Mats Jonasson

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Personal profile

An enthusiastic, analytical and innovative senior researcher who possess a world unique knowledge in vehicle
dynamics, control and mechatronics. I have deep knowledge in actuators, such as brake and steering systems, and how they can be controlled.

I have well established relations with automotive industry and have experience in how to fruitfully cooperate. My uniqueness is my ability to work widely from the generation of ideas resulting in a product. Works well and prefer to act within a team environment.

Objective

I will bring strategic value and develop current skillset further. Moreover, I will use my experience to coach and inspire the organisation with competence and network. I will contribute to developing value in vehicle dynamics control competence at Chalmers.

Employment history

2018 – now **Chalmers, Vehicle Dynamics**
Senior Researcher in Vehicle dynamics
- Academic supervisor for the PhD project VehFuncArch
- Researcher in CityBusPlatoonAD project
- Teacher in Vehicle Dynamics course

2016 – 2018 **Volvo Cars, Active Safety**
Technical Expert in Vehicle dynamics and motion control
- Developed theory on how to use torque vectoring control to improve vehicle energy efficiency.
- Developed a torque allocator with QP solver than is planned to be used by power train and chassis functions to balance car motion and energy goals.
- Initiated and lead of a project about using machine learning to estimate road friction. The project is a pioneer project on how to use statistical math for motion state estimation.
- Key person of developing the vehicle motion state estimation organisation for self-driving cars.
- Developed theory and methods of dead reckoning position estimation by using Kalman filters.
- Key person in system design for future function architecture.
- Key contributor of the development of active tyre force excitation technology to estimate tyre parameters.

2013 – now **KTH Vehicle Dynamics (20%)**
Affiliated Faculty within innovative vehicle concepts
- Development of teaching and laboratory material to Applied Vehicle Dynamics Control (SD2231) for estimation of vehicle motion states.
- Assisting the PhD students Peikun Sun and Mohammad Mehdi Davari.
- Supervision of master thesis work.
- Teaching in Vehicle Engineering (SD1001) including lab exercise and lectures.
- Development of teaching material and teaching in Vehicle System Technology (SD2221).
- Teaching in Applied Vehicle Dynamics Control (SD2231).
- Leading candidate work in Fordonsteknik (SA105X).

2011 – 2014 **KTH Vehicle Dynamics (20%)**
Guest Researcher
- PhD supervisor for Johannes Edrén och Daniel Wanner.
- Teaching and development in course material in Fordonsdynamik (SD2225).
- Teaching in Vehicle Engineering (SD1001) including lab exercise and lectures.
- Leading candidate work in Fordonsteknik (SA105X).
- Initiating a PhD project ”Improving driving enjoyment in vehicles”.

- Completing Forskarhandledning (LH207V) samt Lärande och Undervisning (LH201V).

2009 – 2016 **Volvo Cars, Active Safety & Chassis**
Development senior engineer
- Developed *Advanced Stability Control* for Volvo V40, V60 hybrid and XC60 in industrialization phase, which now is in series production.
- Took over and created a Volvo Cars branch of *Roll over Stability Control* program from Ford US.
- Developed an own *Active Yaw Controller*, as a replacement of the existing one from the brake supplier.
- Developed *Tyre Force Estimator* in the new XC90.
- Verification of *Roll Stability Control* functions by physical car tests.
- Supervising PhD students in *Post Impact Control, Fault-Tolerant Control, Over-Actuated Vehicles* and *Friction Estimation* in research projects.
- Acting as a guest researcher/affiliated faculty at KTH Vehicle Dynamics since 2011 (Appendix 7).
- Introduced the simulation tool *Carmaker* for analysis of vehicle dynamic behaviour.
- Leading and participate advanced engineering projects such as *TorqSense* and *VDDM2017*.
- Founder of a new function mentioned as *Emergency Evasive Assist*.
- Internal teacher at Volvo Cars and give lectures in the Chassis school.
- Belonging to the decision & control group in the *Drive me* project. Developing fault-tolerant control technology.
- Participating and leading expeditions to north part of Sweden.
- Arrange demo test drives at test tracks for management and internal customers.
- Initiate new projects. One example is *ProbeFriction*, which is an advanced engineering project 2016.
- Designing experiments at test track and driving simulator for understanding human factor experience for *Evasive Manoeuvre Assist*.
- Coordinate activities with vehicle dynamics department at KTH and Chalmers, for example arranging meetings and master thesis work.
- Perform strategic work together with suppliers, e.g. defining new interfaces and control architecture.
- Regularly scanning technology developments globally, writing and reviewing articles. I'm a member in Editorial board of International Journal of Vehicle Systems Modelling and Testing.

2004 – 2009 **Volvo Cars, Active Safety & Chassis**
Industrial PhD student
- Fostered to be an independently working researcher.
- My research suggested how future chassis technologies can be used to increase active safety.
- Teaching and participating in courses, developed my communication skills.

1998 – 2004 **Volvo Cars, Electric & Electronics**
Development engineer
- Component responsible for all antennas on Volvo cars.
- Performing Electromagnetic computer simulation and testing.
- Designing antenna systems. Invented and patented the antenna system at XC90 (in production 2002).

1997 – 1998 **Semcon**
Development engineer
- Development of Volvo Cars flight recorder at Powertrain department at Volvo Cars.

Education

2015 **Docent/Associate Professor in Vehicle Dynamics (See Appendix 1)**
KTH, Stockholm, Sweden

2009 **PhD in Vehicle Dynamics (See Appendix 1, 2)**
KTH, Stockholm, Sweden

2007 **Licentiate in Vehicle Dynamics (See Appendix 1, 2)**
KTH, Stockholm, Sweden

1997 **Master of Science (Civilingenjör) in Electrical Engineering (See Appendix 1)**
Chalmers, Gothenburg, Sweden

Other courses relevant for the position

2013 **Lärande och undervisning 7.5p (LH201V)**
KTH, Stockholm, Sweden

2011 **Forskarhandledning 3p (LH207V)**
KTH, Stockholm, Sweden

Languages

Swedish mother tongue
English fluent
German beginner

Driving license

B
T3 T3 is a driving license for test drivers on handling tracks. T3 is the highest grade.

Publications

Papers published in international reputed periodicals which have been subject to referee´s assessment

1. M. Jonasson, S. Zetterström and A. S. Trigell, 'Autonomous corner modules as an enabler for new vehicle chassis solutions', FISITA Transactions 2006, paper F2006V054T, 2006.

