

UNIVERSITY OF PRETORIA

CURRICULUM VITAE – PROF PIETER SCHALK ELS

(Updated 31 October 2019)

1. BIOGRAPHICAL SKETCH

1.1 GENERAL INFORMATION									
Surname	Els								
First names	Pieter Schalk			ID Number					
Citizenship	RSA			Title	Prof	Female		Male	X
Place of birth	Rustenburg, South Africa			Date of birth			6 September 1968		
Population group	African		Coloured		Indian		White	X	Other <i>(Please specify)</i>
Department	Mechanical and Aeronautical Engineering			Position			Professor		
Direct Telephone	012-420-2045			Direct Telefax			012-362-5087		
E-mail	Schalk.els@up.ac.za								
Date of appointment	01/05/1999			Permanent full-time			X	Temporary full-time	

1.2 ACADEMIC QUALIFICATIONS OBTAINED				
Degree/ Diploma	Field of study	Higher education institution	Year	Distinctions
PhD	Mechanical Engineering	University of Pretoria	2006	Not applicable
M.Eng	Mechanical Engineering	University of Pretoria	1993	Cum Laude
B.Eng	Mechanical Engineering	University of Pretoria	1990	Cum Laude

1.3 WORK EXPERIENCE TO DATE		
Name of employer	Capacity and/or type of work	Period From (mm//yy to mm//yy)
University of Pretoria	Professor	01/16 to present
University of Pretoria	Associate Professor	01/08 to 12/15
University of Pretoria	Senior Lecturer	05/99 to 12/07
Reumech Ermetek	Test Engineer, Senior Test Engineer, Senior Design Engineer	01/94 to 04/99

2. TEACHING ACTIVITIES

2.1 Courses presented		
Course	Level (e.g. second year, Masters)	Self developed (Yes or No)
Dynamics	Second year (2000 to 2002, 2004 to 2012)	No
Vehicle Engineering	Fourth year (1999 to 2018)	Yes
Vehicle Dynamics	Post Graduate (2000)	No
Advanced Vehicle Engineering	Post Graduate (2002, 2004 to 2010)	Yes
Vehicle Dynamics	Post Graduate (2011 to 2019)	Yes

2.2 Other education and pedagogic courses presented		
Course	Year	Institution
Vehicle dynamics	2008	Ismans, Le Mans, France
Vehicle dynamics	2009	Ismans, Le Mans, France
Tire-Vehicle Dynamics Short course (6 hours of lectures – web based)	2013	Virginia Tech, USA

3. TEACHING OUTPUTS

3.1 Educational publications and products
<p>Study guides:</p> <p>Vehicle Engineering (1999 to 2019)</p> <p>Vehicle Dynamics (2000)</p> <p>Advanced Vehicle Engineering (2002, 2004 to 2010)</p> <p>Vehicle Dynamics (2011 to 2019)</p>

4. OTHER TEACHING CONTRIBUTIONS

4.1 Membership of national and international bodies

None

4.2 Visits to local and overseas universities as guest professor or lecturer in regard to teaching

- 1) *Guest Professor teaching a vehicle dynamics course as part of a “Masters degree en race car vehicle engineering” at Ismans in Le Mans, France (2 weeks in 2008 and 2 weeks in 2009)*
- 2) *Tire-Vehicle Dynamics Short course (6 hours of lectures – web based), 2013, Virginia Tech*

4.3 Participation in national and international teaching associations, bodies, committees

ISTVS workgroup on Off-road Vehicle Dynamics and Terramechanics education (chaired workgroup meeting at 2012 ISTVS conference, 24 to 28 September 2012, Pretoria, South Africa)

5. POSTGRADUATE SUPERVISION

5.1 Supervision or co-supervision of students who have completed degrees

Name of student	Degree ¹ /Title of dissertation/thesis and date completed	Supervisor	Co-supervisor(s)	Duration of studies (years)
Doctoral degrees				
MJ Stallmann	PhD, Cost effective FTire parameterisation methods for ride simulations with large off-the-road tyres, 2018	Prof PS Els		4
U Spangenberg	PhD, Reduction of rolling contact fatigue through control of wheel wear shape, 2017	Prof PS Els	Dr RD Fröhling	3
HA Hamersma	PhD, ABS braking on rough terrain, 2017	Prof PS Els		3
TR Botha	PhD, Digital Image Correlation: Applications in Vehicle Dynamics, 2015	Prof PS Els		3
C Kat	PhD, Validated leaf spring suspension models, 2012	Prof PS Els		3
K Nolte	Doctor Philosophiae, Evaluation of resistance training equipment using three dimensional musculoskeletal modelling focusing on the biomedical and anthropometric considerations of the end-user, 2011	Prof PE Krüger (Biokinetics)	Prof PS Els	4
MJ Thoresson	PhD, Efficient gradient-based	Dr PE Uys	Dr PS Els	3

¹ Indicate whether Honours, Masters research, Masters coursework with dissertation or Doctorate

