Curriculum Vitae

Personal Details

Arend L. Schwab (Arend Leendert SCHWAB)
Male, April 6, 1955, Naarden, The Netherlands
Married, three children

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Expertise & Research

Dynamics of mechanical systems. Multibody dynamics; in particular flexible bodies and rolling contact. Classical Mechanics; in particular Nonlinear Dynamics and Structural Mechanics. Finite Element Methods. Vehicle Dynamics; in particular Bicycle Dynamics. Biomechanics; in particular Mechanics of locomotion. Dynamics of walking robots.

Education & Employment

1983–present	Assistant Professor, Delft University of Technology, of Mechanical, Maritime and Materials Engineering (3mE), Laboratory for Engineering Mechanics.
2002–2003	Visiting Professor (sabbatical leave) at Cornell University, Ithaca NY, USA, Department of Theoretical en Applied Mechanics. Host: Prof. Andy Ruina Ph.D.
2002 (April)	Ph.D. at Delft University of Technology, *Dynamics of Flexible Multibody Systems; Small Vibrations Superimposed on a General Rigid Body Motion.* Advisor: Prof. dr. ir. P. Meijers.
1986–1991	Assistant Professor, Delft University of Technology, Department of Mechanical Engineering, Section of Computer Aided Design.
1983 (Nov.)	M.Sc. (cum laude) at Delft University of Technology, *Dynamics of Mechanisms with Compliant Links.* Advisor: Prof. dr. ir. J.F.Besseling.
1981–1983	Teaching Assistant, Delft University of Technology, Department of Mechanical Engineering, Laboratory for Engineering Mechanics.
1979–1981	Military service, enlisted, reserve officer rank 1th lieutenant.
1979 (July)	B.Sc. (cum laude) in Mechanical Engineering at Polytechnical School Dordrecht, *A FORTRAN program for FEM analysis of 3D beam and truss structures.*

Professional Activities

2007	Co-organizer of the Symposium *Advances in Contact Mechanics: A Tribute to J. J. Kalker*, Delft University of Technology, Oct 6–8, 2008, Delft, The Netherlands.
2007	Co-organizer of the *Symposium on Railroad Vehicle Systems Dynamics* at the DETC ASME 2007 conference, Sep 4–7, 2007, Las Vegas, Nevada, USA.
2007	Member of the panel for evaluation of grant applications in mechanical engineering for the *Research Council for Natural Sciences and Engineering of the Academy of Finland*, May 30, Helsinki, Finland.
2006–present	National representative for the *International Federation for the promotion of Mechanism and Machine Science (IFToMM)* (with Dr. Just Herder)
2006	Member of the Ph.D. Dissertation committee of Daniel Garcia Vallejo, July 17, 2006, *Dynamics of rigid-flexible multibody systems using absolute coordinates.* Advisor: Prof. Jaime Dominguez Ph.D., Dept of Mechanical Engineering, University of Seville, Spain.
2006	Member of the Ph.D. Dissertation committee of Kari E. Dufva, March 10, 2006, *Development of Finite Elements for Large Deformation Analysis of Multibody Systems.* Advisor: Prof. Aki Mikkola Ph.D., Dept of Mechanical Engineering, Lappeenranta University of Technology, Finland.
2005	Co-organizer of the *Symposium on Railroad Vehicle Systems Dynamics* at the DETC ASME 2005 conference, Sep 10–13, 2006, Philadelphia PA, USA.
2004	Co-organizer of the 2004 *Asian Conference on Multibody Dynamics*, Aug 1–4, 2004, Seoul, Korea.
2004	Member of the Ph.D. Dissertation committee of Martijn Wisse, Sep 20, 2004, *Essentials of dynamic walking; Analysis and design of two-legged robots.* Advisor: Prof. Frans C. T. van der Helm Ph.D., Dept of Mechanical Engineering, Delft University of Technology, The Netherlands.
2003–present	Organizing the Mechanics Colloquium at the Department of Mechanical Engineering, Delft University of Technology.
2002–present	Reviewing scientific Journal manuscripts and Conference contributions, on average 24 per year.
2002	Lectures on Multibody Dynamics, March 8–27, Course on European Master in Modelisation of Continuum, The university of Ho-Chi-Min, Vietnam.
1998–present	Member ASME, American Society of Mechanical Engineers.
1995–1996	Member of the advisory teaching program committee of the faculty of Mechanical Engineering.
1991–1998	Member [Chairman (1994-1995)] of the ITM group for development of computer assisted testing (weekly tests and periodic exams) for the undergraduate courses in Statics, Dynamics and Mechanics of Materials at the Department of Mechanical Engineering, Deft University of Technology .
1986–present	Member of the CADOM (Computer Aided Design of Mechanisms) group at Delft University of Technology