2. M. Jonasson and O. Wallmark, 'Stability of an electric vehicle with permanent-magnet in-wheel motors during electrical faults', The World Electric Vehicle Association Journal, Vol. 1, pp. 100–107, 2007.

3. M. Jonasson and O. Wallmark, 'Control of electric vehicles with autonomous corner modules: implementation aspects and fault handling', International Journal of Vehicle Systems Modelling and Testing, Vol. 3, No. 3, pp. 213–228, 2008.

4. M. Jonasson and J. Andreasson, 'Exploiting autonomous corner modules to resolve force constraints in the tyre contact patch', International Journal of Vehicle System Dynamics, Vol. 46, No. 7, pp. 553–573, 2008.

5. M. Jonasson and F. Roos, 'Design and evaluation of an active electromechanical wheel suspension system', Journal of Mechatronics, Vol. 18, Issue 4, pp. 218–230, 2008.

6. J. Backmark, E. Karlsson, J. Fredriksson and M. Jonasson, 'Using future path information for improving stability of an overactuated vehicle', International Journal of Vehicle Systems Modelling and Testing, Vol. 4, No. 3, pp. 218–231, 2009.

7. M. Jonasson, J. Andreasson, A. S. Trigell and B. Jacobson, 'Utilisation of actuators to improve vehicle stability at the limit: from hydraulic brakes towards electric propulsion', Journal of Dynamic Systems, Measurement and Control, Vol. 133, Issue 5, 27 July 2011.

8. M. Jonasson, J. Andreasson, B. Jacobson and A. S. Trigell, 'Global force potential of over-actuated electric vehicles', International Journal of Vehicle System Dynamics, Vol. 48, No. 9, pp. 983–998, 2010.

9. D. Yang, T. J. Gordon, B. Jacobson, M. Jonasson and M Lidberg, 'Optimized brake-based control of path lateral deviation for mitigation of secondary collisions', Proceedings of the Institution of Mechanical Engineers, Part D, Journal of Automobile Engineering, Vol. 225, Issue 12, December 2011.

10. D. Yang, T.J. Gordon, B. Jacobson and M. Jonasson, 'Quasi-linear optimal path controller applied to post-impact vehicle dynamics', IEEE Transactions on Intelligent Transportation Systems, Vol. 13, Issue 2, pp. 1586-1598, 2012.

11. J. Edrén, P. Sundström, M. Jonasson, B. Jacobson, J. Andreasson and A. S. Trigell. 'Road friction effect on the optimal vehicle control strategy in two critical manoeuvres', International Journal of Vehicle Safety, Vol. 7, No. 2, 2014.

12. D. Yang, T. J. Gordon, B. Jacobson and M. Jonasson, 'A nonlinear post-impact path controller based on optimized brake sequences', International Journal of Vehicle System Dynamics: International Journal of Vehicle Mechanics and Mobility, Vol. 50, Sup. 1, pp. 131-149, 2012.

13. D. Yang, T. Gordon, B. Jacobson and M. Jonasson, 'Closed-loop controller for post-impact vehicle dynamics using individual wheel braking and front axle steering', International Journal of Vehicle Autonomous Systems, Vol. 12, No.2, pp. 158 – 179, 2014.

14. D. Yang, B. Jacobson, M. Jonasson and T.J. Gordon, 'Minimizing vehicle post-impact path lateral deviation using optimized braking and steering sequence', International Journal of Automotive Technology, Vol. 15 (1), pp. 7-17. 2014.

15. D. Yang, T. Gordon, B. Jacobson and M. Jonasson. 'An optimal path controller minimizing longitudinal and lateral deviations after light collisions', Transactions on Intelligent Transportation Systems, Vol.13, No. 4, 2012.

16. J. Edrén, M. Jonasson, J. Jerrelind, A. S. Trigell and L. Drugge, 'Utilization of optimization solutions to control active suspension for decreased braking distance', International Journal of Vehicle System Dynamics: International Journal of Vehicle Mechanics and Mobility, 2014.

17. D. Wanner, L. Drugge, A. S. Trigell, O. Wallmark and M. Jonasson, 'Control allocation strategies for an electric vehicle with a wheel hub motor failure', International Journal of Vehicle Systems Modelling and Testing, Vol. 10, No. 3, 2015.

18. A. Albinsson, F. Bruzelius, P. Petterson, M. Jonasson and B. Jacobson 'Inertial parameter estimation for vehicles with electric propulsion', accepted for publication in the Proc. IMechE, Part D: Journal of Automobile Engineering, 2015.

19. M. M. Davari, M. Jonasson, J. Jerrelind, A. Stensson Trigell, "An energy oriented control allocation strategy for over-actuated road vehicles", submitted for publication, 2017.

20. R. Estepa, A. Estepa, J. Wideberg, M. Jonasson, A. S. Trigell, 'More Effective Use of Urban Space by Autonomous Double Parking', Journal of Advanced Transportation, Vol. 2017, Article ID 8426946, 2017.

21. M. Jonasson and M. Thor, 'Steering Redundancy for Self-Driving Vehicles using Differential Braking', International Journal of Vehicle System Dynamics, Published online: 14 Aug 2017.

22. P. Sun, A. S. Trigell, L. Drugge, J. Jerrelind, M. Jonasson, 'Exploring the potential of camber control to improve vehicles efficiency during cornering', accepted for publication to Energies, Topical Collection Electric and Hybrid Vehicles Collection, 2018.

23. J. Edrén, M. Jonasson, J. Jerrelind, A. S. Trigell and L. Drugge, 'Energy efficient cornering using over-actuation', accepted for publication, International Journal of Vehicle System Dynamics, 2018.

Conference proceedings, full articles with peer-reviewed abstracts

24. O. Wallmark and M. Jonasson, 'Vehicles with autonomous corner modules - control and fault handling aspects', Proceedings of the Program Review Meeting - MIT Industry Consortium on Advanced Automotive Electrical/Electronic Components and Systems, Seattle, U.S.A., 2007.

25. J. Andreasson and M. Jonasson, 'Vehicle model for limit handling - implementation and validation', Proceedings of the 6th Modelica Conference, Bielefeld, Germany, 2008.

26. M. Jonasson, J. Andreasson, B. Jacobson and A. S. Trigell, 'Modelling and parameterisation of a vehicle for validity under limit handling', Proceedings of the 9th International Symposium on Advanced Vehicle Control, Vol. 1,pp. 202–207, Kobe, Japan, 2008.