	optimisation of suspension characteristics for an off-road vehicle, 2007			
Masters Degrees				
F Feldesi	Strain measurement inside tyres	Dr TR Botha	Prof PS Els	1
RA Kapp	Wireless Vehicle-in-the-Loop Platform for Supervisory Control	Dr TR Botha	Prof PS Els	3
K Poovendran	Masters research, 2018 Torque vectoring	Dr TR Botha	Prof PS Els	2
J Jooste	Masters research, 2018, Ride comfort	Dr C. Kat	Prof PS Els	2
DK Johnson	Masters research, Real-time digital image correlation, 2018	Dr TR Botha	Prof PS Els	1
GS Heymans	Masters research, Controllable suspension systems, 2018	Prof PS Els	Dr TR Botha	2
JF Grobler	Masters research, MR fluid suspension, 2018	Prof PS Els		3
VH Wehrmeyer	Masters research, Rollover, 2018	Prof PS Els		5
NA van der Merwe	Masters research, ABS Braking, 2017	Prof PS Els		1
R Grabe	Masters research, Ride comfort, 2017	Dr C Kat	Prof PS Els	2
KRS Wright	Masters research, Tyre wear and ageing, 2017	Prof PS Els		2
R Strauss	Masters research, Brake based integrated rollover prevention and yaw control for an off-road vehicle, 2016	Prof PS Els		2
AG Guthrie	Masters research, 3D Computer Vision Contact Patch Measurements Inside Off-road Vehicle Tyres, 2016	Prof PS Els		2
HB Bosch	Masters research, FTire model parameterization and validation of an all-terrain SUV tyre, 2016	Prof PS Els		2
WCW Penny	Masters research, Anti-lock Braking System performance on rough terrain, 2016	Prof PS Els		2
JS Van Den Berg	Masters research, Effects of Friction and Gas Modelling on Vehicle Dynamics Simulation, 2015	Prof NJ Theron	Prof PS Els	4
TP Löwe	Masters research, Modelling of a Passive Hydraulic Steering for Locomotives, 2015	Prof PS Els	Dr C Kat	1
M Kapp	Masters Research, Robust High Speed Autonomous Steering of an Off-Road Vehicle, 2015	Prof PS Els		1
BV Linström	Masters Research, Real-Time Non-Linear Vehicle Preview Model, 2015	Prof PS Els		2
Y Babulal	Masters Research, Large Tyre Testing and Modelling for Handling, 2015	Prof PS Els		4
RF Meeser	Masters Research, Magneto-Rheological (MR) Damper Design for Off-Road Vehicle Suspension with Flow Blocking Ability, 2015	Prof PS Els		4
JM Conradie	Masters Research, Finite Element Modelling of Off-Road Tyres, 2015	Prof PS Heyns	Prof PS Els	4
MJ Stallmann	Masters Research, Tyre parameterisation and modelling, 2014	Prof PS Els		2
A Strydom	M.Eng, Controllable suspension design using Magnetorheological fluid, 2013	Prof PS Els	Dr S Kaul	3
HA Hamersma	M.Eng, Longitudinal vehicle dynamics control for improved vehicle safety, 2013	Prof PS Els		2
SF Van Der Westhuizen	M.Eng, Slow active suspension control for rollover prevention, 2013	Prof PS Els		2
TR Botha	Masters Research, High speed autonomous off-road vehicle steering,	Prof PS Els		1

	2011			
HGA Breytenbach	Masters Research, Optimal vehicle suspension characteristics for increased structural fatigue life, 2009	Prof PS Els		1
CM Becker	Masters Research, Profiling of rough terrain, 2009	Prof PS Els		2
PH Cronje	Masters Research, Improving off-road vehicle handling using an active anti-roll bar, 2009	Prof PS Els		1
C Kat	Masters Research, Suspension forces on a tri-axle air suspended semi-trailer, 2009	Prof PS Els		1
BP Uys	Masters Research, Omrol van Veldvoertuie, "Rollover of off-road vehicles", 2007	Dr PS Els		2
R Bester	Masters Research, The ride comfort vs. handling decision for off-road vehicles, 2007	Dr PE Uys	Dr PS Els	1
C-J Van Eeden	Masters Research, The steering relationship between the first and second axles of a 6x6 off-road military vehicle, 2007	Dr PS Els		5 (Part time)
CL Giliomee	Masters Research, Analysis of a four state switchable hydropneumatic spring and damper system, 2005	Prof JL Van Niekerk	Dr PS Els	7 (Part time, includes Hons)
W Misselhorn	Masters Research, Development of Hardware-in-the-loop testing for vehicle suspension systems, 2005	Prof NJ Theron	Dr PS Els	4 (includes Hons)
MJ Thoresson	Masters Research, Mathematical Optimization of the Suspension of the Suspension System of an Off-Road Vehicle for Ride Comfort and Handling, 2004	Dr PS Els	Dr PE Uys, Prof J Snyman	2
N Janse van Rensburg	Masters Research, Time delay in a semi-active damper, 2000	Prof JL Steyn	Dr PS Els	3
B.Eng (Hons) degrees				
M Van Der Westhuizen	B.Eng (Hons), 2018	Dr C Kat	Prof PS Els	1
TMG Komana	B.Eng (Hons), 2018	Prof PS Els		2
W Botes	B.Eng (Hons), 2018	Dr TR Botha	Prof PS Els	1
M Pegram	B.Eng (Hons), 2018	Dr TR Botha	Prof PS Els	1
K Maake	B.Eng (Hons), 2018	Prof PS Els	Dr HA Hamersma	1.5
A Peenze	B.Eng (Hons), 2017	Prof PS Els		1
F Feldesi	B.Eng (Hons), 2017	Prof PS Els	Dr TR Botha	1
O Scholtz	B.Eng (Hons), 2017	Prof PS Els		1.5
NA van der Merwe	B.Eng (Hons), 2016	Prof PS Els		1
K Poovendran	B.Eng (Hons), 2016	Prof PS Els		1
J Jooste	B.Eng (Hons), 2016	Dr C Kat	Prof PS Els	1
DK Johnson	B.Eng (Hons), 2016	Prof PS Els	Dr TR Botha	1
AG Vosloo	B.Eng (Hons), 2016	Prof PS Els		1
R Grabe	B.Eng (Hons), 2016	Dr C Kat	Prof PS Els	1.5
RA Kapp	B.Eng (Hons), 2015	Prof PS Els		1
KRS Wright	B.Eng (Hons), 2015	Prof PS Els		1
GS Heymans	B.Eng (Hons), 2015	Prof PS Els		1
W Scholtz	B.Eng (Hons), 2015	Prof PS Els		1
JF Grobler	B.Eng (Hons), 2014	Prof PS Els		1
BH Kent	B.Eng (Hons), 2014	Prof PS Els		1
MJR Schoeman	B.Eng (Hons), 2014	Prof PS Els		1
HB Bosch	B.Eng (Hons), 2013	Prof PS Els		1
JC Kruger	B.Eng (Hons), 2013	Prof PS Els		1

