student. Nature of the work was to design a method to electrically heat the housing of a spindle sufficiently to allow the thermal induced bearing loads to be controlled.

3)   Jeffrey Martin, "Measurement of Thermal Induced Spindle Bearing Loads", May, 2000. With John Harder, Ph.D. student. Nature of the work to refine the data acquisition and control system for measuring thermal induced loads in the lab's spindle.

4)   Weber, Matthew, "Measurement of Prosthetic Foot Stiffness and Damping", May 1989. With Mark Mooradian, M.S. student. Design and conducted experiments of force deflection characteristics of prosthetic feet. Data collected resulted in a paper. Stein, J.L., and Hu, S., "Design of Prosthetic Feet: A Finite Element Approach", Proceeding of the Symposium on Biomechanics of Normal and Prosthetic Gait, 1987 ASME Winter Annual Meeting.

5)   ME450 Design Teams (8 students),, Dec 1993. I was a co-advisor with Prof. Al Ward. Worked with Thomas Rolph, M.S. student. Design and built the first prototype revolute milling machine.

6)   Voss, Mark "Design of a Load and Temperature Applicator for a Machine Tool Spindle System" May 1994. With Jay Tu, Professor, Purdue and several of his students. Built and characterized a device for applying loads to a laboratory based spindle system. The device was used to generated data for a paper Tu, J.F. and Stein, J.L. (to appear, accepted 5/17/95) "Active Thermal Preload Regulation for Machine Tool Spindles with Rolling Element Bearings" *Journal of Engineering for Industry* . (An earlier version also appeared in the proceedings of the 1994 ASME WAM Symposium on *Mechatronics in Manufacturing*, Chicago, IL.)

7)   Pigman, Scott R., "Dynamic System Modeling of A Revolute Milling Machine" May 1994. With Tszy-Shuh Chang, Ph.D. student. Nature of the work was to characterise the dynamic characteristics of the prototype revolute machine tool in the lab. Results include a report describing the model developement, sumation results and insight into the dominant design factors.

8)   Sondee, Daniel C., "Off-line Control Of A Scrap Metal Meltdown Process at Halmstads Jarnverks", Summer 84.

9)   Black, Rodney D., "Three Dimensional Profile Mapping Using The IBM7565 Manufacturing Robot", Spring 84.

10)   Gates, Terence M., "Statistical Process Control: Implementation at Header Products Inc.", Fall 83.

11)   McMullin, Richard, "Machine Vision Systems", Fall 83.

RESEARCH
(except Publications (see above))

Contributions to Research

Prof. Stein has been involved in the modeling, analysis and design of mechanical systems for close to thirty years through work that has been supported by federal agencies (e.g., NSF, NIH, DOD, DOE), and industry (e.g., GM, Ford, Chrysler, Navistar, Eaton, etc.). He has made fundamental contributions to design science through his work on automated modeling of dynamics systems; to complex systems through his work on internet-distributed hardware in-the-loop simulation; to manufacturing systems through his work on model based monitoring; and control of dynamic systems as well as to bioengineering systems through his work on above/knee amputee gait biomechanics as well as the design and control of above/knee prostheses. This work has been applied to advanced transportation systems (e.g., design and control of hybrid vehicles, vehicle to grid design and control strategies, advance battery modeling, driver behavior, etc.), reconfigurable machine tool design and monitoring, concurrent engineering of vehicle powertrain components, and finally the design of above/knee prostheses.

Prof. Stein is the pioneer of automated modeling as applied to the development of proper models. These are models whose complexity are necessary yet sufficient to meet a modeling object while simultaneously retaining a physically meaningful realization. His energy based activity metric to assess the importance of elements in a model has been incorporated into at least two commercial software packages and has served as the basis for 5 doctoral dissertations. The activity metric has lead to the development of algorithms for reducing, partitioning, simplifying (reducing the structure), parameterizing and scaling models. This work has been applied to many of the research areas described above including: design analysis of coupled infrastructures, Vehicle to Grid Control and Design strategies including the maximizing use of renewal resources through controlled charging of plug-in hybrid vehicles. He has also applied the above techniques to hybrid vehicle design, concurrent powertrain component design through internet distributed engine-in-the-loop simulation, heavy-duty trucks engine vibration analysis, as well as machine tool monitoring, design and control. He also served on a Ph.D. thesis committee of a former student in his modeling class who applied proper modeling techniques to the design of fuel cell systems.

Prof. Stein's work in model based monitoring has led to an understanding of the role of thermal induced bearing loads in precision high speed spindles, simple methods for monitoring dynamic cutting forces in machine tools and monitoring the level of backlash in machine tool drive systems. Ford and GM have applied some of these methods to their production machinery.