27. J. Andreasson, M. Jonasson and H. Tummescheit, 'Modelica-simulation aktiver sicherheitsscenarios mit validierten fahrzeugmodellen in dymola', Proceedings of the ASIM-Workshop 2009, Dresden, Germany, 2009.

28. J. Edrén, M. Jonasson, A. Nilsson, A. Rehnberg, F. Svahn, J. Andreasson and A. S. Trigell, 'Modelica and Dymola for vehicle dynamics applications at KTH', 7th Modelica Conference 2009, Como, Italy, 2009.

29. J. Edrén, M. Jonasson, A. S. Trigell, J. Jerrelind and L. Drugge, 'The development of a down-scaled over-actuated vehicle equipped with autonomous corner module functionality', FISITA World Automotive Congress, Hungary, Budapest, 2010.

30. D. Yang, T. J. Gordon, M. Lidberg, M. Jonasson and B. Jacobson, 'Post-impact vehicle path control by optimization of individual wheel braking sequences'. Proceedings of 10th International Symposium on Advanced Vehicle Control, Loughborough, United Kingdom, 2010.

31. P. Sundström, M. Jonasson, J. Andreasson, A. S. Trigell and B. Jacobson. 'Path and control optimisation for over-actuated vehicles in two safety-critical maneuvers', Proceedings of 10th International Symposium on Advanced Vehicle Control, Loughborough, United Kingdom, 2010.

32. M. Jonasson, J. Andreasson and A.S Trigell, 'Evaluation of instantaneous force allocation compared to trajectory optimization', 11th International Symposium on Advanced Vehicle Control, Seoul, South Korea, 2012.

33. D. Wanner, J. Edrén, M. Jonasson, O. Wallmark, L. Drugge and A. S. Trigell 'Fault-tolerant control of electric vehicles with in-wheel motors through tyre-force allocation', 11th International Symposium on Advanced Vehicle Control, Seoul, South Korea, 2012.

34. J. Edrén, M. Jonasson, J. Jerrelind and A. S. Trigell, 'Utilization of vertical loads by optimization for integrated vehicle control', 11th International Symposium on Advanced Vehicle Control, Seoul, South Korea, 2012.

35. A. Albinsson, F. Bruzelius, M. Jonasson and B. Jacobson, 'Tire force estimation based on the recursive least square method utilizing wheel torque as a sensor and validation in simulations and experiments', 12th International Symposium on Advanced Vehicle Control, Tokyo, Japan, 2014.

36. A. Gurov, A. Sengupta, M. Jonasson and L. Drugge, ‘Collision avoidance driver assistance system using combined active braking and steering’, 12th International Symposium on Advanced Vehicle Control, Tokyo, Japan, 2014.

37. D. Yang, T.J. Gordon, M. Jonasson and B. Jacobson, ‘Application of an optimal path controller on curved roads after collisions’, 12th International Symposium on Advanced Vehicle Control, Tokyo, Japan, 2014.

38. D. Yang, X. Xie, F. Bruzelius, B. Augusto, B. Jacobson and M. Jonasson, ‘Evaluation of post impact control function with steering and braking superposition in high-fidelity driving simulator’, to be presented at the International Symposium on Future Active Safety Technology toward zero-traffic-accident (FAST-zero), Gothenburg, Sweden, 2015.

39. M. Mattsson, R. Mehler, M. Jonasson and A. Thomasson, ‘Optimal model predictive acceleration controller for a combustion engine and friction brake actuated vehicle’, 8th IFAC International Symposium on Advances in Automotive Control, Norrköping, Sweden, 2016.

40. M. M. Davari, M. Jonasson, J. Jerrelind, A. S. Trigell and L. Drugge, ‘Rolling loss analysis of combined camber and slip angle control’, 13th International Symposium on Advanced Vehicle Control, Munich, Germany, 2016.

41. D. Yang, M. Jonasson, T. Halleröd and R. Johansson, ‘Evaluation of an evasive manoeuvre assistance system at imminent side collisions’, 13th International Symposium on Advanced Vehicle Control (AVEC 2016), Munich, Germany, 2016.

42. P. Sun, A. S. Trigell, L. Drugge, J. Jerrelind, M. Jonasson, ‘Analysis of camber control and torque vectoring to improve vehicle energy efficiency’, Dynamics of Vehicles on Roads and Tracks: Proceedings of the 25th International Symposium on Dynamics of Vehicles on Roads and Tracks (IAVSD 2017), Rockhampton, Queensland, Australia, 2017.

43. S. Roychowdhury, M. Zhao, A. Wallin, N. Ohlsson, M. Jonasson, ‘Machine learning models for road surface and friction estimation using front-camera images’, submitted to International Joint Conference on Neural Networks (IJCNN 2018), Rio, Brazil, 2018.

44. D. Yang, M. Jonasson, M. Idegren, ‘Torque Vectoring Control for Progressive Cornering Performance in AWD Electric Vehicles’, submitted to 14th International Symposium on Advanced Vehicle Control (AVEC 2018), Beijing, China, 2018.

45. T. Gordon, Y. Gao, D. Yang, M. Jonasson, B. Jacobson, ‘Robust implementation of automated collision avoidance using an updating particle reference’, submitted to 14th International Symposium on Advanced Vehicle Control (AVEC 2018), Beijing, China, 2018.

Other publications

46. M. Jonasson, ‘Aspects of autonomous corner modules as an enabler for new vehicle chassis solutions’, Licentiate thesis in Vehicle Engineering, TRITA-AVE2006:101, KTH Vehicle Dynamics, Stockholm, Sweden, 2007.

47. M. Jonasson, ‘Exploiting individual wheel actuators to enhance vehicle dynamics and safety in electric vehicles’, Doctoral thesis in Vehicle Engineering, TRITA-AVE 2009:33, KTH Vehicle Dynamics, Stockholm, Sweden, 2009.