AG Guthrie	B.Eng (Hons), 2013	Prof PS Els		1
M Kapp	B.Eng (Hons), 2013	Prof PS Els		1
TP Löwe	B.Eng (Hons), 2013	Prof PS Els		1
WCW Penny	B.Eng (Hons), 2013	Prof PS Els		1
BV Linstrom	B.Eng (Hons), 2012	Prof PS Els		1
VH Wehrmeyer	B.Eng (Hons), 2012	Prof PS Els		1
TR Botha	B.Eng (Hons)	Prof PS Els		1

5.2 Current post-graduate students					
Name of student	Degree ²enrolled for and date of first registration	Project title	Supervisor	Co-supervisor(s)	Year of registration
Doctoral degrees					
CM Becker	PhD, 2016	In-situ tyre parameterisation	Prof PS Els		2016
Masters degrees					
Wilhelm van de Kamp	Masters research, 2019	Collision management	Dr. Kim Batselier (TU Delft)	TR Botha PS Els	
M Van Der Westhuizen	Masters research, 2019	Human response to vibration	Dr C Kat	Prof PS Els	2019
W Botes	Masters research, 2019	Real-time slip angle measurement	Dr TR Botha	Prof PS Els	2019
M Pegram	Masters research, 2019	Smart tyres	Dr TR Botha	Prof PS Els	2019
K Maake	Masters research, 2018	Collision management	Prof PS Els	Dr HA Hamersma	2018
TMG Komana	Masters research, 2018	Tyre pressure control	Prof PS Els		2018
A Peenze	Masters research, 2018	Controllable suspension	Prof PS Els		2018
O Scholtz	Masters research, 2017	Terrain roughness effects in tyre modeling	Prof PS Els		2017
AG Vosloo	Masters research, 2017	Controllable suspension	Prof PS Els		2017
TC Meyer	Masters research, 2016	Train speed MPC	Prof PS Els	Dr TR Botha	2016
BH Kent	Masters research, 2015	Longitudinal and lateral vehicle control	Prof PS Els	Dr TR Botha	2015
B.Eng (Hons) degrees					
K Alves	B.Eng (Hons), 2019		Prof PS Els		2019
J Catterick	B.Eng (Hons), 2019		Dr TR Botha	Prof PS Els	2019
B De Wet	B.Eng (Hons), 2019		Prof PS Els		2019
L Fritz	B.Eng (Hons), 2019		Dr HA Hamersma	Dr TR Botha Prof PS Els	2019
R Kruger	B.Eng (Hons), 2019		Prof PS Els		2019
K Braun	B.Eng (Hons), 2019		Prof PS Els	Dr TR Botha	2019
R De Sousa	B.Eng (Hons), 2019		Dr HA Hamersma	Dr TR Botha Prof PS Els	2019
A Carvalho	B.Eng (Hons), 2019		Dr HA Hamersma	Prof PS Els	2019

6. RESEARCH FUNDING

² Indicate whether Honours, Masters research, Masters coursework with dissertation or Doctorate

6.1 Obtaining research funds (Optional)			
Origin of research funds (e.g. contract research, THRIP, international funding organisations, other(s))	Title of research project or programme	Duration	Money allocated (R)
International research funding (EU Horizon 2020 Marie Curie RISE, European Research Office of the US Army, Cold Regions Research and Engineering Laboratory (CRREL), Geotechnical and Structures Laboratory (GSL), DARPA)	Several research projects have been completed with European, North American and South African research institution as well as industry partners.	I regularly participate in many projects within my focus area. Projects range from 6 months to 3 years	Approximately R5M per year over the past 5 years
International industry funding (John Deere, Caterpillar, FNSS, Idiada etc.)			
NRF (NEP, Incentive funding, Focus area funding))			
Mine Health and Safety Council (MHSC)			

7. RESEARCH OUTPUTS

7.1 Publications in peer-reviewed or refereed journals

Publications published in peer-reviewed or refereed journals:

1. Wright, K.R.S., Botha, T.R. and Els, P.S., 2019, Effects of age and stiffness on the friction properties of an SUV tyre, Journal of Terramechanics Volume 84, pp. 21-30.
2. Ivanov, V., Savitski, D., Augsburg, K., Els, P.S., Kat, C., Botha, T.R., Dhaens, M., Sandu, C., He, R., McBride, S., Vazquez, A.G.A., and Victorino, A.C., 2019, Challenges of Integrated Vehicle Chassis Control: Some Findings of the European Project EVE, IEEE Journal of Industry Applications, Volume 8, Issue 2, pp. 218-230,
3. Botha, T.R., Johnson, D.K., Els, P.S. and Shoop, S.A., 2019, Real time rut profile measurements in varying terrain using digital image correlation, Journal of Terramechanics, Vol. 82, pp. 53-61.
4. Johnson, D.K., Botha, T.R. and Els, P.S., 2019, Real-time side-slip angle measurements using digital image correlation, Journal of Terramechanics, Vol 81, pp. 35-42.
5. He, R., Sandu, C., Khan, A.K., Guthrie, A.G., Els, P.S. and Hamersma, H.A., 2019, Review of terramechanics models and their applicability to real-time applications, Journal of Terramechanics, Vol 81, pp. 3-22.
6. Spangenberg, U, Fröhling, R.D. and Els, P.S., 2019, Long-term wear and rolling contact fatigue behaviour of a conformal wheel profile designed for large radius curves, Vehicle System Dynamics, Volume 57, no. 1, pp.44-63.
7. Van Der Merwe, N.A., Els, P.S. and Žuraulis, V., 2018, ABS Braking on Rough Terrain, Journal of Terramechanics, Vol. 80, pp. 49-57.
8. Schreiber, V., Ivanov, V., Augsburg, K., Noack, M., Shyrokau, B., Sandu, C. and Els, P.S., 2018, Shared and Distributed X-in-the-Loop Tests for Automotive Systems: Feasibility Study, IEEE Access, Volume 6, pp. 4017- 4026.

