

References

- 1 Karnopp, D. C. and Crosby, M. J., 'System for Controlling the Transmission of Energy between Spaced Members,' U.S. Patent 3,807,678, April 1974
- 2 Ahmadian, M., Reichert, B. A., and Song X., 'Harmonic Analysis of Semiactive Suspensions,' Proceedings of DETC'97, Sacramento, CA, September 14-17, 1997
- 3 Ivers, D. E., and Miller, L. R., 'Experimental Comparison of Passive, Semiactive on/off, and Semiactive Continuous Suspensions,' SAE, Truck and Bus Meeting and Exposition, Charlotte, NC, November 6-9, 1989
- 4 Ivers, D. E., and Miller, L. R., 'Semiactive Suspension Technology: An Evolutionary View,' DE-VOL. 40, Advanced Automotive Technologies, ASME 1991
- 5 Carlson, J. D., and Chrzan, M. J., 'Magnetorheological Fluid Dampers,' Patent No. 5,277,281, Jan 11, 1994
- 6 Carlson, J. D., Catanzarite, D. M., and Clair, K. A. St., 'Commercial Magneto-Rheological Fluid Devices,' Int. Conf. On Eletro-Rheological, Magneto-Rheological Suspensions and Associated Technology, Sheffield, 10-14 July, 1995
- 7 Isermann, R., Lachmann, K. H., and Matko, D., 'Adaptive Control Systems,' Prentice Hall, 1992
- 8 Ioannou, P. A., and Sun, J., 'Robust Adaptive Control,' Prentice Hall, 1996
- 9 Widrow, B., and Stearns, S. D., 'Adaptive Signal Processing,' Prentice Hall, 1985
- 10 Shoureshi, R., 'Method and Apparatus for Intelligent Active and Semiactive Vibration Control,' Patent No. 5,418,858, May 23, 1995
- 11 Henry, R. R., Applebee, M. A., and Murty, B. V., 'Full Car Semiactive Suspension Control Based on Quarter Car Control,' U.S. Patent 5,475,596, Dec. 12, 1995
- 12 Venhovens, P. J. Th., 'The Development and Implementation of Adaptive Semiactive Suspension Control,' Vehicle System Dynamics, 23(1994), pp. 211-235
- 13 Boyle, F. P., Petek, N., and Smith, D. P., 'Method For Controlling Motion Using an Adjustable Damper,' Patent No. 5,582,385, December 10, 1996
- 14 Bußhardt, J., and Isermann, R., 'Realization of Adaptive Shock Absorbers by Estimating Physical Process Coefficients of a Vehicle Suspension System,' 1992 ACC/WM1
- 15 Blankenship, G. L., and Polyakov, R. G., 'Nonlinear Adaptive Vehicle Suspensions,' Proceedings of the American Control Conference, San Francisco, CA, June 1993
- 16 Karnopp, D. C., Crosby, M. J., and Harwood, R. A., 'Vibration Control Using Semiactive Force Generators,' ASME Journal of Engineering for Industry, p.p. 619-626, May 1974

- 17 Karnopp, D. C., 'Design Principles for Vibration Control Systems Using Semiactive Dampers,' *Journal of Dynamic Systems, Measurement, and Control*, 448/Vol. 112, September 1990
- 18 Inman, D. J., 'Engineering Vibration,' Prentice Hall, 1994
- 19 Ahmadian, M., "On the Isolation Properties of Semiactive Dampers," *Journal of Vibration and Control*, Vol. 5, No. 2, March 1999, pp. 217 - 232
- 20 Tao, G., and Kokotovic, V. C., 'Adaptive Control of Systems with Actuator and Sensor Nonlinearities,' John Wiley & Sons, Inc., 1996
- 21 Kaufman, H., Bar-Kana, I., and Sobel, K., 'Direct Adaptive Control Algorithms (Theory and Applications),' Springer-Verlag, 1994
- 22 Widrow, B., and Walach, E., 'Adaptive Inverse Control,' Prentice Hall, 1996
- 23 Astrom, K.J., and Wittenmark, B., 'Adaptive Control,' Addison-Wesley, 1989