1983–2000	Member of the DELT (Delft Eindehoven Leuven Twente) colloquium for Mechanisms and Machine Theory.
1983–present	Advisor for 16 M.Sc. students and 3 Ph.D. students.

Community Service

Active member within Amnesty International. Singer in a chamber choir and an oratorium choir. Chairman of the board of governors of an oratorium choir, organizing concerts and tours.

Courses Taught

Graduate Level:

2004–present	MATLAB in Engineering Mechanics, wb1443.
2002–2003	Applied Multibody Dynamics, TAM674 (Cornell).
1999–2000	Advanced Dynamics, wb1205.
1997–present	Multibody Dynamics, advanced, wb1413.
1988–1990	Wind Energy Conversion, CTme5147.

Undergraduate Level:

1996–present	Multibody Dynamics, introduction wb1310, wb1307.
1994–1996	Structural Mechanics, wb1102.
1993–1994	Statics, wb1101.
1991–1996	Dynamics, wb1103.
1986–1991	Computer Aided Design, wb3110.

Invited Talks

2007	"Benchmark Problems in Flexible Multibody Dynamics," *2007 Workshop on Multibody Dynamics*, Sep 3, University of Illinois at Chicago (UIC), Chicago, USA.
2007	Keynote address, "Dynamics and Stability of Man-Powered Systems," *2007 Arctic Summer Conference on Dynamics, Vibration and Control*, Aug 6–10, Ivalo, Finland.
2006	"Bicycle Dynamics," March 9, Department of Mechanical Engineering, Lappeenranta University of Technology, Finland.
2005	Keynote address, "Recent Developments in Passive Dynamic Walking Robots," and "Bicycle Dynamics," *Third Arctic-Mediterranean Post Graduate Workshop on Intelligent Machines and Transport Systems*, Nov 13–20, 2005, University of Seville, Seville, Spain.
2005	"Bicycle Dynamics," Oct 5, Department of Theoretical and Applied Mechanics (TAM), Cornell University, Ithaca, NY, USA.
2005	"Benchmark Results on the Stability of an Uncontrolled Bicycle," May 16, Department of Applied Mathematics and Theoretical Physics (DAMTP), University of Cambridge, UK.

2005 "Recent Developments in Passive Dynamic Walking Robots," May 13, School of MMME, The University of Nottingham, UK.

2004 "SPACAR: A Finite Element Approach in Flexible Multibody Dynamics," Sep 27, University of Illinois at Chicago (UIC), Chicago, USA.

2003 "Modelling of Rolling Contact in a Multibody Environment," *Workshop on Multibody System Dynamics*, May 12, University of Illinois at Chicago (UIC), Chicago, USA.

2003 "Stability of an Uncontrolled Bicycle," Oct 24, School of MMME, The University of Nottingham, UK.

2001 "Basin of attraction of the simplest walker," Sep 14, Department of Theoretical and Applied Mechanics (TAM), Cornell University, Ithaca, NY, USA.

1999 "The wheel as a special finite element for modelling rolling contact in a multibody dynamics environment", April 21, Université catholique de Louvain, Louvain-la-Neuve, Belgium.