9. Linström, B.V., Els, P.S. and Botha, T.R., 2018, A Real-Time Non-Linear Vehicle Preview Model, *International Journal of Heavy Vehicle Systems*, Vol. 25, No. 1, pp. 1-22.
10. Spangenberg, U., Fröhling, R.D. and Els, P.S., 2018, The effect of rolling contact fatigue mitigation measures on wheel wear and rail fatigue, *Wear*, Volumes 398–399, pp. 56–68.
11. Hamersma, H.A. and Els, P.S., 2017, ABS performance evaluation taking braking, stability and steerability into account, *International Journal of Vehicle Systems Modelling and Testing*, Vol. 12, Nos. 3/4, pp.262-283.
12. Kat, C., Johrendt, J.L. and Els, P.S., 2017, Methodology for developing a neural network leaf spring model, *International Journal of Vehicle Systems Modelling and Testing (IJVSMT)*, Vol 12, Nos. 1/2, pp. 94-113.
13. Meeser, R.F., Kaul, S. and Els, P.S., 2017, Investigation into the flow blocking ability of a novel magneto-rheological damper unit, *ASTM Journal of Testing and Evaluation*, Vol. 45 No. 5, pp. 1601-1608.
14. Guthrie, A.G., Els, P.S. and Botha, T.R., 2017, 3D Contact Patch Measurement Inside Rolling Tyres, *Journal of Terramechanics*, Vol 69, pp. 13-21.
15. Hamersma, H.A., Botha, T.R. and Els, P.S., 2016, The dynamic rolling radius of a pneumatic tyre on hard terrains, *International Journal of Vehicle Systems Modelling and Testing*, Vol 11, No. 3, pp. 234-251.
16. Bosch, H.B., Hamersma, H.A. and Els, P.S., 2016, Parameterization and validation of an all-terrain SUV FTire model, *Journal of Terramechanics*, Vol 67, pp.11–23.
17. Spangenberg, U, Fröhling, R and Els, P.S., 2016, Influence of wheel and rail profile shape on the initiation of rolling contact fatigue cracks at high axle loads, *Vehicle System Dynamics: International Journal of Vehicle Mechanics and Mobility*, Volume 54, Issue 5, pp. 638–652.
18. Penny, W.C.W. and Els, P.S., 2016, The test and simulation of ABS on rough terrain, *Journal of Terramechanics*, Vol. 67, pp.1–10.
19. Conradie, J.M., Els, P.S. and Heyns, P.S., 2016, Finite Element Modelling of Off-Road Tyres for Radial Tyre Model Parameterization, *Proc. IMechE, Part D: Journal of Automobile Engineering*, Vol. 230(4), pp. 564–578.
20. Botha, T.R. and Els, P.S., 2015, Digital image correlation techniques for measuring tyre-road interface parameters: Part 1 - Side-slip angle measurement on rough terrain, *Journal of Terramechanics*, Vol 61, pp.87-100.
21. Botha, T.R. and Els, P.S., 2015, Digital image correlation techniques for measuring tyre-road interface parameters: Part 2 - Longitudinal tyre slip ratio measurement, *Journal of Terramechanics*, Vol 61, pp.101-112.
22. Babulal, Y, Stallmann, M.J. and Els, P.S., 2015, Parameterisation and Modelling of Large Off-Road Tyres for On-Road Handling Analyses, *Journal of Terramechanics*, Vol 61, pp. 77-85.
23. Botha, T.R. and Els, P.S., 2015, Rough terrain profiling using digital image correlation, *Journal of Terramechanics*, Vol 59, pp. 1-17.

24. Van Der Westhuizen, S.F. and Els, P.S., 2015, Comparison of different gas models to calculate the spring force of a hydropneumatic suspension, *Journal of Terramechanics*, Vol 57, pp. 41-59.
25. Hamersma, H.A. and Els, P.S., 2014, Improving the braking performance of a vehicle with ABS and a semi-active suspension system on a rough road, *Journal of Terramechanics*, Vol 56, pp. 91-101.
26. Stallmann, M.J., Els, P.S. and Becker, C.M., 2014, Parameterization and Modelling of Large Off-Road Tyres for Ride Analyses: Part 1 - Obtaining Parameterization Data, *Journal of Terramechanics*, Vol 55, pp. 73-84.
27. Stallmann, M.J. and Els, P.S., 2014, Parameterization and Modelling of Large Off-Road Tyres for Ride Analyses: Part 2 - Parameterization and Validation of Tyre Models, *Journal of Terramechanics*, Vol 55, pp. 85-94.
28. Hamersma, H.A. and Els, P.S., 2014, Longitudinal vehicle dynamics control for improved vehicle safety, *Journal of Terramechanics*, Vol 54, pp. 19-36.
29. Ngwangwa, H.M., Heyns, P.S., Breytenbach, H.G.A. and Els, P.S., 2014, Reconstruction of road defects and road roughness classification using Artificial Neural Networks simulation and vehicle dynamic responses: Application to experimental data, *Journal of Terramechanics*, Vol 53, pp. 1-18.
30. Becker, C.M. and Els, P.S., 2014, Profiling of rough terrain, *International Journal of Vehicle Design*, Vol. 64, Nos. 2/3/4, pp. 240-261.
31. Thoresson, M.J., Botha, T.R. and Els, P.S., 2014, The relationship between vehicle yaw acceleration response and steering velocity for steering control, *International Journal of Vehicle Design*, Vol. 64, Nos. 2/3/4, pp. 195-213.
32. Van Der Westhuizen, S.F. and Els, P.S., 2013, Slow active suspension control for rollover prevention, *Journal of Terramechanics*, Vol. 50, 2013, pp.29-36.
33. Nolte, K., Krüger, P.E., Els, P.S. and Nolte, H., 2013, Three dimensional musculoskeletal modelling of the abdominal crunch resistance training exercise, *Journal of Sports Sciences*, Vol. 31, No. 3, pp. 264 - 275.
34. Kat, C. and Els, P.S., 2012, Validation metric based on relative error, *Mathematical and Computer modelling of Dynamical Systems*, Vol. 18, No. 6, October 2012, pp. 487-520.
35. Kat, C. and Els, P.S., 2011, Elasto-plastic leaf spring model, *International Journal of Engineering Systems Modeling and Simulation*, Vol. 3, Nos. 3/4, 2011, pp. 126-139.
36. Breytenbach, H.G.A. and Els, P.S., 2011, Optimal vehicle suspension characteristics for increased structural fatigue life, *Journal of Terramechanics*, Vol. 48, pp. 397-408
37. Nolte, K., Krüger, E.P. and Els, P.S., 2011, Three dimensional musculoskeletal modelling of the seated biceps curl resistance training exercise focusing on the biomechanical and anthropometric considerations of the end-user, *Sports Biomechanics*, Vol. 10, Issue 2, pp.146-160.
38. Cronje, P.H. and Els, P.S., 2010, Improving off-road vehicle handling using an active anti-roll bar, *Journal of Terramechanics*, Vol. 47, pp. 179-189.