- 24 Acker, B., Darenburg, W., and Gall, H., 'Active Suspension for Passenger Cars,' *Proceedings of the 11 th Annual IAVSD Symposium*, 1991
- 25 Yi, K. and Hedrick, K., 'Dynamic Tire Force Control by Semiactive Suspensions,' *Journal of Dynamic Systems, Measurements, and Control*, Vol. 115, No. 3, pp. 465-474, September 1993
- 26 Valasek, M., Novak, M., Sika, Z., and Vaculin, O., 'Extended Groundhook – New Concept of Semiactive Control of Truck's Suspension,' *Vehicle System Dynamics*, Vol. 27, No. 5-6, pp. 289-303, June 1997
- 27 Ahmadian, M., 'A Hybrid Semiactive Control for Secondary Suspension Applications,' *Proceedings of the Sixth ASME Symposium on Advanced Automotive Technologies*, 1997 ASME International Congress and Exposition, November 1997
- 28 Crolla, D.A., and Abdel-Hady, M.B.A., 'Active Suspension Control: Performance Comparisons using Control Laws Applied to a Full-Vehicle Model,' *Vehicle System Dynamics*, 20, 1991
- 29 Lieh, J., 'Semiactive Damping Control of Vibrations in Automobiles,' *Journal of Vibration and Acoustics*, Vol. 115, No. 3, pp. 340-343, July 1993
- 30 Margolis, D.L., 'The Response of Active and Semiactive Suspensions to Realistic Feedback Signals,' *Vehicle System Dynamics*, Vol. 11, No. 5-6, pp. 267-282, December 1982.
- 31 Margolis, D.L., 'A Procedure for Comparing Passive, Active, and Semiactive Approaches to Vibration Isolation,' *Journal of the Franklin Institute*, Vol. 315, No. 4, pp. 225-238, April 1983.
- 32 Hwang, S., Heo, S., Kim, H., and Lee, K., 'Vehicle Dynamic Analysis and Evaluation of Continuously Controlled Semiactive Suspensions Using Hardware-in-the-loop Simulation,' *Vehicle System Dynamics*, Vol. 27, No. 5-6, pp. 423-434, June 1997

- 33 Miller, L.R., 'Tuning Passive, Semiactive, and Fully Active Suspension Systems,' Proceedings of the 27 th IEEE Conference on Decision and Control, December 1988
- 34 Bellizzi, S. and Bouc, R., 'Adaptive Sub-Optimal Parametric Control for Non-Linear Stochastic Systems: Application to Semiactive Isolators,' Probabilistic Methods in Applied Physics, 223-238, 1995
- 35 Hrovat, D., Margolis, D.L., and Hubbard, M., 'An Approach Toward the Optimal Semiactive Suspension,' Journal of Dynamic Systems, Measurement, and Control, Vol. 110, No. 3, pp. 288-296, September 1988
- 36 Cheok, K.C., and Huang, N.J., 'Lyapunov Stability Analysis for Self-learning Neural Model with Application to Semiactive Suspension Control Systems,' 1989 IEEE
- 37 Hashiyama, T., Behrendt, S., Furuhashi, T., and Uchikawa, Y., 'Fuzzy Controllers for Semiactive Suspension System Generated through Genetic Algorithm,' 1995 IEEE
- 38 Frost, G.P., Gordon, T.J., Howell, M.N., and Wu, Q.H., 'Moderated Reinforcement Learning of Active and Semiactive Vehicle Suspension Control Laws,' Proc Instn Mech Engrs Vol 210, MechE 1996
- 39 Titli, A., Roukieh, S., and Dayre, E., 'Three Control Approaches for the Design of Car Semiactive Suspension (Optimal Control, Variable Structure Control, Fuzzy Control),' 32nd IEEE CDC, San Antonio, Texas, December, 1993
- 40 Yeh, E.C., and Tsao, Y.J., 'Fuzzy Preview Control Scheme of Active Suspension for Rough Road,' Int. J. of Vehicle Design, Vol. 15, No. ½, 1994