Own patents and patent applications

1. 'Antenna Unit', No. US6396447, 1999.
2. 'A steering system for a vehicle', No. EP1795433 and EP1795433, 2005.
3. 'A braking system and a method for braking a vehicle', No. EP1935737, 2006.
4. 'Method and arrangement for controlling a suspension of a vehicle wheel', No. EP1935679 and EP1935679, 2006.
5. 'Method and arrangement for assisting a driver of a vehicle to turn the vehicle when driving during glare ice conditions', US8738265 B2, 2014.
6. 'Vehicle tyre to road friction value estimation arrangement', P1868EP00, 2013, pending.
7. 'Threat based feedforward control of a vehicle's understeering', P1919EP00, 2014.
8. 'Differential braking for steering redundancy', P2049EP00, 2015, pending
9. 'Method and apparatus for a critical evasive manoeuvre assist system', P2061EP00, 2015, pending.
10. 'Tyre to road friction estimation arrangement by exiting wheel torques', P2053EP00 and EP15172369, 2015, pending.
11. 'Simultaneous vehicle dynamics state estimation using pitch-rate sensor', P2187EP00, 2016-10-13.
12. 'Method to estimate road friction using wheel torque control and rack force sensing', P2189EP00, 2016-10-13.
13. 'Friction estimation and wheel slip control arrangement by gradient seeking methods', P2250EP00, 2017-02-06.
14. 'Probe friction to stay on roads in curves', P2295EP00, 2017-08-18.
15. 'Driving strategies and detection for treacherous road condition', I4536SE00, 2017-09-01.
16. 'A system that determines the friction between road and tire separately', I4613SE00, 2017-12-09.
17. 'Evasive steering torque assist', I4646SE00, 2018-01-18.
18. 'Friction estimation using front-camera image signal processing', I4663SE00, 2018-02-02.
19. 'System and Apparatus for utilization of Aggregated Weather Data for Road Surface Condition-Related Estimations', I4685SE00, 2018-02-06
20. "Steering Guidance", I4759SE00, 2018-05-09
21. "Road Recovery Assistance", I4881SE00
22. "METHOD AND APPARATUS to detect and assist over-reacting drivers at low friction road under evasive maneuvers", which has received docket number I4790SE00, 2018-06-11
23. Speed limiter to allow for a safe stop, I4838SE00, 2018-07-16
24. Patent application VCC ref: P2381US00 – Catchword: Stand-still road friction estimation by steering actuation
25. Patent application VCC ref: P2460US00 – Catchword: DRIVING SURFACE FRICTION ESTIMATIONS USING VEHICLE STEERING

Active participation in national and international conferences

1. Presentation of paper at Fisita World Automotive Congress, Yokohama, Japan, Oct 22-27, 2006.
2. Presentation of paper at Electric Vehicle Symposium 22, Yokohama, Japan, Oct. 23-28, 2006.
3. Invited as presenter to Research and Development of Hybrid Vehicles in Japan and Sweden, Gothenburg, Sweden, Nov. 29, 2006.
4. Invited presentation at Review Meeting - MIT Industry Consortium on Advanced Automotive Electrical/Electronic Components and Systems, Seattle, U.S.A., 2007.
5. Presentation of paper at the 9th International Symposium on Advanced Vehicle Control, Kobe, Japan, Oct. 6-9, 2008.
6. Invited as a presenter to Energisystem i vägfordon, Skövde, Sweden, Nov. 19-20, 2008.
7. Keynote speech at the 21st International Symposium on Dynamics of Vehicles on Roads and Tracks, Stockholm, Sweden, Aug 17-21, 2009.
8. Principal session chair and presenter of paper at the 10th International Symposium on Advanced Vehicle Control, Loughborough, United Kingdom, Aug. 22-26, 2010.
9. Presenter of three papers at the 11th International Symposium on Advanced Vehicle Control, Seoul, South Korea, Sep. 8-12, 2012.

10. Presenter of "Evasive Manoeuvre Assist" at Vehicle Dynamics in a cooperative environment, Swedish Vehicular Engineering Association, May 27, 2014, Södertälje, Sweden.
11. Presenter of one paper at the 12th International Symposium on Advanced Vehicle Control, Seoul, Tokyo, 2014.
12. Presenter of "PISC- Post Impact Stability Control (Pre-Crash)" at Safer project day 2015, Gothenburg, Sweden, 2015.
13. Presenter of "Steering Redundancy for Self-Driving Vehicles using Differential Braking" at 13th International Symposium on Advanced Vehicle Control, Munich, Germany, 2016.
14. Committed to present, "Automated Road Friction Estimation using Car-sensor Suite: Machine Learning Approach", at Autonomous Vehicle Software Symposium 2018, Stuttgart, Germany, 2018.

Supervision of students

Supervision of bachelor and master thesis

1. Johan Backmark and Erik Karlsson, "Trajectory optimisation for overactuated vehicles", Master Thesis (30 credits) in Electrical Engineering, Chalmers University of Technology, 2008. Mats Jonasson was main supervisor and Jonas Fredriksson, Chalmers, was examiner.
2. Mattias Forslund and Cedric Nyberg, "Energiförbrukning i ACM system", Bachelor thesis (15 credits) in Vehicle Engineering, KTH, 2008. Mats Jonasson was main supervisor and Annika Stensson Trigell, KTH, was examiner.
3. Kristian Ahlberg and Ted Holmberg, "Regenerativ bromsning – en analys av regenerativ bromsning med hjulmotorer", Bachelor thesis (15 credits) in Vehicle Engineering, KTH, 2009. Mats Jonasson was main supervisor and Annika Stensson Trigell, KTH, was examiner.
4. Sofie Jarelius and Samuel Holt, "Hjulmotorer i hybridfordon – fördel vid regenerativ bromsning", Bachelor thesis (15 credits) in Vehicle Engineering, KTH, 2009. Mats Jonasson was main supervisor and Annika Stensson Trigell, KTH, was examiner.
5. Payam Maroufi and Solayman El Masoudi, "En lovande teknik – hybridbil" , Bachelor thesis (15 credits) in Vehicle Engineering, KTH, 2012. Mats Jonasson was main supervisor and Annika Stensson Trigell, KTH, was examiner.
6. Abhinav Sengupta and Alexey Gurov, "Evaluating the effectiveness of collision avoidance functions using state-of-the-art simulation tools for vehicle dynamics", Master Thesis (30 credits) in Vehicle Engineering, KTH, 2013. Mats Jonasson was main supervisor and Lars Drugge, KTH, was examiner.
7. Ida Petersson and Johanna Risö, "Automotive path following using model predictive control", Master Thesis (30 credits) in Signals and Systems, Chalmers, 2014. Mats Jonasson was main supervisor and Bo Egart, Chalmers, was examiner.
8. John Sedin, "Analys av varför bilar styr fram när båtar och flygplan styr bak", Bachelor thesis (15 credits) in Vehicle Engineering, KTH, 2014. Mats Jonasson was main supervisor and Annika Stensson Trigell, KTH, was examiner.
9. You Wang and Lokur Preshant, "Driver skill influence on effectiveness of evasive manoeuvre assist functions", Master Thesis (30 credits) in Vehicle Engineering, KTH, and Signal and Systems, Chalmers, 2015 (ongoing). Mats Jonasson is main supervisor and Lars Drugge, KTH, and Jonas Fredriksson, are examiners.
10. Rasmus Mehler and Mathias Mattson, "Optimal vehicle speed control using a predictive controller for an overactuated vehicle", Master Thesis (30 credits) in Vehicular Systems, LiU, 2015 (ongoing). Mats Jonasson was the main supervisor and Lars Eriksson, LiU was examiner.
11. Rudrendu Shekar, "Stability Analysis for Friction Estimation using Active Tire Excitation", Master Thesis (30 credits) in Vehicle Engineering, KTH, 2016. Mats Jonasson is main supervisor and Lars Drugge, KTH, is examiner.
12. Charlotte Lanfelt and Åsa Rogenfelt, "Dead reckoning during safe stop of autonomous vehicles", Master Thesis in Control Engineering, Chalmers, Signal and Systems, 2017. Mats Jonasson is main supervisor and Jonas Fredriksson, Chalmers, is examiner.
13. Shuangshuang Chen, "Road friction estimation using hidden Markov models", Master Thesis in Signal processing, Chalmers, 2017, ongoing. Mats Jonasson is main supervisor and Thomas McKelvey is examiner.