39. Thoresson, M.J., Uys, P.E., Els, P.S. and Snyman, J.A., 2009, Efficient optimisation of a vehicle suspension system, using a gradient-based approximation method. Part 1. Mathematical modelling, *Mathematical and Computer Modelling*, Vol. 50, pp. 1421-1436.
40. Thoresson, M.J., Uys, P.E., Els, P.S. and Snyman, J.A., 2009, Efficient optimisation of a vehicle suspension system, using a gradient-based approximation method. Part 2. Optimisation results, *Mathematical and Computer Modelling*, Vol. 50, pp. 1437-1447.
41. Kat, C. and Els, P.S., 2009, Interconnected air spring model, *Mathematical and Computer Modelling of Dynamical Systems*, Vol. 15, No. 4, August 2009, pp. 353–370.
42. De Wet, G.J., Steyn, J.L. and Els, P.S., 2008, Simulation and experimental verification of solenoid valve characteristics for semi-active damper, *International Journal of Vehicle Design*, Vol. 47, Nos. 1/2/3/4.
43. Els, P.S., Theron, N.J., Uys, P.E. and Thoresson, M.J., 2007, The Ride Comfort vs. Handling Compromise for Off-Road Vehicles, *Journal of Terramechanics*, Vol. 44, pp. 303–317.
44. Theron, N.J. and Els, P.S., 2007, Modelling of a semi-active hydropneumatic spring-damper unit, *International Journal of Vehicle Design*, Vol. 45, No. 4, pp. 501-521.
45. Uys, P.E., Els, P.S. and Thoresson, M.J., 2007, Suspension settings for optimal ride comfort of off-road vehicles travelling on roads with different roughness and speeds, *Journal of Terramechanics*, Vol. 44, pp. 163-175.
46. Uys, P.E., Els, P.S., Thoresson, M.J., Voigt, K.G. and Combrinck, W.C., 2006, Experimental determination of moments of inertia for an off-road vehicle in a regular engineering laboratory, *The International Journal of Mechanical Engineering Education*, Vol. 34, No. 4, pp. 291-314.
47. Els, P.S., Uys, P.E., Snyman, J.A. and Thoresson, M.J., 2006, Gradient-based approximation methods applied to the optimal design of vehicle suspension systems using computational models with severe inherent noise, *Mathematical and Computer Modelling*, Vol. 43, pp. 787-801.
48. Misselhorn, W.E., Theron, N.J. and Els, P.S., 2006 Investigation of hardware-in-the-loop for use in suspension development, *Vehicle System Dynamics*, Vol. 44, No. 1, pp. 65-81.
49. Uys, P.E., Els, P.S. and Thoresson, M.J., 2006, Criteria for Handling Measurement, *Journal of Terramechanics*, Vol. 43, pp. 43-67.
50. Els, P.S., 2005, The Applicability of Ride Comfort Standards to Off-Road Vehicles, *Journal of Terramechanics*, Vol. 42, pp. 47-64.
51. Giliomee, C.L., Els, P.S. and Van Niekerk, J.L., 2005, Anelastic Model of a Twin Accumulator Hydro-pneumatic Suspension System, *R & D Journal*, July 2005, pp. 11-17.
52. Els, P.S. and Uys, P.E., 2003, Investigation of the Applicability of the Dynamic-Q Optimisation Algorithm to Vehicle Suspension Design, *Mathematical and Computer Modelling*, Vol. 37, pp. 1029-1046.
53. Janse van Rensburg, N., Steyn, J.L. and Els, P.S., 2002, Time delay in a semi-active damper: Modelling the bypass valve, *Journal of Terramechanics*, Vol. 39, pp 35-45.

54. Els, P.S. and Van Niekerk, J.L., 2000, Dynamic modelling of an off-road vehicle for the design of a semi-active, hydropneumatic spring-damper system, *Vehicle System Dynamics*, Volume 33, Issue SUPPL., 2000, Pages 566-577
55. Els, P.S. and Grobbelaar, B., 1999, Heat Transfer Effects on Hydropneumatic Suspension Systems, *Journal of Terramechanics*, Vol. 36, pp. 197-205.
56. Els, P.S. and Holman, T.J., 1999, Semi-Active Rotary Damper for a Heavy Off-Road Wheeled Vehicle, *Journal of Terramechanics*, Vol. 36, pp. 51-60.
57. Giliomee, C.L. and Els, P.S., 1998, Semi-Active Hydropneumatic Spring and Damper System, *Journal of Terramechanics*, Vol. 35, pp. 109-117.
58. Els, P.S. and Grobbelaar, B. 1993, Investigation of the Time- and Temperature Dependency of Hydropneumatic Suspension Systems, SAE Technical Paper Series no. 930265, Published in *Vehicle Suspension and Steering Systems*, SAE Special Publication SP-256, pp. 55-65.