- 41 Cherry, A.S., and Jones, R.P., 'Fuzzy Logic Control of an Automotive Suspension System,' IEE Proc.-Control Theory Appl., Vol. 15, No. 2, March 1995
- 42 Lazareva, T.G. and Shitik, I.G., 'Magnetic and Magnetorheological Properties of Flowable Compositions Based on Barium and Strontium Ferrites and Iron Oxides,' Proceedings of the Society for Optical Engineering, Vol. 3040, pp. 185-189, March 1997
- 43 Ashour, O., Kinder, D., Giurgiutiu, V., and Rogers, C., "Manufacturing and Characterization of Magnetorheological Fluids," Proceedings of the Society for Optical Engineering, Vol. 3040, pp. 174-184
- 44 Ashour, O., Rogers, C.A., and Kordonsky, W. "Magnetorheological Fluids: Materials, Characterization, and Devices," Journal of Intelligent Material Systems and Structures, Vol. 7, March 1996, pp. 123-130

- 45 Kordonsky, W., "Elements and Devices Based on Magnetorheological Effect," *Journal of Intelligent Materials, Systems, and Structures*, Vol. 4, pp. 65-69, January 1996
- 46 Bolter, R., and Janocha, H., "Design Rules for MR Fluid Actuators in Different Working Modes," *Proceedings of the Society for Optical Engineering*, Vol. 3045, pp. 148-159, March 1997
- 47 Jolly, M.R., Carlson, J.D., and Munoz, B.C., "A Model of the Behavior of Magnetorheological Materials," *Smart Materials and Structures*, Vol. 5, No. 5, pp. 607-614, October 1996
- 48 Ballo, I., 'Power Requirement of Active Vibration Control Systems,' *Vehicle System Dynamics*, Vol. 24, No. 9, 1995, pp. 683
- 49 Nevala, K., and Jaerviluoma, M., 'An Active Vibration Damping System of a Driver's Seat for Off-Road Vehicles,' *Annual Conference on Mechatronics and Machine Vision in Practice 1997*, Toowoomba, Australia
- 50 Nevala, K., Kangspuoskari, M., and Leinonen, T., 'Development of an Active Suspension Mechanism for the Seat Vibration Damping,' *Robotics and Manufacturing – International Conference – IASTED – 1996*, Honolulu, HI
- 51 Wu, X., and Griffin, M.J., 'The Influence of End-Stop Buffer Characteristics on the Severity of Suspension Seat End-Stop Impacts,' *Journal of Sound and Vibration*, Vol. 215, No. 4, 1998, pp.989
- 52 Wu, X., and Griffin, M.J., 'Towards the Standardization of a Testing Method for the End-Stop Impacts of Suspension Seats,' *Journal of Sound and Vibration*, Vol 192, No. 1, 1996, pp. 307
- 53 Cebon, D., Besinger, F.H., and Dole, D.J., 'Control Strategies for Semiactive Lorry Suspensions,' *Proc Instn Mech Engrs*, Vol 210 ImchE 1996
- 54 Hrovat, D., Margolis, D. L., and Hubbard, M., 'An Approach Toward the Optimal Semiactive Suspension,' *Trans. ASME, J. Dyn. Sys. Meas. Cont.*, Vol. 110, pp. 288-295, September 1998
- 55 Satoh, M., Fukushima, N., Akatsu, Y., Fujimura, I., and Fukuyama, K., "An Active Suspension Employing an Electrohydraulic Pressure Control System," *Proceedings of the 29th IEEE Conference on Decision and Control*, December 1990
- 56 Sommerfeldt, S. D., and Tichy, J., 'Adaptive Control of a Two-stage Vibration Mount,' *J. Acoust. Soc. Am.* 88(2), August 1990
- 57 Sommerfeldt, S. D., and Tichy, J., 'Adaptive Control of a Two-stage Vibration Mount,' *Proceedings of the 27th Conference on Decision and Control*, Austin, Texas, December 1988