Prof. Stein's work on concurrent engineering of complex systems has made fundamental contributions to the study of transparency, robustness and stability analysis for the design of internet distributed hardware in the loop simulation. He has also developed a

systematic method for the evaluation of dynamic system models which as been applied to the handling evaluation of vehicles (mass and c.g. height estimation in vehicles with limited sensing).

Finally Prof. Stein has made fundamental contributions to biosystems engineering through his work on novel combination of gait models and a servo hydraulic prosthetic simulator (a novel, hardware in the loop simulator for prosthetic control and design studies). He has made contributions to human behavior engineering through work on modeling human driver behavior for purposes of automatically detecting distracting driving.

Grants and Contracts

The NSF Engineering Research Center (ERC) and the NSF EFRI RESIN program as well as the Automotive Research Center (ARC) have been, and in the case of ARC continue to be a significant source of support for Prof. Stein's research activities. He also just completed a project funded by the University of Michigan under their Global Challenges for a Third Century (GCTC) initiative and continues to receive support from their Mobility Transformation Center (MTC).

 "As the University of Michigan prepares to celebrate its bicentennial in 2017, the Third Century Initiative has been established to inspire innovative programs that enhance the student learning experience and develop creative approaches to the world's greatest challenges" (http://thirdcentury.umich.edu)). Part of this initiative is to fund highly interdisciplinary work that will have high impact. Prof. Stein just completed a Phase I grant ($300K (no indirect costs), 1 year) "Sustainable Transportation for a 3rd Century: An Interdisciplinary Approach to Addressing the Last Mile Problem for Enhanced Accessibility." This grant included 5 other co-PIs from urban planning, public policy, business school, electrical engineering and natural resources to address the design and control of autonomous vehicles as a share public resource. The objective was to examine the interplay between the design and control of the autonomous vehicle along with the design of the smart power grid, the management of energy resources, the design of community infrastructure and the societal deployment issues, and measure our success by sustainability metrics. The approach represented an "up front" and integrated analysis of the problem that simultaneously involves multiple disciplines to determine the feasibility of using autonomous vehicles to solve the last-mile problem. Overcoming the last-mile problem was a first step in the deployment of a fundamentally transformed transportation system.

"The MTC is a public/private R&D partnership that will lead a revolution in mobility by developing the foundations for a commercially viable ecosystem of connected and automated vehicles. One of the central goals is to develop and implement an advanced system of connected and automated vehicles in Ann Arbor by 2021."

(http://www.mtc.umich.edu) My (along with co-PIs Greg Keoleian, Tulga Ersal and Lidia Kostyniuk) research project ''Road map of autonomous vehicle deployment priorities in Ann Arbor'' is one of several projects supported by MTC. The purpose of this two year project (starting May, 2014) is to collaborate with MTC and industrial partners to develop a road map for Ann Arbor Automation deployment that best meets the mobility needs of our community and also enhances sustainability. The set of best outcomes will provide the basis for the Ann Arbor Automation deployment road map (one of the objectives for the MTC more generally).

The NSF Emerging Frontiers Research Initiative sponsored in 2008 a call for grants in REsiliency and Sustainability of INfrastructures. Prof. Stein is the PI on a grant obtained under this program called "A Multi-Scale Design and Control Framework for Dynamically Coupled Sustainable and Resilient Infrastructures, with Application to Vehicle-to-Grid Integration". Prof. Stein is joined with 4 co-PIs and 5 research investigators to understand and develop tools for the design and control of coupled infrastructures with respect to their resiliency and sustainability. This 4 year, $2,000,000 award, is using the plug-in hybrid vehicle as an exemplar of a device that couples two infrastructures. In this case the electric power grid and the transportation system. Beyond directorship of the program, Prof. Stein main contribution is in the use of his modeling, model reduction expertise to integrate the large scale, both in time and space, models of the vehicle, the vehicle components, the grid and the grid control units. The vehicle component of particular importance and difficult to model are the Lithium Ion battery pack used to store electrical energy on board the vehicle. Traditional electrochemistry models are in the form of PDEs that when discretized result in over 7 thousand states and hundreds of coupled nonlinear algebraic constraints. Prof. Stein along with Dr. Hosam Fathy and their students have dramatically reduced the size and increased the numerical efficiency of this model and, as such, have then been able to complete design and control studies.

The ARC is a DOD Center of Excellence in Modeling and Simulation of Ground Vehicles. The original proposal to responding to the BAA was written primarily by Profs. Stein, Pierre and Papalambros. Prof. Papalambros became the Center Director; Pierre and Stein were named Associate Directors. Prof. Stein continues to be one of the Associate Directors and the center is now in its fourth phase with an annual average budget of $6 million/year for a project total value for the three plus phases of $90 million. This center provides partial support to 15 – 20 faculty and full support to over 30 gradate research assistants across approximately six partner schools. Specific projects supported by ARC are only shown for the last three years. Earlier projects are shown grouped under more general headings that covered work of similar nature done over 3-5 years.