Supervision of PhD students

1. Mats Jonasson has been a co-supervisor as well as industrial advisor and project leader for Derong Yang at Chalmers, Gothenburg. Her PhD project "Enhanced post-impact stability control" was started 2009 and Derong defended her dissertation in 2013.
2. Mats Jonasson has been a co-supervisor and an industrial advisor to Johannes Edrén at KTH Vehicle Dynamics. His PhD project "Generic vehicle motion modelling and control for enhanced driving dynamics and energy management" started in 2008 and Johannes defended his dissertation in December 2014.
3. Mats Jonasson has been a co-supervisor and an industrial advisor to Daniel Wanner at KTH Vehicle Dynamics. His project "Fault-tolerant over actuated HEVs" started in 2010 and Mats Jonasson was engaged in the definition of the project. Two papers written by Mats Jonasson and Oskar Wallmark initiated the embryo to the projects. Daniel defended his dissertation 2015.
4. Mats Jonasson was a co-supervisor as well as project leader for Anton Albinsson at Chalmers, Gothenburg. His PhD project "TorqSens" was started 2013 and is ongoing.

Awards

1. Best paper award, 12th International Symposium on Advanced Vehicle Control, Tokyo, Japan, 2014.
2. Nomination to Volvo Cars Technical Award (VCTA), "EMA for safety steering", 2014.

Membership in academies

1. Member in Editorial board of International Journal of Vehicle Systems Modelling and Testing since September 2011.
2. Member in SVEA - Swedish Vehiclular association
3. Member in IAVSD - International Association of Vehicle System Dynamics

Teaching profile

My teaching is within the field of road vehicle dynamics. It covers vehicle modelling, simulation, state estimation and control. I teach students at KTH at different stages as well as internally at Volvo Cars. In addition to my teaching, I am supervising PhD students and Master thesis students. Owing to my employment in academia and industry, my view of learning is associated to applied technical knowledge but in the light of scientific methods. My teaching style is problem based, which means emphasizing the underlying problem that should be solved and thereby increase students motivation for learning.

My style
My teaching is characterized by my experience from research and industry. My own research, which is still ongoing, has given me access to scientific secured methods and a critical attitude. Moreover, my research has strengthened the knowledge in my area since I'm well acquainted with current related research. My role in industry has given my insight from the academia that can be applied on real problems which needs to be solved in industry. I try to communicate my knowledge from my research to the students. Commonly, I'm associating to current PhD projects, talking about problems that the research society are striving to solve, etc. These things usually arouse students' curiosity about the subject.

Problem-based learning
Having mentioned my style above, my teaching is characterized by giving the student the ability to be able to apply knowledge to practical problems.

"Problem-based learning reflects the way people learn in real life; they simply get on with solving the problems life puts before them with whatever resources are to hand"
(Biggs & Tang 2011)

By demonstrating the underlying problem, so does the incentive to find solutions and increase student motivation for learning. Since one of the learning in the Vehicle Dynamics course is to apply knowledge on practical problems, it is consequently important to stimulate problem-based learning during my meetings with the students.

A good starting point is to discuss the basis of an underlying problem. Problem-based learning encourages students to get involved, resulting in a higher interaction between the students and me. Usually, I hold a discussion with the students where I bring in aspects and knowledge from other disciplines.

During exercises, it is also good that students are given either too much information or too little information that is necessary to solve the problem. For a typical real problem in the industry there is a wealth of information that is redundant. However some parts of the information may be difficult to access. Hence, the student must be able to understand which information that is really relevant, or alternatively, make assumptions about information that is not accessible in the task description. I encourage students to understand what information is needed and help them to be able to do assumptions that are good enough.

It has been shown that students who use problem-based learning fail their exam more frequently (Biggs & Tang 2011). Therefor I believe it is important to also adapt the examination to problem-based learning, which probably not is very common among problem-based teachers. As an example, I propose to examine the students' ability to handle over-determined information. I have made observations that the students' engagement, and thereby the effectiveness of their leaning, is increasing during problem-based learning sessions.

Heterogeneity
A challenge I face in my role as a teacher is that there are two different categories of students. One category is car enthusiast students who may have a solid experience in cars. Typically, these like to repair cars and handle mechanical tools. Often they have cars as their own private hobby. The second category is students who view the course as a theoretical challenge, but without having any practical experience of cars. This is a problem because it is difficult to teach the subject to a crowd with too diverse backgrounds.

The Vehicle Dynamics course requires good knowledge of mathematics, which is considered to be difficult. It helps also if you have car experience. Without the latter, it may be difficult to relate and understand the object car that is central. As a teacher, it becomes difficult to judge whether focus should be put on mathematics or practice. In these situations teachers tend to add the level too high (Hedin 2006).

Heterogeneity of prior knowledge is a real challenge and I deal with it by starting with a short rehearsal to cover abilities that do not exist in the class. To deal with this problem I plan to introduce an activity with mixed groups starting in the beginning of the course. Each group will solve a problem that involves both practical and mathematical solution capability. The idea of this group work is to equalize differences in prior knowledge and the practically oriented students can instruct the non-practice oriented ones. The results will be reported in writing and verbally in groups.