Publications accepted for publication in peer-reviewed or refereed journals:

1. Botha, T.R. and Els, P.S., Vehicle Centre of Mass, Roll-Centre and Pitch-Centre Height Estimation, submitted for publication in *IJVSMT*, March 2019.

Publications submitted for publication in peer-reviewed or refereed journals:

1. Bennett, R, Kapp, R.A., Botha, T.R. and Els, P.S., The Influence of Wireless Communication Transport Latencies and Dropped Packages on Vehicle Stability with an Offsite Steering Controller, submitted for publication in *IET Intelligent Transport Systems*, July 2019.
2. Feldesi, F., Botha, T.R. and Els, P.S., Full-field Strain Measurement of the Inside of an Agricultural Tyre During Static Vertical and Longitudinal Tests, submitted for publication in *Journal of Terramechanics*, July 2019.
3. Becker, C.M. and Els, P.S., Motion Resistance Measurement on Large Lug Tyres, submitted for publication in *Journal of Terramechanics*, 14 May 2019.
4. Poovendran, K., Botha, T.R. and Els, P.S., Brake Based Torque Vectoring Control of Vehicle Yaw Rate and Side-Slip Angle with Integrated Roll-Over Prevention, submitted for publication in *Vehicle System Dynamics*, 25 March 2019.
5. Jooste, J.S., Kat, C., Grant, C.C., Becker, P.J. and Els, P.S., Cardiovascular Response to Whole-Body Vibration on an Automobile Seat, submitted for publication in *Ergonomics*, 15 Feb 2019
6. Gräbe, R., Kat, C., Els, P.S. and Van Staden, P., Ride comfort difference thresholds using vertical seat vibration for a vehicle on a 4-poster test rig, submitted for publication in *Applied Ergonomics*, 24 May 2019.
7. Albinsson, A., Bruzelius, F., Els, P.S., Jacobson, B. and Bakker, E., Tire Vibration Considerations in Vehicle Based Tire Testing, submitted for publication in *Tire Science and Technology*, July 2017.

7.2 Books and/or chapters in books

Kolansky, J., Sandu, C., Botha, T.R. and Els, P.S., Multibody Dynamics Techniques for Real-Time Parameter Estimation, Chapter 6.3 of NATO Science for Peace and Security Series D: Information and Communication Security – Vol. 44, Advanced Autonomous Vehicle Design for Severe Environments, ISSN 1874-6268, IOS Press, 2015.

7.3 Published full-length conference papers/keynote addresses

Papers published in conference proceedings

1. Pegram, M., Botha, T.R. and Els, P.S., 2019, Full-field strain measurement of the contact patch via the inside tyre surface, Proceedings of the 26th IAVSD Symposium on Dynamics of Vehicles on Roads and Tracks, Gothenburg, Sweden, 12-16 August 2019.
2. Hamersma, H.A. and Els, P.S., 2019, Integrated chassis control for improved braking performance on rough roads, Proceedings of the 26th IAVSD Symposium on Dynamics of Vehicles on Roads and Tracks, Gothenburg, Sweden, 12-16 August 2019.
3. Botes, W., Botha, T.R. and Els, P.S., 2019, Sideslip angle measurement using direct DIC measurements and a kinematics based unscented Kalman filter, Proceedings of the 26th IAVSD Symposium on Dynamics of Vehicles on Roads and Tracks, Gothenburg, Sweden, 12-16 August 2019.
4. Kat, C. and Els, P.S., 2019, Effect of tire pressure on ride comfort from an integrated chassis control perspective, Proceedings of the 26th IAVSD Symposium on Dynamics of Vehicles on Roads and Tracks, Gothenburg, Sweden, 12-16 August 2019.
5. Van Der Westhuizen, M., Kat, C. and Els, P.S., Quantification of variation in car seat vibration input over a mission profile and comparison to typical driving conditions, Proceedings of the 26th IAVSD Symposium on Dynamics of Vehicles on Roads and Tracks, Gothenburg, Sweden, 12-16 August 2019.
6. Peenze, A. and Els, P.S., 2018, Semi-active suspension switching strategies on off-road vehicles for rollover prevention, Proceedings of the joint 10th Asia-Pacific Conference of ISTVS and 39th Annual Meeting of Japanese Society for Terramechanics, Kyoto, Japan, 11-13 July 2018.
7. Becker, C.M. and Els, P.S., 2018, Static and dynamic parameterization test rigs for large tyres, Proceedings of the joint 10th Asia-Pacific Conference of ISTVS and 39th Annual Meeting of Japanese Society for Terramechanics, Kyoto, Japan, 11-13 July 2018.
8. Feldesi, F., Botha, T.R. and Els, P.S., 2018, Improvement of 3D contact patch measurement using cameras inside rolling tyres, Proceedings of the joint 10th Asia-Pacific Conference of ISTVS and 39th Annual Meeting of Japanese Society for Terramechanics, Kyoto, Japan, 11-13 July 2018.
9. Berndt, A.E., Penny, W.C.W. and Els, P.S., 2017, Investigating Different Vehicle Velocity Estimators and an Adaptive Kalman Filter for Anti-Lock Braking Systems for Off-Road