The ERC is an NSF ERC in Reconfigurable Manufacturing Systems. The original proposal was written by Prof. Koren but with significant help from many including: Profs. Ulsoy, Ni, Stein, Kannatey-Asibu, and Hu. Prof. Koren has been its one and only project director. The center's total budget over its life was approximately $33 million.

Note: Traditional single investigator grants obtained from NSF and NIH are shown in bold.

SUCCESSFUL GRANTS And CONTRACTS

1) "Iterative Learning Control for Caterpillar Operator Modeling**",** Caterpillar, $80K, Phase 1 (8 mos) (co-PI with Tulga Ersal).
2) "Advanced Hazard Avoidance in Autonomous Ground Vehicles" ARC, 1 year, $116,319 (co-PI with Tulga Ersal).
3) "Delay Compensation in Teleoperated Vehicles" ARC, ~$120K/yr. 9/1/14, 3 years. (co-PI with Tulga Ersal)
4) "Compact Auxiliary Diesel Generator Enhanced with Electronic Fuel Injection" Navy SBIR/STTR, Lead group is Busek, my portion $15K for system optimization, 6 mos.
5) "Road Map of Autonomous Vehicle Deployment Priorities in Ann Arbor" Michigan Transportation Center, co-PI. PI (Keoleian), $50K/yr, 2 years, 2014 – 16.
6) "Sustainable Transportation for a 3rd Century: An Interdisciplinary Approach to Addressing the Last Mile Problem for Enhanced Accessibility. "University of Michigan Global Challenges for a Third Century Initiative, $300K (direct costs), 1 year. PI. Co-PIs, J. Levine, I. Hiskens, G. Keoleian, S. Parthasarathy, O. Wu, J. Kelly, T. Ersal.
7) **"Challenges to the Emerging Discipline of Resilient and Sustainable Interdependent Critical Infrastructures" NSF Workshop Proposal, $50K, 2012-2012.**
8) "Data-Based Techniques for Battery-Health Prediction" DoE: CERC – CVC (Clean Energy Research Center - A Clean Vehicle Collaboration between the University of Michigan and Tsinghua University (People Republic of China), $100,000/year 2012-2016. (co-PI with Prof. Dennis Bernstein)
9) "Internet-Distributed Hardware-in-the-Loop Simulation" DoD:ARC, $138,000 for first year (2012) of 3 year grant.
10) "Vehicle-Dynamics-Conscious Real-Time Hazard Avoidance in Autonomous Ground Vehicles" DoD:ARC, $123,000 for the first year (2012) of a 3 year grant.
11) "Internet-Distributed Hardware-in-the-Loop Simulation" DoD:ARC, $125,000, 2011
12) "Modeling, Design and Control of Military V2MG2V Micro-Grid Systems," DoD: ARC[2], $84,934 out of a $350,000 project., TARDEC, $84,934 , 6/10-7/11
13) "Analysis and Validation of Base Excitation Approach to Off-Road Vehicle Mass Estimation", DoD: ARC , $110K, 2010
14) "Internet-Distributed Hardware-in-the-Loop Simulation", DoD: ARC , $110K, 2010
15) "Analysis and Validation of Base Excitation Approach to Off-Road Vehicle Mass Estimation", DoD: ARC , $70K, 2009
16) "Internet-Distributed Hardware-in-the-Loop Simulation", DOD: ARC, $70K, 2009
17) **"A Multi-Scale Design and Control Framework for Dynamically Coupled Sustainable and Resilient Infrastructures, with Application to Vehicle-to-Grid Integration", NSF EFRI RESIN Program, $2,000,000 , Sept. 2008 - Aug. 2012**

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[2] ARC funded projects in 2008, 9 & 10 were competed for jointly with Dr. Hosam Fathy.

18) "An Integrated Vehicle, Engine, and Human Driver Simulation Platform", DOD: ARC III, $70K/yr, 2008

19) "Optimal Sensor Package Selection for Off-road Vehicle Mass Estimation", DOD: ARC, $70K/yr, 2008

20) Graduate Fellowship for Scott Moura **NSF**, Full Tuition/Stipend, 3 years

21) "Long-Haul Integration of Hardware-In-The-Loop Facilities" (part of a larger project directed by Mark Brudnak and Alex Reid of TARDEC) w/ Hosam Fathy, Zoran Filipi, TARDEC: ARC, $25k/yr, 2008

22) "Integrated Vehicle System Simulation" Borg Warner, $100,000, 2007. (w/ Assanis et al)

23) "Transmission System Modeling for Assessing the Impact of Technology Insertion on Parasitic Losses", Borg Warner, $100,000, 2007.