In order to get a better view of the heterogeneity, I will also hand out a test in the beginning of the course to gain an understanding of the variance of prior knowledge of the class. Simultaneously with this test, I will ask questions about what the expectations students have for the course, so-called "Introductory questionnaire" see (Mazur 1997), where I can get feedback what form of teaching that the students expect.

Equalization of math skills will not be fully accessed by the above mentioned group work. It is also difficult to tone down those elements of teaching as the course objectives include parts that require math skills. Therefore, I plan to early in the course hand out repetition document that summarizes the most important mathematical skills required, i.e. a sort of formulas with typical solutions. The idea here is that those with the worst skills in math should be able to raise their level.

Provide students with tools

My experience is that teachers commonly solve tasks during lectures and tutorials with little reflection about the choice of methods available. My own depth interviews with students in the course Vehicle Dynamics confirm this picture, where the students tell us that they spend a majority of their time writing of the teacher's solutions on the whiteboard, although these are available in written form from start. Students complain "teachers do not tell how to solve a problem, but just start writing." This way of teaching stimulates superficial learning that minimizes effort and worries but with constraints to manage the task. Memorization often used instead of understanding. What we want to achieve is deep learning where the student finds the task meaningful.

I think it is important for students to understand which methods are available to solve a given problem. This is important because the students should bring a "toolbox" of applied methods that they can use to real problems in their working lives. Tools mean here processes that are needed to reach a solution. Usually I initially present alternative methods available to solve a given problem. I also hold a discussion with students about the limitations of each method. Finally I motivate the choice of the method that I demonstrate. The focus must be to understand each step that should be performed in the calculation, rather than getting all the details.

Often the teacher summarizes what had just been taught in conjunction with the completion of the lesson. Knowledge, however, is better remembered over time when students themselves actively give their reviews on the content of the lesson (Biggs & Tang 2011). Therefore, my goal is that before learning activities is closing a student should voluntarily summarize the content of the lesson. At best, it will be a fruitful discussion and a good feedback for me as a teacher. To encourage students to sign up for this, I will offer some type of reward.

Peer teaching

One challenge in my teaching situation is that students often are quiet and few dare to ask questions that risk being perceived as "stupid questions." This implies that there are few discussions and I receive poor feedback on what the students have understood. However, there is a need to highlight issues from their own perspective.

"There may be no single best method of teaching, but the second best is student teaching other students" (McKeachie et al. 1986).

The citation concerns so called peer teaching where students teach. At these occasions, students tend to open up and ask "dumb" questions. They can here get help from each other to interpret what I actually had said. One idea that dealt e.g. in (Biggs & Tang 2011) is to have group discussions led by a student tutor.

I recommend about 15 minutes presentations for each group where each presentation is evaluated by me at forehand. Finally, I sum up and fill in where it is needed. This is time consuming, so I prioritize execution of this method only when I suspect there are many students who do not understand. To my help I have now also "Introductory questionnaire" described above. Peer teaching also brings a variety of teaching, which benefits students' different learning styles.

I also have very good experiences of student correction. When a student revises another student's assignment /lab etc. there occurs an excellent learning opportunity since the students can reflect on others results. Often the students invest large efforts because they are reluctant to show themselves incompetent in front of their peers. Another advantage is that the correction burden for me as a teacher is facilitated.

Finally in this educational reflection, I want to highlight the importance of a good education climate. The teacher's role is to me teamwork with other teaching colleagues in the planning, execution and evaluation phases. It is important to have transparency and constantly support each other to improve the teaching.

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(Mazur 1997)	Mazur, E. (1997), Peer Instruction: A User's Manual, Prentice Hall. ISBN 0-13-565441-6.
(McKeachie et al. 1986)	McKeachie, W. J., Pintrich, P., Lin, Y., and Smith, D. (1986), Teaching and learning in the college classroom: A review of the research literature. University of Michigan, US.

Teaching experience

Teaching at KTH during the period 2004 to 2009:

Approximately 10% of this time has been spent on teaching and contact with students. Mats Jonasson took part as a teacher in the following parts:

- The course "Vehicle engineering for a better environment" (KTH, 4B1424, 5 credits), which belonged to the Green Vehicle National University Programme. Teaching included leading a laboratory exercise, leading one exercise in power train and leading one project assignment. The laboratory exercise gave insight in emissions of HC, CO and NOx as well as fuel consumption for a combustion engine. Measurements were done in a laboratory with a gasoline engine with a catalytic converter. Students wrote reports that were corrected firstly by exchanging the reports in between the students. Finally, Mats Jonasson judged and corrected the reports. Course assignment through Bilda.

- The course "Fördjupningsarbete i fordonsteknik" (KTH, 4B1430, 10 credits). Mats Jonasson was leading one exercise in power train and leading one project assignment. Students wrote reports that were corrected by Mats Jonasson. Course assignment through Bilda.
- The course "Bachelor Degree project in vehicle engineering" (KTH, SA105X, 15 credits, first cycle). Mats Jonasson was a supervisor for three different projects in the area of regenerative braking and energy consumption of electrical steering system. Course assignment through Bilda.
- The course Vehicle dynamics (KTH, SD2225, 11 credits, second cycle). Mats Jonasson held lectures about vehicle modelling and validation. This course gives knowledge in what vehicle models are typically used and how subsystems and complete vehicles are modelled and validated depending on the particular purposes. Particular attention is paid on how parameters to the models are determined. Course assignment through Bilda.

Teaching after the PhD degree (2009-2018):

- Mats Jonasson is a guest lecturer (2009-2018) in "Vehicle dynamics" (KTH, SD2225, 11 credits, second cycle, approx. 20 students) in vehicle modelling and validation. This is a course for students at the fourth year on the Master level. The overall aim is to give the student a deeper insight in mathematical modeling, computer based simulation, measurements and analysis of a vehicle's motion. Here I teach about how mathematical models can be validated such that they perform equally as the real word vehicle. Course assignment through Bilda.
- Mats Jonasson has contributed to the course design to a completely new course "Applied Vehicle Dynamics Control" (KTH, SD2231, 7.5 credits, second cycle) which started 2014. The course aims to give fundamental knowledge within vehicle dynamics control and vehicle state estimation. Mats have designed a laboratory exercise for vehicle state estimation. Mats is also one of the guest lecturers in the course. Course assignment through Bilda.
- Mats Jonasson is a guest lecturer (2014-2017) in Applied Vehicle Dynamics Control (KTH, SD2231, 7.5 credits, second cycle, approx. 20 students). Mats gives an introductory lecture about vehicle dynamics control in cars.
- Mats Jonasson is a laboratory assistant (2014-2016) in Applied Vehicle Dynamics Control (KTH, SD2231, 7.5 credits, second cycle, approx. 20 students).
- Mats Jonasson has been the main lecturer for the technical project (2014-2017) in the course "Vehicle Engineering" (KTH, SD1001, 9 credits, first cycle) for the students that have selected this road vehicle project. Mats have given lectures in vehicle dynamics theory and a laboratory exercise with a radio controlled down scaled car. Students have presented reports orally and in written form. Course assignment for the whole course in Bilda and the technical project by distributed questionnaire.
- Development of teaching material and teaching (2016-2017) in Vehicle System Technology (SD2221).