- Vehicles, Proceedings of the 19th International & 14th European-African Regional Conference of the ISTVS, Budapest, September 25–27.
10. Botha, T.R., Guthrie, A.G., Jimenez, E., Els, P.S. and Sandu, C., 2017, Tyre Longitudinal Velocity and Slip Measurements from the Inside of a Tyre, Proceedings of the 19th International & 14th European-African Regional Conference of the ISTVS, Budapest, September 25–27.
 11. Guthrie, A.G., Botha, T.R., Jimenez, E., Els, P.S. and Sandu, C., 2017, Dynamic 3D Measurement of Tyre-Terrain Interaction, Proceedings of the 19th International & 14th European-African Regional Conference of the ISTVS, Budapest, September 25–27.
 12. He, R., Khan, A.K., Guthrie, A.G., Sandu, C. and Els, P.S., 2017, A Technical Survey on Terminology, Testing Methodologies, and Equipment Used in Modeling and Parameterization of Soft Soil for Vehicular Applications, Proceedings of the 19th International & 14th European-African Regional Conference of the ISTVS, Budapest, September 25–27.
 13. Johnson, D.K., Botha, T.R. and Els, P.S., 2017, Real-Time Slip Angle Measurements Using Digital Image Correlation, Proceedings of the 19th International & 14th European-African Regional Conference of the ISTVS, Budapest, September 25–27.
 14. Žuraulis, V., Van Der Merwe, N.S., Scholtz, O and Els, P.S., 2017, Modelling and Validation of a Testing Trailer for ABS and Tyre Interaction on Rough Terrain, Proceedings of the 19th International & 14th European-African Regional Conference of the ISTVS, Budapest, September 25–27.
 15. Wright, K.R.S. and Els, P.S., 2017, The Effects of Age on the Stiffness Properties of a SUV Tyre, Proceedings of the 19th International & 14th European-African Regional Conference of the ISTVS, Budapest, September 25–27.
 16. Ivanov, V. Augsburg, K., Savitski, D., Schreiber, V., Els, P.S. and Dhaens, M., Collaborative engineering of integrated chassis control for ground vehicle: Case study of lifelong learning technologies in automotive mechatronics, Proceedings of the 2017 IEEE International Conference on Mechatronics (ICM), Feb 2017, Churchill, Victoria, Australia. pp. 449–454.
 17. Spangenberg, U., Els, P.S. and Fröhling, R.D., Wheel-Rail design and maintenance considerations for Reducing Rail Rolling Contact Fatigue, Proceedings of the 25th IAVSD International Symposium on Dynamics of Vehicles on Roads and Tracks, Central Queensland University Rockhampton, from 14-18 August 2017.
 18. Hamersma, H.A. and Els, P.S., Wheel hop estimation on rough roads, Proceedings of the 25th IAVSD International Symposium on Dynamics of Vehicles on Roads and Tracks, Central Queensland University Rockhampton, from 14-18 August 2017.
 19. Els, P.S. and Scholtz, O., Sensitivity of tyre simulation to road profile measurement resolution, Proceedings of the 25th IAVSD International Symposium on Dynamics of Vehicles on Roads and Tracks, Central Queensland University Rockhampton, from 14-18 August 2017.
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21. Stallmann, M.J. and Els, P.S., The Challenging Task of Parameterizing Off-the-Road (OTR) FTire Models, 4th FTire User Meeting, 12 September 2017, Aachen, Germany
22. Botha, T.R., Els, P.S., Shoop, S.A., Becker, C.M. and Sopher, A., 2016, Three-Dimensional Rut Profile Measurement in Snow and Mud, Proceedings of the 8th ISTVS Americas Regional Conference, Troy, MI, September 12-14.
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26. Shoop, S.A., Els, P.S., Becker, C.M., Botha, T.R. and Sopher, A., 2016, Evaluation of Digital Image Correlation Technique for Off-Road Mobility in All-Season Conditions, Proceedings of the 8th ISTVS Americas Regional Conference, Troy, MI, September 12-14.
27. Sopher, A., Shoop, S.A., Stanley, J., Els, P.S., Becker, C.M. and Botha, T.R., 2016, Instrumentation and Testing of a High Mobility Multipurpose Wheeled Vehicle, Proceedings of the 8th ISTVS Americas Regional Conference, Troy, MI, September 12-14.
28. Wright, K.R.S. and Els, P.S., 2016, The Sensitivity of Static Tyre Tests and the Effects of Aged Tyres, Proceedings of the 10th South African Conference on Computational and Applied Mechanics, Potchefstroom, 3 – 5 October 2016.
29. Botha, T.R., Guthrie, A.G., Stallmann, M.J. and Els, P.S., 2016, The usage of digital image correlation in tyre research, Proceedings of the 10th South African Conference on Computational and Applied Mechanics, Potchefstroom, 3 – 5 October 2016.
30. Kat, C., Grabe, R. and Els, P.S., Ride comfort sensitivity to speed over different roads for an off-road vehicle, Proceedings of the 10th South African Conference on Computational and Applied Mechanics, Potchefstroom, 3 – 5 October 2016.
31. Botha, T.R. and Els, P.S., Kinematic analysis of a tyre rolling over rough terrain using digital image correlation, Proceedings of the 13th European Conference of the ISTVS, Rome, Italy, 2015
32. Botha, T.R. and Els, P.S., Rut measurement of soft soil terrain using digital image correlation, Proceedings of the 13th European Conference of the ISTVS, Rome, Italy, 2015
33. Becker, C.M. and Els, P.S., The applicability of the friction circle concept to off-road tyres, Proceedings of the 13th European Conference of the ISTVS, Rome, Italy, 2015
34. Penny, W.C.W. and Els, P.S., Anti-Lock Braking Systems on Rough Terrain, Proceedings of the 13th European Conference of the ISTVS, Rome, Italy, 2015
35. Dhaens, M, Els, P.S., Sandu, C, Savitski, S and Ivanov, V., State-of-the-art and Future Developments in Integrated Chassis Control for Ground Vehicles, Proceedings of the 13th European Conference of the ISTVS, Rome, Italy, 2015