24) "Estimating the Mass of a HMMWV/JLTV on Rough Terrain: A Key Tool for Active Safety", DoD: ARC, $70K, 2007.

25) "RAMPED: A Tool for Rapid Model Parameterization from Experimental Data", DoD: ARC, $70K/yr, 2007.

26) "Rapid System Design and Control Scaling: A Key Tool for Vehicle Procurement and Rapid Redesign", DoD: ARC, $70K/yr, 2007.

27) "Scalable Modeling for Vehicle System Simulation, Procurement, and Robust Design", DoD: ARC, $70K/yr, 2006.

28) "Accelerating Large System Parameter Identification Through Model Reduction and Sensitivity Analysis", DoD: ARC, $70K/yr, 2006.

29) "A Platform for Integrated Hybrid Truck Modeling, Design, and Real-Time Simulation", DoD: ARC, $70K/yr, 2006.

30) "Automated Modeling for Reconfigurable Machine Tools", ERC/Navistar, $35K.

31) "Scaling of Dynamic System: A Fuel Cell Case Study", DoD: ARC, $70K/yr, 2005.

32) "Assessing Model Range of Validity in the Presence of Parameter and Input Uncertainty", DoD: ARC, $70K/yr, 2005.

33) "Integrated Engine-the-Loop Vehicle Simulation", DoD: ARC, $70K/yr, 2005

34) "Robust Mass and CG Height Estimation for Vehicle Control", Daimler/Chrysler, $130K, 2004-06.

35) "Integrated Controller Design for Reconfigurable Machine Tools", NSF:ERC, $10K, 2005-06.

36) "Powertrain Simulation and Integration" (co-PI with Prof. Assanis), International Truck and Engine Co./Navistar, $200K, 9/00-12/03.

37) "A Modular Modeling Approach for the Control of Reconfigurable Machine Tool Systems", NSF: ERC, $60K/yr, 9/02-12/05.

38) "Analysis and Control of Thermal Induced Spindle Bearing Loads for Reconfigurable Machines", NSF: ERC, $60-100K/yr, 9/96 - 4/04.

39) "Assessing Model Quality and Range of Validity", DoD: ARC, $65K/yr, 4 years, 2001 – 2004.

40) "Automated Model Partitioning for Vehicle Design and Control", DoD: ARC, $65K/yr, 4 years, 2001 - 2004.

41) "Integrated Hybrid Vehicle Simulation Environment", DoD: ARC, $65K/yr, 5 years 2001 - 2005.

42) "Proper Modeling: Model Order Reduction Based on Activity", DoD: ARC, $65K/yr, 5 years, 1996 – 2000.

43) "Model Deduction of Continuous Structures and Model Reduction Based on Inertia Elimination", ARCI, $65K/yr, 5 years, 1996 - 2000.

44) "VESIM: A Software Simulation Environment for Vehicle Engine Interactions in Ground Vehicles", ARCI, $65K/yr, 5 years, 1996 - 2000.

45) "Development of Advanced Ride Quality Models for Vehicle Design, DaimlerChrysler", $150K, 9/96 –8/00.

46) "Establishment of a Graduate Traineeship Program in Machine Tool Technology" (P.D. Prof. Ni, Co-P.I.s Profs. Ulsoy, Koren and Kannetey-Asibu: Amended in July, 97 w/ $112,500 of additional funds, NSF, $557.5K, 5 years, 10/93- 9/98.

47) "Modeling the Driving Conflicts Posed by Intelligent Cruise Control (ICC)" (co-P.I. with Robert Ervin), US Dot Research Center of Excellence In IVHS, $100K, 2 years, 3/95 -2 97.

48) "Design of Computer Experiments for Modeling the Driving Conflicts Posed by Intelligent Cruise Control (ICC)", Great Lakes Center for Truck and Transit Research, $229.7K, 1 year, 9/95 - 8/96.

49) College of Engineering Control Systems Seminar Series: Seminar Coordinator, GM, $5K, 1 year, 9/95-4/96.

50) "Well-Conditioned Observers for High-Performance, Low-Cost, Sensing System", NSF, $180K, 3 years, 5/1993 - 4/1996.

51) "A High Efficiency Powerplant For Heavy Trucks and Buses: A Feasibility Study", Great Lakes Center for Truck and Transit Research, $27K, 1 year, 9/94 - 8/95.