Publications

Theses

Schwab, A. L. (2002). *Dynamics of Flexible Multibody Systems*. Ph.D. thesis, Delft University of Technology, x+155 pp.

Schwab, A. L. (1983). *Dynamica van mechanismen met vervormbare schakels*(Dynamics of Mechanisms with Compliant Links). M.Sc. thesis, Delft University of Technology.

Journal articles

Meijaard, J. P., Papadopoulos, Jim M., Ruina, Andy, and Schwab, A. L. (2007) "Linearized dynamics equations for the balance and steer of a bicycle: a benchmark and review," *Proceedings of the Royal Society A* 463:1955–1982.

Kooijman, J. D. G., Schwab, A. L., and Meijaard, J. P. (2007) "Experimental validation of a model of an uncontrolled bicycle," *Multibody System Dynamics*, Online First version.

Wisse, M., Hobbelen, D. G. E., and Schwab, A. L., (2007) "Adding an upper body to passive dynamic walking robots by means of a bisecting hip mechanism". *IEEE Transactions on Robotics* 23(1):112–123.

Wisse, M., and Schwab, A. L., (2005) "Skateboards, bicycles, and three-dimensional biped walking machines: Velocity-dependent stability by means of lean-to-yaw coupling", *Int. J. Robotics Research*, **24**(6), pp. 417–429.

Wisse, M., Schwab, A. L., Van der Linde, R. Q., and Van der Helm, F. C. T., (2005) "How to Keep From Falling Forward: Elementary Swing Leg Action for Passive Dynamic Walkers", *IEEE Transactions on Robotics*, **21**(3), pp. 393–401.

Schwab, A. L., and Meijaard, J. P., and J. M. Papadopoulos , (2005) "Benchmark Results on the Linearized Equations of Motion of an Uncontrolled Bicycle", *KSME International Journal of Mechanical Science and Technology*, **19**(1), pp. 292–304.

Wisse, M., Schwab, A. L., and Van der Helm, F. C. T., (2004) "Passive dynamic walking model with upper body", *Robotica* **22**, pp. 681–688.

Schwab, A. L., and Meijaard, J. P. , "Dynamics of Flexible Multibody Systems with Non-Holonomic Constraints: A Finite Element Approach". *Multibody System Dynamics* **10**, 2003, pp.107- 123.

Schwab, A. L., Meijaard, J. P., and Meijers. P., (2002) "A comparison of revolute joint clearance models in the dynamic analysis of rigid and elastic mechanical systems," *Mechanism and Machine Theory* **37**, 895– 913.

Schwab, A. L., and Meijaard, J. P., (2002) "Small vibrations superimposed on a prescribed rigid body motion," *Multibody System Dynamics* **8**, pp. 29–49.

Wisse, M., Schwab, A.L., and Van der Linde, R. Q., (2001) "A 3D passive dynamic biped with yaw and roll compensation," *Robotica* **19**, pp. 275–284.

Schwab, A. L., and Meijaard, J. P., (1999) "Dynamics of flexible multibody systems having rolling contact: Application of the wheel element to the dynamics of road vehicles," *Vehicle System Dynamics Supplement* **33**, pp. 338–349.

Segla, S., Kalker–Kalkman, C. M., and Schwab, A. L., (1998) "Statical balancing of a robot mechanism with the aid of a genetic algoritm," *Mechanism and Machine Theory* **33**, pp. 163–174.

Schwab, A. L., and Werff, K. van der, (1993) "The use of computers in the design of discrete component systems," *Computer Methods in Applied Mechanics and Engineering* **103**, pp. 231–246.

Soest, A. J. van, Schwab, A. L., Bobbert, M. F., and Ingen Schenau, G. J. van, (1993) "The influence of the biarticularity of the gastrocnemius muscle on vertical-jumping achievement," *Journal of Biomechanics* **26**, pp. 1–8.