- 58 Geng, Z. J., Pan, G. G., Haynes, L. S., Wada, B. K., and Garba, J. A., 'An Intelligent Control System for Multiple Degree-of-Freedom Vibration Isolation,' *Journal of Intelligent Material Systems and Structures*, Vol. 6 – November 1995

- 59 Baumann, W. T., 'An Adaptive Feedback Approach to Structural Vibration Suppression,' Virginia Tech, September 1995
- 60 Rubenstein, S. P., and Allie, M. C., 'A Switching Element Adaptive Control Algorithm For Nonlinear Systems,' Symposium on Recent Development of Acoustic and Vibration Control, Virginia Tech, 1991
- 61 Ehgott, R. C., and Marsri, S. F., 'Modeling the Oscillatory Dynamic Behavior of Electro-Rheological Materials in Shear,' Smart Materials and Structures, Vol. 4, 1992, pp.275-285
- 62 McClamroch, N. H., and Gavin, H. P., 'Closed Loop Structural Control Using Eletrorheological Dampers,' Proceedings of American Control Conferences, Seattle, Washington, June 1995
- 63 Hsu, J. C., and Meyer, A. U., 'Modern Control Principles and Applications,' McGraw-Hill, pp. 116-120
- 64 Shames, I. H., and Cozzarelli, F. A., 'Elastic and Inelasitc Stress Analysis,' Taylor & Francis, 1997
- 65 Kamath, G. M., Hurt, M. K., and Wereley, N. M., 'Analysis and Testing of Bingham Plastic Behavior in Semiactive Electrorheological Fluid Dampers,' Smart Materials and Structures, 5 (1996) 576-590
- 66 Kamath, G. M., and Wereley, N. M., 'A Nonlinear Viscoelastic-plastic Model for Electrorheological Fluids,' Smart Materials and Structures, 6(1997) 351-359
- 67 Spencer, B. F., Dyke, S. J., Sain, M. K., and Carlson, J. D., 'Phenomenological Model of a Magnetorheological Damper,' ASCE Journal of Engineering Mechanics, 1996
- 68 Spencer, B. F., Dyke, S. J., Sain, M. K., and Carlson, J. D., 'Modeling and Control of Magnetorheological Dampers for Seismic Response Reduction,' Smart Materials and Structures, 5 (1996) 565-575
- 69 Wen, Y. K., and Asce, M., 'Method for Random Vibration of Hysteretic Systems,' Journal of The Engineering Mechanics Division, Vol. 102 No .1-3, April 1976
- 70 Nayfeh, A., 'Introduction to Perturbation Techniques,' John Wiley & Sons, Inc., 1993
- 71 SAE Standard, 'Measurement of Whole Body Vibration of the Seated Operator of Off-Highway Work,' SAE J1013 AUG92
- 72 SAE Standard, 'Vibration Performance Evaluation of Operator Seats,' SAE J1384 JUN93
- 73 Song, X., Schulz, M. J., Pai, P. F., and Naser, A. S., 'An Automated Design Technique for Nonlinear Structures and Controllers,' Journal of Vibration and Control, Vol. 5, No. 1, January, 1999, pp.123
- 74 Ahmadian, M., Song, X., and Reichert, B. A., 'Semiactive Control of Structural Resonance,' Proceedings of the 11th VPI&SU Symposium, Blacksburg, May 12-14, 1997
- 75 Miller, L. R., 'Control Method and Means for Vibration Attenuating Damper,' U.S. Patent 4,821,849, Apr. 18, 1989

- 76 Miller, L. R., and Nobles, C. M., 'Methods for Eliminating Jerk and Noise in Semiactive Suspensions,' SAE, Truck and Bus Meeting and Exposition, Detroit, MI, October 1990
- 77 Miller, L. R., and Nobles, C. M., 'The Design and Development of a Semiactive Suspension for a Military Tank,' SAE, Future Transportation Technology Conference and Exposition, San Francisco, CA, August 8-11, 1988