52) "Active Safety Conflict Model (ASCOM)" (Co-P.I. with Dr. Bob Ervin), US Dot Research Center of Excellence In IVHS, $50K, 1year3/94 - 4/95.

53) "Advanced Motor Control For Automotive Steering and Active Suspension Applications", Ford, $83K, 1 year,7/94-7/95.

54) "A Novel Milling Machine Structure" (co-PI with Al Ward), Industrial Technology Institute, $90.9K, 1 year, 9/92 - 8/93.

55) "SST (Synthesis of Simulation Technologies)" co-PI w/ Mike Sayers of UMTRI, Chrysler, Corp., $100K, 8-12/92.

56) "A Novel Milling Machine Structure" (co-PI with Al Ward), NSF, $9K, 4 mos., 1992.

57) "ME360 Lab Development", MEAM, University of Michigan, $15K, 1990 - open

58) "DC Servo System for Model-Based Monitoring Evaluation", MEAM, University of Michigan, $4K, 1990-91.

59) "Spindle System for Evaluation of Thermal Induced Bearing Load Monitor", MEAM, University of Michigan, $7.5K, 1990-91.

60) "Rackham Dissertation Fellowship" (J.F. Tu), Rackham Graduate School, University of Michigan, $1K, 1991.

61) "Ford Motor Co. Manufacturing Fellowship" (for doctoral student Bruce Wilson), Ford, $6K, 1991.

62) "Ford Motor Co. Manufacturing Fellowship" (for doctoral student Kunsoo Huh), Ford, $16K, 1991.

63) "Rackham Pre-doctoral Fellowship" (for doctoral student Kunsoo Huh), Rackham Graduate School, University of Michigan, $10K, 1 year,1990-91.

64) "Ford Motor Co. Manufacturing Fellowship" (for doctoral student Bruce Wilson), Ford, $25K, 1 year1990-91.

65) "Ford Motor Co. Manufacturing Fellowship" (for doctoral student Kunsoo Huh), Ford, $4.9K, 1 Sem. 1990.
66) "Ford Motor Co. Manufacturing Fellowship" (for doctoral student Yih-Tun Tseng), Ford, $4,900 , 1 Sem. 1990.
67) "ME340 Lab Development", MEAM Department, $10K, 1 year,1989-90.
68) "Servo Slide System", MEAM/NSF, $4.6K Matching, 1 year, 1989-90.
69) "Modeling and Control of Prosthetic Feet", NSF/ REU Supplement, $4K, 7 mos., 1990.
70) "Mathematical Modeling of Manufacturing Processes" (Co-P.I. w/ A.G Ulsoy, Ford Motor Co., $200K, 3 years7/87-6/91.
71) "NSF-PYI Matching Funds", NSF, $167K, 1987-91.
72) "Design and Control of Servo Systems", NSF- Presidential Young Investigator Award, $125K, 5 years, 9/87 - 8/92.
73) "Design and Control of Servo Systems", Ford Gift for PYI award, $17K, 1987-88.
74) "NSF-PYI Matching Funds", NSF, $17K, 1987-88.
75) "Inline Torque Sensor", Eaton Corporation Donation, value is $3.1K, 1987.
76) "NSF-PYI Matching Funds", NSF, $3.1K, 1987.
77) "Measurement Signal Selection for System Monitoring", Rackham Faculty Grant, $10K, 1/87- 12/87.
78) "Dynamic Modeling of Prosthetic Gait", NIH, $190K, 3 years, 8/1/86- 7/31/89.
79) "Expert System Based Machine Tool Monitor", Univ. of Michigan Consortition on Metal Cutting, $10K, 1/87 - 12/87.
80) "Machine Diagnostics Using Remote Sensing", NSF, $158.5K, 2 years, 3/15/87- 3/14/89.
81) "Center for Research in Integrated Manufacturing", Univ. of Michigan, College of Engineering, $22.1K, 9/1/85 - 8/1/86.
82) "Adaptive and Sensor Based Control of Machine Tools" (Project Director and Co-principal investigator with Prof. Ulsoy.), GM Corp., $138.7K, 6/1/84 - 5/30/85.
83) "Adaptive and Sensor Based Control of Machine Tools" (Project Director and Co-principal investigator with Prof. Ulsoy.), GM Corp., $99.2K, 6/1/83 - 5/31/84.
84) "Research and Curriculum Development: A Proposal for a Computer Aided Test System", UofM Col. of Engr., $83.4K, 5/83- 4/84
85) "Request for Participation in Engineering Productivity Project (joint w/ Ulsoy, Kannatey-Asibu, Felbeck), UofM Col. of Engr., 1 Computer Apollo DN460, 4/84.