Soest, A. J. van, Schwab, A. L., Bobbert, M. F., and Ingen Schenau, G. J. van, (1992) "SPACAR: a software subroutine package for simulation of the behaviour of biomechanical systems," *Journal of Biomechanics* **25**, pp. 1219–1226.

Conference publications

Schwab, A. L., Gerstmayr, J., and Meijaard, J. P. (2007) "Comparison of three-dimensional flexible thin plate elements for multibody dynamic analysis: finite element formulation and absolute nodal coordinate formulation," In *Proceedings of the ASME 2007 International Design Engineering Technical Conferences & Computers and Information in Engineering Conference, IDETC/CIE 2007*, September 4-7, 2007, Las Vegas, Nevada, USA, CD-ROM, ASME, New York, 12pp.

Schwab, A. L., Kalker-Kalkman, C. M. (2007) "Joost J. Kalker (1933–2006): A life in rolling contact," In *Proceedings of the ASME 2007 International Design Engineering Technical Conferences & Computers and Information in Engineering Conference, IDETC/CIE 2007*, September 4-7, 2007, Las Vegas, Nevada, USA, CD-ROM, ASME, New York, 3pp.

Schwab, A. L., Meijaard, J. P., Kooijman, J. D. G. (2007) "Some recent developments in bicycle dynamics," In *Proceedings of the 12th World Congress in Mechanism and Machine Science, IFToMM 2007*, June 17–21, 2007, Besancon, France, CD-ROM, 6 pp.

Schwab, A. L., Meijaard, J. P. and Kooijman, J. D. G. (2006) "Experimental validation of a model of an uncontrolled bicycle," In *Proceedings of III European Conference on Computational Mechanics, Solids, Structures and Coupled Problems in Engineering*, June 5–9, 2006, Lisbon, Portugal, CD-ROM, 16pp.

Meijaard, J. P. and Schwab, A. L. (2006) "Linearized equations for an extended bicycle model," In *Proceedings of III European Conference on Computational Mechanics, Solids, Structures and Coupled Problems in Engineering*, June 5–9, 2006, Lisbon, Portugal, CD-ROM, 18pp.

Schwab, A. L., and Meijaard, J. P. (2006) "How to draw Euler angles and utilize Euler parameters," In *Proceedings of IDETC/CIE 2006, ASME 2006 International Design Engineering Technical Conferences & Computers and Information in Engineering Conference*, September 10–13, 2006, Philadelphia, PA, CD-ROM, ASME, New York, 7pp.

Schwab, A. L., and Meijaard, J. P. (2005) "Comparison of three-dimensional flexible beam elements for dynamic analysis: finite element method and absolute nodal coordinate formulation," In *Proceedings of IDETC/CIE 2005, ASME 2005 International Design Engineering Technical Conferences & Computers and Information in Engineering Conference*, September 24-28, 2005, Long Beach, CA, USA, CD-ROM, ASME, New York, 9pp.

Schwab, A. L., and Meijaard, J. P., and J. M. Papadopoulos (2005) "A Multibody Dynamics Benchmark on the Equations of Motion of an Uncontrolled Bicycle". In *Proceedings of the Fifth EUROMECH Nonlinear Dynamics Conference, ENOC-2005*, August 7-12, 2005, Eindhoven University of Technology, The Netherlands, pp. 511–521.

Herder, J. L., and Schwab, A. L. ,"On Dynamically Equivalent Force Systems and their Application to the Balancing of a Broom or the Stability of a Shoe Box," (2004) In *Proceedings of DETC'04 ASME 2004 Design Engineering Technical Conferences and Computers and Information in Engineering Conference*, September 28-October 2, 2004, Salt Lake City, Utah, USA, CD-ROM, ASME, New York, 11pp.

Schwab, A. L., and Meijaard, J. P., and Papadopoulos, J. M. (2004) "Benchmark Results on the Linearized Equations of Motion of an Uncontrolled Bicycle". In *Proceedings of the Second Asian Conference on Multibody Dynamics, ACMD'04*, August 1–4, 2004, Seoul, Korea, The Korean Society of Mechanical Engineering, 9 pp.