- 78 Huang, Z., 'Controls for a Semiactive Chassis,' U.S. Patent No. 5,020,781, Jun. 4, 1991
- 79 Karnopp, D., and Margolis, D., 'Adaptive Suspension Concepts for Road Vehicles,' *Vehicle System Dynamics*, 13(1984), pp. 145-160
- 80 Reichert, B. A., 'Application of Magneto-Rheological Dampers for Vehicle Seat Suspensions,' Master Thesis, Virginia Tech, December, 1997
- 81 Isermann, R., 'Modeling and Design Methodologies For Mechatronic Systems,' *IEEE/ASME Transactions on Mechatronics*, Vol. 1, No. 1, March 1996
- 82 Isermann, R., 'On the Design and Control of Mechatronic Systems – A Survey,' *IEEE Transactions on Industrial Electronics*, Vol. 43, No. 1, February 1996
- 83 Kamath, G. M., Wereley, N. M., and Jolly, M. R., 'Analysis and Testing of a Model-Scale Magnetorheological Fluid Helicopter Lag Mode Damper,' the American Helicopter Society 53rd Annual Forum, Virginia Beach, VA, April 29-May 1, 1997
- 84 Reybrouck, K., 'A Non Linear Parametric Model of an Automotive Shock Absorber,' *Vehicle Suspension System Advancements*, SP-1031, February 1994
- 85 Weiss, K. D., Carlson, D., and Nixon, D. A., 'Viscoelastic Properties of Magneto- and Electro-Rheological Fluids,' *Journal of Intelligent Material Systems and Structures*, Vol. 5, November 1994
- 86 Spencer, B. F., Carlson, J. D., Sain, M. K., and Yang, G., 'On the Current Status of Magnetorheological Dampers: Seismic Protection of Full-Scale Structures,' *Proceedings of 1997 American Control Conference*, Albuquerque, New Mexico
- 87 Wereley, N. M., and Pang, L., 'Nondimensional Analysis of Semi-Active Electrorheological Dampers Using Approximate Parallel Plate Models,' 11th VPI&SU Symposium on Structural Dynamics and Control, 12-14 May 1997
- 88 Wasserman, D.E., 'Human Exposure to Whole-Body Vibration and Medical Therapy,' *Sound and Vibration*, Acoustical Publications, Inc., July 1997
- 89 Song, X., Ahmadian, A., Southward, S., and Miller, L. R., 'Non-parametric Model of Magneto-Rheological Dampers', ,” *Smart Materials and Structures*, submitted
- 90 Fuller, C. R., and Elliott, S. J., and Nelson, P. A., 'Active Control of Vibration,' Academic Press Inc., 1996
- 91 Khalil, H., 'Nonlinear Systems,' Prentice Hall, 1996
- 92 Isermann, R., 'Parameter Adaptive Control Algorithms – A Tutorial,' *Automatica*, Vol. 18, pp.513-528, September 1982

- 93 Crosby, M. J. and Karnopp, D. C., 'The Active Damper,' The Shock and Vibration Bulletin 43, Naval Research Laboratory, Washington, D. C., 1973
- 94 Krasnicki, E. J., 'Comparison of Analytical and Experimental Results for a Semiactive Vibration Isolators,' Shock and Vibration Bulletin, Vol. 50, September 1980
- 95 Ahmadian, M., and Marjoran, R. H., 'On the Development of a Simulation for Tractor Semitrailer Systems with Semiactive Suspensions,' ASME, DSC-VOL. 13, Advanced Automotive Technologies, Book No. H00546-1989
- 96 Ahmadian, M., 'Ride Evaluation of a Class 8 Truck with Semiactive Suspensions,' DSC-VOL. 52, Advanced Automotive Technologies, ASME 1993
- 97 Ahmadian, M., Song, X., and Reichert, B. A., 'Semiactive Control of Multibody Systems,' Proceedings of the 11th VPI&SU Symposium, Blacksburg, May 12-14, 1997