SERVICE

Revised June 17, 2014

SERVICE

Major Committee Assignments at the University of Michigan
   Mechanical Engineering (ME) Department (formerly MEAM Department)

- ME Honors and Awards Committee, member, 2014-2015
- ME350 Machine Design, Course Leader, 2013 - present
- ME Honors and Awards Committee, member, 2013-2014
- ME Honors and Awards Committee, member, 2012-2013
- ME Honors and Awards Committee, member, 2011-2012
- ME Honors and Awards Committee, member, 2010-2011
- ME Honors and Awards Committee, member, 2009-2010
- ME Faculty Search Committee, Chair, 2005-2006
- ME Faculty Search Committee, 2004-2005
- ME Graduate Committee, 2003-2004
- ME Graduate Committee, 2002-2003
- UMME/ME Dept. Mentorship Program, Mentor Fall 01 – Winter 03.
- ME: Automotive Research Center; Associate Director Fall 1996 - present
- ME Honors and Awards Committee, Fall 2000
- MEAM Honors and Awards Committee, 1/1/99 – 12/31/99, Chair
- MEAM Advisory Committee, Fall 1998, member
- MEAM Faculty Search Committee, 1998, member
- MEAM Review Committee, 1998, member
- Area Coordinator for the Systems and Control Area: 1991-1997.
- Course Leader ME360, 1985-2004
- Department Advisory Committee, 1/1/94 - 6/96**.**
- Member of the Undergraduate Curriculum Review Committee. 1990-96.
- Faculty Search Committee, 1993-95, member
- Undergraduate Program Committee. 1989-1992
- Systems/Design Option Advisor. 1988-1992
- Faculty Re-appointment Committees (4):
- Founder and Assistant Director of the Mechanical Systems Laboratory. 1991-present
- Honors and Awards Committee. 1987-1988
- Faculty Advisor to Pi Tau Sigma. 1983-1990

College of Engineering

- Casebook Committee, Michael Umbriac, 2 year Lecture reappointment, 2013-14
- Casebook Committee, Jonathan Lutz, Promotion to Assoc. Research Scientist, 2012-13.
- InterPro Review Committee, Chair, 2010
- Casebook Committee, Kenn Oldham (ME) 3 years reappointment, 2009-10, Chair.
- Casebook Committee, Anouck Girard (Aero) 3 years reappointment, 2008-9.
- ME Department representative to the Scholastic Standing Committee, 2007-2008
- Casebook Committee, Dawn Tilbury Promotion to Full Professor, 2006-2007, Chair.
- Casebook Committee, Suman Das Promotion to Associate Professor with tenure, 2005-2006, Chair.
- Casebook Committee, Huei Peng Promotion to Full Professor, 2004-2005, Chair
- Examiner, ELI Testing Program, Fall 2003.
- CRLT Peer Review Evaluation of ME360&ME450 (Fall 2002).
- Casebook Committee, Anna Stefanapoulou Promotion to Associate Professor with tenure, Fall 2002, Member.
- Casebook Committee, Brent Gillespie Three year Reappointment, Winter 2002, Chair.
- Casebook Committee, Dawn Tilbury Promotion to Associate Professor with tenure, 2000-2001, Chair.
- Casebook Committee, Sridhar Kota, Promotion to Full Professor, 1999, Member.
- Casebook Committee, Huei Peng, Promotion to Associate Professor with tenure, 1998-1999, Chair.
- Casebook Committee, Dawn Tilbury, Three year Reappointment, Winter 1998, Chair.
- Faculty Committee on Discipline, 1991-94, member, 1994-98, Chair.
- Casebook Committee, Michael Bridges, Three year Reappointment, Winter 1997, Chair.
- Casebook Committee, Robert Fijan, Three year Reappointment, Winter 1992, Chair.
- Office of Technology Transfer Review Committee, Chair, Winter 96
- Casebook Committee, Sridhar Kota, Promotion to Associate Professor with tenure, Winter 1990, Chair.
- Dept. Chairman Search Committee for the Mechanical Engineering and Applied Mechanics Dept. 1990-1991, Chair,.
- Casebook Committee, Deba Dutta Three year Reappointment, Winter 1992, Chair.
- Control Seminar Series Coordinator 1993-95.
- Control Systems Exec. Coordinating Committee, 1995 – 1997.
- Curriculum Committee, W91, member.

University of Michigan

- Director Search Committee, U. of Mich. Transportation Research Inst. (Winter 2015).
- Executive Committee, U of Mich. Transportation Research Inst., 9/92-6/95, 9/95-6/98, member.

- Associate Director and Thrust Area Leader, <u>Automotive Research Center</u>, 1994-present.