Schwab, A. L., and Meijaard, J. P. (2002) "Two Special Finite Elements for Modelling Rolling Contact in a Multibody Environment". In Nobuyuki Shimizu et al. editor, *Proceedings of the First Asian Conference on Multibody Dynamics, ACMD'02*, July 31 – August 2, 2002, Iwaki, Fukushima, Japan, The Japan Society of Mechanical Engineering, pp. 386- 391.

Schwab, A. L., and Wisse, M. (2001) "Basin of attraction of the simplest walking model," *Proceedings of ASME Design Engineering Technical Conferences,* September 9–12, 2001, Pittsburgh, PA, CD-ROM, ASME, New York, 9pp.

Meijaard, J. P., and Schwab, A. L. (2001) "A component mode synthesis look at planar beam elements," *Proceedings of ASME Design Engineering Technical Conferences,* September 9–12, 2001, Pittsburgh, PA, CD-ROM, ASME, New York, 10pp.

Meijaard, J. P., Ockels, W. J., and Schwab, A. L. (1999) "Modelling of the dynamic behaviour of a laddermill, a novel concept to exploit wind energy," *Proceedings Third International Symposium on Cable Dynamics,* Trondheim (Norway), 16–18 August 1999, A.I.M., Liege, pp.229–234.

Schwab, A. L., and Meijaard, J. P. (1999) "The belt, gear, bearing and hinge as special finite elements for kinematic and dynamic analysis of mechanisms and machines," in Leinonen, T. (ed.), *Proceedings of the Tenth World Congress on the Theory of Machines and Mechanisms*, IFToMM, June 20–24, 1999, Oulu, Finland, Oulu University Press, Vol 4, pp. 1674–1679.

Meijaard, J. P., and Schwab, A. L. (1999) "A systematic approach to the analysis of rotor dynamic systems," in Leinonen, T. (ed.), *Proceedings of the Tenth World Congress on the Theory of Machines and Mechanisms*, IFToMM, June 20–24, 1999, Oulu, Finland, Oulu University Press, Vol 4, pp. 1375–1386.

Schwab, A. L., Meijaard, J. P., and Meijers P. (1998) "Dynamics of flexible multibody sytems with joint clearance," In Ghosh, A., Sinha, P. K., Dasgupta, G., and Kundu, S. (eds), *Proceedings of the International Conference on Theoretical, Applied, Computational and Experimental Mechanics,* December 1–5 1998, Aerospace Engineering Department, Indian Institute of Technology, Kharagpur, India, 12 pp.

Schwab, A. L., and Meijaard, J. P. (1997) "Small vibrations superimposed on non-linear rigid body motion," In *Proceedings of ASME Design Engineering Technical Conferences,* September 14–17, 1997, Sacramento, CA, CD-ROM, ASME, New York, 1997, 7pp.

Schwab, A. L., and Meijaard, J. P. (1996) "Multibody systems and small vibrations," In Geril, P., Javor, A., Lehmann, A., and Molnar, I. (eds), *Modelling and Simulation 1996*, ESM'96. Society for Computer Simulation, Gent, pp. 958–962.

Personal References

The people named below may be able to make some comment about me. None of them have been asked to serve as reference. They are just people to check with if you are trying to figure out what I am about without asking me.

Andy Ruina, Theoretical & Applied Mechanics, Cornell University, Ithaca, NY, USA.
Ahmed A. Shabana, Mechanical Engineering, University of Illinois at Chicage, USA.
Ben Jonker, Mechanical Engineering, University of Twente, The Netherlands.
Hans B. Pacejka, Mechanical Engineering, Delft University of Technology, The Netherlands.
Jaap P. Meijaard, School of MMME, University of Nottingham, UK.

Rotterdam, October 5, 2007