- 98 Elbeheiry, E.M., Karnopp, D. C., Elaraby, M. E., and Abdelraaouf, A. M., 'Advanced Ground Vehicle Suspension Systems - A Classified Bibliography,' Vehicle System Dynamics, pp. 231-258, 24 (1995)
- 99 Margolis, D. L., and Goshtasbpour, M., 'The Chatter of Semiactive On-Off Suspensions and its Cure,' Vehicle System Dynamics, 13(1984), pp. 129-144
- 100 Reichert, B. A., Ahmadian, M. and Song, X., 'Experimental Analysis of Heavy Vehicle Seat Suspensions with Magneto-Rheological Dampers,' ASME Journal of Vibration and Acoustics, in preparation
- 101 Song, X., Ahmadian, M., Southward, S., and Miller, L. R., 'Design of Adaptive Control For a Class of Nonlinear Vibration Systems,' ASME Journal of Vibration and Acoustics, in preparation
- 102 Thomson, W. T., 'Theory of Vibration with Application,' Prentice Hall, 1993
- 103 Ivers, D. E., 'Semiactive Damper Valve Means with Eletromagnetically Movable Discs in the Piston,' U.S. Patent No. 4,921,272, May 1, 1990
- 104 Boone, K. R., Miller, L. R., Schroeder, W. R., and Nobles, C. M., 'Method of Operating a Vibration Attenuating System Having Semiactive Damper Means,' U.S. Patent No. 4,936,425, Jun. 26, 1990
- 105 Ivers, D. E., and Nobles, C. M., 'Semiactive Damper Valve Means and Methods,' U.S. Patent No. 5,004,079, Apr. 2, 1991
- 106 Majeed, K. N., 'Full Vehicle Suspension Control,' U.S. Patent No. 5,071,157, Dec. 10, 1991
- 107 Kunz, D., and Kallenbach, R., 'Process for Undercarriage Regulation,' US Patent No. 5,383,124, January 17, 1995
- 108 Amirouche, F. M. L., 'Seat Suspension System Using Human Body Responses,' US Patent No. 5,418,858, May 23, 1995

Vita

Xubin Song was born on October 3, 1966 in Zhejiang Province, China. Throughout most of his childhood, he stayed with his grandmother, a loyal Christian, with the solid financial support from his parents. He was fascinated in automatic machines and flying planes. After finishing high school at his hometown in June of 1982 at Yiwu County, Zhenjiang Province, he began his undergraduate study at Nanjiang University of Aeronautics & Astronautics. Surely his major concentrated on automatic control. As soon as he got his Bachelor degree of Electrical Engineering with excellent academic performance in July of 1986, he was recommended to join the graduate program for his Master degree at Beijing Institute of Control Devices (BICD), China Academy of Launch-Vehicle Technology. According to the degree requirement, he spent one year completing most of his graduate courses at Harbin Institute of Technology. At the end of 1988, he received his Master degree of Electrical Engineering and was immediately employed by BICD as an engineer. In August of 1994, he began his Master degree of Mechanical Engineering at North Carolina A&T State University, Greensboro, NC. He joined Virginia Tech to pursue his Ph.D. of Mechanical Engineering in May of 1996. In February of 1999, he joined the Product Engineering Department of MSX International in Auburn Hills, Michigan. Xubin completed his degree requirements in December of 1999, and received his Ph.D. from Virginia Tech in the same month.