Administrative Duties at U of M (position, dates)
Automotive Research Center

- Associate Director 1994-2009

- Leader of Vehicle Terrain Dynamics Thrust Area, 1994-1998

- Leader of the Intelligent Vehicle Systems Thrust Area, 1998 – 2002

- Leader of the Dynamics and Controls of Vehicles and Mobile Robots, 2002 – 2004

- Leader of the Dynamics and Control of Vehicles, 2004 – 2012.

Service to Government or Professional Societies
ASME

- ASME Energy and Environmental Standards Advisory Board (EESAB), chair, 7/15 – 6/20

- ASME Energy and Environmental Standards Advisory Board (EESAB), member, 9/11 – 6/16

- Dynamic Systems and Design Group, Member at Large, 2002 – 5.

ASME Dynamic Systems and Control Division (DSC).
•<u>General</u>

- 2012 Dynamic Systems and Control Conference, Program Chair.

- Director, AACC Board of Directors, 12/2009-11/2011

- Honors and Awards Committee, Chair, 2007-11

- Honors and Awards Committee, Member, 2005-7

- DSC Editorial Board, member 2008 – 2010

- Alternate Director, AACC Board of Directors, 12/2007-11/2009

- Honor and Awards Committee 2005-7.

- DSC Representative to the Systems and Design Group, 2002-5.

- Advisory Committee, 2003-6.

- Past Chair in charge of Nominations, 2002-3•

- Chair, Executive Committee, 2001-2

- Vice-Chair, 2000-1

- Executive Committee, 1998-03.

- Division Secretary, 1995-98

- Associate Editor, Journal of Dynamic Systems Measurement and Control, 1991 - 4. Re-appointed 1994 -1997. Resigned 1995 to assume Secretary responsibilities.

- Honors Committee, member, 1993-1996.

- Long Range Planning Committee, member, 1993-present.

- O. Hugo Shuck 1994 ACC Best Paper Award Committee, January 1995

- DSC Program Representative to ASME for 1990 WAM

- Newsletter Editor, 1987-1988.

- Publicity Chairman, 1987-1988.

- Technical Panels:
    - "Modeling and Identification" 1995-present, member.
    - "Modeling and Identification" 1992 - 1995, chair.
    - "Modeling and Identification" 1989-1991, member.
    - "Biomechanical Systems", Founder 1988 - 1992, chair.
    - "Manufacturing Systems", 1989 - 1992, chair
    - "Manufacturing Systems", 1993 - 2007, member
    - "Expert Systems and Artificial Intelligence", 1986-1992, member.

    - "Expert Systems and Artificial Intelligence", 1986-1992, co-founder w/ R. Shoureshi

- **Conferences Organized**

    - General Chair, Japan/USA Symposium on Flexible Manufacturing 2000, Ann Arbor, MI (jointly sponsored by ASME, JSME & ISCS)

Special Sessions/Workshops

    - 2013 Educational Session "Modeling and Simulation: What Are the Fundamental Skills and Practices to Impart to Our Students?", 2013 DSCC, Organized and Chair.
    - 2009 Frontier Session "Progress and Challenges in the Configuration, Control, and Battery Management of Vehicle-To-Grid (V2G) Integration Systems", 2009 DSCC, Invited Speaker.

- **Symposia Organized**

    - Chairman, Organizer, and Editor for a Symposia on *Modeling* at ASME IMECE (formerly WAM):
        - 2003 Automated Modeling (assistant to Loucas Louca, Chair)
        - 2002 Automated Modeling (assistant to Loucas Louca, Chair)
        - 2001 Automated Modeling (assistant to Loucas Louca, Chair)

- •2000 Automated Modeling (assistant to Loucas Louca, Chair)
- •1996, Automated Modeling, Co-chaired with B. Wilson
- •1995, Automated Modeling
- •1994, Automated Modeling
- •1993, Automated Modeling
- •1992, Automated Modeling, Co-chaired with B. Wilson
- •1991, Automated Modeling, Co-chaired with B. Falkenhainer
- •1989, Teaching Physical System Modeling, Co with R. Rosenberg

- •Chairman, Organizer, and Editor for a Symposia on *Manufacturing* at ASME WAM or ACC as indicated.
  - •1995, Applied Diagnostics, ACC, Co with G. Rizzoni
  - •1994, Model-Based Monitoring, WAM, Co with J. Tu
  - •1994, Applied Diagnostics, ACC, Co with K. Danai
  - •1993, Control of Manuf. Proc., ACC, Co with G. Ulsoy
  - •1992, Panel "Fundamental Research in Manufacturing for National Competitiveness", WAM, moderator (co-organized w/ Y. Koren)
  - •1989, Control of Manufacturing Processes, WAM, Co with Y. Koren, and J. Holmes.
  - •1988 , Sensors and Control for Manufacturing, WAM, Co with E. Kannatey-Asibu, and Y. Koren.