Teaching aid production and development
Mats Jonasson has contributed to the design of a laboratory tutorial in the course "Applied Vehicle Dynamics Control" (KTH, SD2231, 7.5 credits, second cycle) which started 2014. The laboratory covers the field of state estimation, and in particular, side-slip estimation of vehicles.

Collaboration within the education programme
Jonasson contributes to the "civilingenjörsprogrammet i Farkostteknik" all the way from year 1, through year 3, 4 and 5 to Master thesis supervision. In the Master programme in Vehicle Engineering, Jonasson contributes in many courses, se the previous explanation.

Teaching activity outside the university and higher education institution
Mats Jonasson is also from 2010 appointed as a teacher in an internal course at Volvo Cars. The course, Active Safety & Chassis School (ENG00008), is arranged by Volvo Cars and is held a couple of times every year. Typically, the class has 25 students from different part of the company. Teaching is performed in the area of vehicle control and includes the following parts:
- Trends and functional architecture within vehicle control
- Vehicle dynamics theory
- Tyre characteristics
- Actuators for motion control

Teaching skills

Teaching.
See the attached course evaluation "Kursutvärdering av teknikprojektet "Utvärdering av kurvtagningsförmåga för en radiostyrd bil"" valid for SD2001 2015 (Appendix 3) regarding Mats contribution as a lecturer.

Teaching aid production and development.
See the attached course evaluation "Kursanalys -KTH" (Appendix 4) regarding Mats contribution to the Laboratory exercise 3 valid for SD2231 2014. The exercise is new and based on feedback from students, we will improve the Lab by e.g. give a deeper introduction to Simulink and encourage students motivation by a competition.

Supervision.
I contemplate supervision as a way of establish cooperation between myself, the students and all other supervisors. The process of discussing problems and seeing the progress of the student is very stimulating. One of the most important keys turns out to be the maturity of being an independent researcher.

During my development as a supervisor to PhD students, I have understood the importance of early writing. I encourage writing the first paper during the first year of studies. I also, nowadays, want the student to regularly write a summary of related references where I let him/her explain differences from own findings. Moreover I'm helping the student to establish a viable network of people.

I expect sometimes students to go into a side track outside what has been decided in the plan. This side track may be very interesting, but does not give any answer to the dictated research question. Here, I think I must release the power of the student and his/her creativeness. Good results could be achieved when allowing the student to follow a dead end (Maybe not for sure a dead end, results can be publishable).

A happy student is a good prerequisite for good result. As a supervisor I must be alert to anomalies and to secure that the student function well in a group of other PhD students and supervisors. The student is also expected to take initiative him/herself and work independently between meetings. After a while the student must feel that he/she "owns" the project.

References for Mats role as co-supervisor for PhD students (See also certificate in Appendix 6):
PhD student Derong Yang, contact Prof. Bengt Jacobson, Chalmers
PhD student Johannes Edren, contact Prof. Annika Stensson Trigell, KTH
PhD student Daniel Wanner, contact Prof. Annika Stensson Trigell, KTH
PhD student Anton Albinsson, contact Prof. Bengt Jacobson, Chalmers

Teaching activity outside the university and higher education institution.
See course evaluation of "Active Safety & Chassis School (ENG00008) 13w48" (Appendix 5) regarding Mats contribution as a lecturer in the Vehicle control part at Volvo Cars.

Further development of my teaching

The meaning of a good supervisor is difficult to grasp. Nevertheless, I believe it is important to bring more knowledge in my way of supervise and what the student expects from me.

I would like to improve my communication with main supervisor to avoid conflicting advice and secure project to go in a unitary direction. I would also like to utilize the competence of student in a better way. This means that I must be willing to take risks to leave my safe area that I know and control.

In my role as a teacher at Volvo Cars, I am a member in our internal teacher network. I regularly train my communication skills by attending lectures, seminars and courses in communication. I believe it is important to further develop the communication ability between myself and students. As one example, my focus just now is to act and reflect more on how to figure out students expectations before a lecture starts. By improving the understanding of expectations, lecture will proceed more efficiently and students will be satisfied.

Externals contacts

Since I am employed by industry and works 20% of my time as affiliated faculty at KTH I have a natural and daily contact between industry/university. Also, through my engagement in SHC - Swedish Hybrid Vehicle Centre I have also contact to other universities in Sweden (Chalmers, LiU, LTH and Uppsala University) as well as the other vehicle manufacturers (Scania CV AB, AB Volvo and previously Saab Automobile and BAE Systems Hägglunds). Also, I have contact to the Energy Agency, since they funded my PhD research and at that time engaged me in several conferences and seminars.

Research profile

Along with the development towards safe and environmentally friendly vehicles, there has been an increasing interest in improved functions of vehicle dynamics. Since conventional chassis are built on a combustion engine base, improvement of vehicle dynamics implies an increased complexity and expensive solutions. Currently, the field maintains significant interest due to the development of hybrid electric vehicles. Here, the electric vehicle becomes an attractive solution due to the opportunity to divide the electric driveline into several electrical machines and allow them to quickly generate torque and revolve independently from each other. If the electrical driveline is distributed closer to the wheels there is a potential to further reduce energy consumption due to less friction losses. Furthermore, when the wheels are allowed to be controlled individually, the trade-off between comfort, safety and energy consumption can more easily be tackled.

One example of a long-term chassis concept, with electrical machines mounted inside the wheel, is the Autonomous Corner Module (ACM). This concept was invented at Volvo Cars in 1998 (see Figure 1a) and further developed by Magna Steyr in collaboration with KTH and Volvo Cars (see Figure 1b). The name "autonomous" indicates that wheel forces and kinematics are individually controlled supporting a common task. This solution also possesses the attribute of modularity, meaning that the one module can be re-used at all four corners and for different vehicle platforms. Figure 1c illustrates the tyre force constrains which are associated to a hybrid vehicle with ACMs.

Fig. 1a

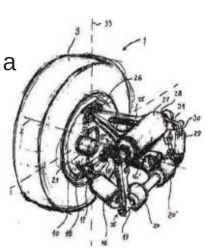

Fig. 1b

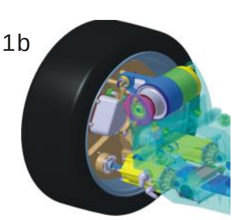

Fig. 1c

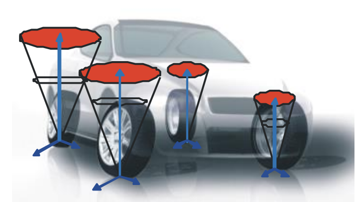

Fig. 1. a) The ACM patent picture from 1998, b) The ACM concept further developed by Magna Steyr, KTH and Volvo Cars in 2007 [16] and c) Illustration of tyre force constraints.

One question that has gained particular attention in the research society is how such concepts should be optimally used. Historically, similar problem has been faced in the aircrafts industry to control the relatively large number of rudder compared with the states that are to be controlled (so called over-actuated systems). Using optimal control theory tyre forces can be allocated to satisfy the remuneration to low energy consumption, low tyre wear and exploitation of tyre-to-road adhesion potential.

With the background above in mind, Mats Jonasson worked as a PhD student in the research project "Autonomous corner modules for hybrid vehicles" at KTH from 2004 to 2009 to give response to the following research question:

How can individual wheel actuators improve vehicle dynamics and safety and how should the actuators then be used?

Mats Jonasson gave answers on possible uses of ACMs and capacity of new vehicle dynamics functions (2005). A control strategy was specifically developed to handle ACMs and similar over-actuated vehicle systems (2005). It was found that this control strategy together with the ACM equipped vehicle have an inherent robustness to handle faults events that threaten vehicle stability (2006). In case of actuator fault, the control of the corresponding may be lost. However, the developed mechatronic system admits the remaining wheels to counteract the effect of the non-functional wheel. Thereby, vehicle stability is ensured without any additional need of extra hardware and case-specific fault-handling strategies.

The ACM control strategy was further developed by Mats Jonasson to allocate vertical forces between the four wheels (2006). It was also found that ACM utilize the available friction between road and tyre better than conventional vehicles. One key finding was the unsymmetrical left-right longitudinal tyre force allocation that increases the margins towards the friction boundary. Owing to the rear-wheel steering ability of the ACMs, it was also found that the mixing between translation and rotational motion during cornering can be controlled to increase the grip.

In collaboration with Magna Steyr, the ACM was further developed together with KTH and Volvo Cars to prepare for industrialization (2006-2009). Basis for a complete rolling prototype Autonomous corner vehicle was delivered.

An electromechanical wheel suspension to the ACM was developed by Mats Jonasson (2007). To evaluate the feasibility of electromechanical dampers in vehicles, a dimensioning method was also developed. By adapting the dimensioning method already during the development process of the vehicle, the compromise between comfort, handling and energy dissipation can be controlled.

A method to evaluate the potential of generating global vehicle forces was developed by Mats Jonasson (2009). This approach is specifically designed to handle all types of over-actuated vehicle systems. After this method was used, important differences were revealed in the ways in which differently equipped vehicle configurations could be actuated.

A quantification of the potential for emergency avoidance manoeuvres of differently actuated vehicles was studied by Mats Jonasson (2009). Friction brakes are most important in such critical manoeuvres. Nevertheless, wheel individual drive and steering on both axles do improve the potential to perform emergency avoidance manoeuvres safely. Such vehicles in real-life traffic would manage critical situations to a larger share with an increased entry speed, assuming a certain frequency distribution of vehicle speed.

The research activates after PhD have primarily covered the fields of over-actuated systems, fault-tolerant control and post-impact control.

Since over-actuated vehicle concepts are equipped with many actuators, those concepts are exposed to high risks of hazards and failure modes. Based on the work presented by Jonasson and Wallmark 2006 a joint research project, "Fault-tolerant over actuated HEVs", was formulated, involving both Jonasson at Volvo Cars, KTH Vehicle Dynamics (Annika Stensson Trigell) and KTH Electrical machines and power electronics (Oskar Wallmark). The project was approved by SHC - Swedish Hybrid Vehicle Centre in 2010 Within the PhD project, the hazards and failure modes have been be classified and analysed. Possible consequences on the dynamic behaviour of the vehicle caused by the identified faults have been analysed, and solutions on to how to compensate for the occurring faults has been developed. The solutions of recovery will be depending on which sensors and actuators that are available. The vehicle control strategy will also be depending on actual type of failure mode. Mats Jonasson, who is an co-supervisor to PhD student Daniel Wanner (lic tech 2013, PhD 2015) in this project, has contributed with control algorithms to compensate for the fault and has taking part of writing paper (2010-2014).

An optimization study was performed (2012) to investigate whether the vehicle control method "Control allocation" is optimal. Control allocation allows the distribution of actuator requests to be independently controlled from the control of the car body itself. This was done by formulating a cost function of tracking error along a reference path and applying an open-loop optimization with the tool "Optimica". The result was evaluated against the control requests from the control allocator.

Mats Jonasson has been a co-supervisor to the PhD student Derong Yang (PhD 2013) in the project "Post-impact stability control", which aims to autonomously control a car after an impact to avoid a second collision. One part of the project was done to understand the character of the vehicle's dynamics after first impact directly after contact. It was found that the optimal control strategy highly depends on the type of vehicle motion state that is generated through the collision. A control strategy using Hamiltonian optimization was developed and Mats has contributed to the problem formulation and has taking part of writing papers (2010-2014).

Jonasson has also been a co-supervisor to the PhD student Johannes Edrén (PhD 2014) in a PhD project "Generic vehicle motion modelling and control for enhanced driving dynamics and energy management". This project aims to understand how over-actuated vehicle concepts should be utilized in the context that sensors actuators not are ideal, i.e. they have constraints and uncertainties. The project has built a down scaled prototype vehicle with ACMs equipped with electrical servo-motors. The project has for example shown that active suspension can be used to influence lateral and longitudinal dynamics, e.g. reducing stopping distance. Mats has contributed with modelling expertise and has taking part in writing papers (2010-2014).