- •Chairman, Organizer, and Editor for a Symposia on *Biomechanical Systems* at ASME WAM
  - •1989, Modeling and Control Issues in Biomechanical Systems, Co with J. Ashton-Miller.
  - •1988, Modeling and Control Issues in Biomechanical Systems
  - •1987, Biomechanics of Normal and Prosthetic Gait

- •Chairman, Organizer, and Editor for a Symposia on *Intelligent Control Systems*
  - 1988 "Intelligent Control Systems", WAM, co with R. Shoureshi.
  - 1988 "Intelligent Control Systems", ACC, co with R. Shoureshi.
  - 1987 "Intelligent Control Systems", WAM, co with R. Shoureshi.
  - 1987 "Intelligent Control Systems", ACC, co with R. Shoureshi.

- •Program Committee, USA-Japan Symposium on Flexible Automation, 1988, member.

- •**Editorial**

  - •Publications Committee, ASME 2008 Dynamic Systems and Control Conference, member
  - •Associate Editor, ASME: 2008 Dynamic Systems and Control Conference.
  - •Associate Editor, Journal of Dynamic Systems Measurement and Control, 1991 - 4. Re-appointed 1994 -1997. Resigned 1995 to assume Secretary responsibilities. Maximum papers under review at one time was approximately 80.

•DSC Program Representative for the Dynamic Systems and Control Division of ASME. Responsible for coordinating the 30 technical sessions allocated to DSC by ASME for the 1990 WAM. In addition, I was responsible for quality control of the symposium proceedings, and pamphlet papers.

•Editor of Symposia Proceedings. All of the ASME technical session described above required production of proceedings.

•Reviews

•ASME Journal of Dynamics Systems, Measurement and Control
•ASME and ACC Conference papers
•ASME Journal of Engineering for Industry
•ASME Journal of Applied Mechanics

Non ASME-DSC activities.

•Manufacturing Organizations

•Organizing Committee, NAMRAC 1996, Organizing Committee, member.
•Organizing Committee, 27th CIRP International Seminar on Manufacturing Systems, member, 1994-1995.

•National Science Foundation

- 2012 NSF RESIN (Resilient and Sustainable Infrastructures) Workshop, Organizer, PI on Workshop Grant, Washington, DC
- Research Initiation Proposal Review Panel March, 1992
- Small Business Initiation Research Proposal Review Panel, Sept., 1991
- Organizing Committee, NSF Workshop on Fundamental Research and U.S. Competitiveness in Manufacturing, (held Nov. 1991).
- Review individual proposals

•Department of Energy

- DOE Smart Grid Investment Grant Merit Program, 2011
- DOE Smart Grid Investment Grant Merit Program, 2010

Elsevier, Inc.

- Editorial Board of Simulation Modeling Practice and Theory, 7/09-present.

•Society for Computer Simulation

•Editorial

•Area Editor (Physical System Modeling) of *Simulation*: Transactions of The Society for Modeling and Simulation International, (2007-9).

Memeber of the International Program Committee for the 2014 International Conference on Bond Graph Modeling (ICBGM'12) Monterey, CA.

Memeber of the International Program Committee for the 2012 International
Conference on Bond Graph Modeling (ICBGM'12) Genoa, Italy
Memeber of the International Program Committee for the 2010 International
Conference on Bond Graph Modeling (ICBGM'10) Orlando, Florida.
Memeber of the International Program Committee for the 2007 International
Conference on Bond Graph Modeling (ICBGM'07) San Diego, CA.
•Memeber of the International Program Committee for the 2005 International
Conference on Bond Graph Modeling (ICBGM'05) Orlando, FL.
•Memeber of the International Program Committee for the 2003 International
Conference on Bond Graph Modeling (ICBGM'03) Orlando, FL.
•Memeber of the International Program Committee for the 2001 International
Conference on Bond Graph Modeling (ICBGM'01) Phoenix, AZ.
•Memeber of the International Program Committee for the 1999 International
Conference on Bond Graph Modeling (ICBGM'99) San Francisco, CA.
•Memeber of the International Program Committee for the 1997 International
Conference on Bond Graph Modeling (ICBGM'97) Phoenix, Arizona.

- 2008 **European Conference on Modeling and Simulation**
  International Program Committee, member

Consulting

Prof. Stein is a registered Profession Engineer in the state of Michigan and has over 25
years experience consulting to industry and serving as an expert witness in product
labiality, trade secret and patent infringement matters. He has testified in court and in
deposition in over 30 litigated matters involving the design of automobiles, hybrid
electric vehicles, trucks, manufacturing machinery and general mechanical systems.