36. Hamersma, H.A. and Els, P.S., Estimating the kinetic roll radius of a tyre on rough terrain, Proceedings of the 13th European Conference of the ISTVS, Rome, Italy, 2015
37. Hamersma, H.A. and Els, P.S., 2015, A comparison of quarter, half and full vehicle models with experimental ride comfort data, Proceedings of the ASME 2015 International Design Engineering Technical Conferences and Computers and Information in Engineering Conference (DETC/CIE2015), Boston, USA.
38. Grobler, J.F. and Els, P.S., Magneto-Rheological (MR) valve for use in hydro-pneumatic suspensions, Proceedings of the ASME 2015 International Design Engineering Technical Conferences and Computers and Information in Engineering Conference (DETC/CIE2015) , Boston, USA.
39. Stallmann, M.J. and Els, P.S., Parameterisation and validation of FTire model for large off-road tyres, 4th International Tyre Colloquium (20th and 21st April 2015), University of Surrey, Guildford, UK
40. Spangenberg, U, Fröhling, R and Els, P.S., Influence of wheel and rail profile shape on the initiation of rolling contact fatigue cracks at high axle loads, 24th IAVSD Symposium, 17-21 August 2015 in Graz, Austria.
41. Strydom, A, Scholtz, W and Els, P.S., Comparative study of magnetorheological damper models for force tracking, Proceedings of the ASME 2015 International Design Engineering Technical Conferences and Computers and Information in Engineering Conference (DETC/CIE2015).
42. Löwe, T.P. and Els, P.S., Modelling of a Passive Hydraulic Steering System for Locomotives, 24th IAVSD Symposium, 17-21 August 2015 in Graz, Austria.
43. Guthrie, A.G., Botha, T.R. and Els, P.S., 3D Computer Vision Contact Patch Measurements Inside Off-Road Vehicle Tyres, The 18th International Conference of the ISTVS, Seoul, Korea, September 22-25, 2014.
44. Botha, T.R. and Els, P.S., Rough Terrain Vehicle side-slip angle measurement using digital image correlation, The 18th International Conference of the ISTVS, Seoul, Korea, September 22-25, 2014.
45. Hamersma, H.A., Botha, T.R. and Els, P.S., Kinetic vs. Kinematic Roll Radius on Rough Roads, The 18th International Conference of the ISTVS, Seoul, Korea, September 22-25, 2014.
46. Bosch, H.B, Hamersma, H.A. and Els, P.S., FTire parameterisation of an SUV tyre, The 18th International Conference of the ISTVS, Seoul, Korea, September 22-25, 2014.
47. Strydom, A and Els, P.S., Vibration isolation analysis of a stabilized platform on a small off-road vehicle, The 9th South African Conference on Computational and Applied Mechanics, 14–16 January, 2014, Somerset West.
48. Botha, T.R. and Els, P.S., Tire Longitudinal Slip-Ratio Measurement Using a Camera, 2014 ASME International Design Engineering Technical Conferences (IDETC) and Computers and Information in Engineering Conference (CIE), 17-20 August, 2014, Buffalo-Niagara, NY, USA.
49. Strydom, A and Els, P.S., The Applicability of Hybrid Control to a Small Off-Road Vehicle

- Without a Differential, 2014 ASME International Design Engineering Technical Conferences (IDETC) and Computers and Information in Engineering Conference (CIE), 17-20 August, 2014, Buffalo-Niagara, NY, USA.
50. Kolanski, J, Sandu, C. and Els, P.S., Tire-Ground Normal Force Estimation from Vehicle System Identification and Parameter Estimation, 2014 ASME International Design Engineering Technical Conferences (IDETC) and Computers and Information in Engineering Conference (CIE), 17-20 August, 2014, Buffalo-Niagara, NY, USA.
 51. Linström, B.V. and Els, P.S., Real-Time Non-Linear Vehicle Dynamics Prediction Model, ISTVS 7th Americas Regional Conference, 4-7 Nov 2013, Tampa, Florida, USA.
 52. Botha, T.R. and Els, P.S., Three-Dimensional Road Profiling Using Stereography, ISTVS 7th Americas Regional Conference, 4-7 Nov 2013, Tampa, Florida, USA.
 53. Stallmann, J.M. and Els, P.S., Data Acquisition and Parameterization Procedure for Large, Off-Road Tires, ISTVS 7th Americas Regional Conference, 4-7 Nov 2013, Tampa, Florida, USA.
 54. Els, P.S., Botha, T.R., Hamersma, H.A. Becker, C.M., Savitski, D., Heidrich, L. and Höpping, K., The Effect of Controllable Suspension Settings On the ABS Braking Performance of an Off-Road Vehicle On Rough Terrain, ISTVS 7th Americas Regional Conference, 4-7 Nov 2013, Tampa, Florida, USA.
 55. Van Der Westhuizen, S.F. and Els, P.S., Comparison of Different Gas Models to Calculate the Spring Force of Hydropneumatic Suspension, ISTVS 7th Americas Regional Conference, 4-7 Nov 2013, Tampa, Florida, USA.
 56. Hamersma, H.A. and Els, P.S., The Development of a Longitudinal Control System for a Sports-Utility-Vehicle, Proceedings of the ASME IDETC/CIE 2013.
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 58. Kat, C., Johrendt, J.L. and Els, P.S., 2012, Computational Efficiency and Accuracy Comparison Of Leaf Spring Modelling Techniques, Proceedings of the ASME IDETC/CIE Conference, Chicago, 12 to 15 August 2012.
 59. Strydom, A, Els, P.S. and Kaul, S., 2012, Magneto-rheological (MR) Damper Modeling for Semi-active Control without Force Feedback, Proceedings of the ASME IDETC/CIE Conference, Chicago, 12 to 15 August 2012.
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 61. Botha, T.R. and Els, P.S., 2012, Road Friction Estimation using Stereography, Proceedings of the 12th European Regional Conference of the ISTVS, Pretoria, South Africa, 24 to 28 September 2012 (peer reviewed).
 62. Strydom, A and Els, P.S., 2012, Model Validation of Mini-Baja Vehicle, Proceedings of the 12th European Regional Conference of the ISTVS, Pretoria, South Africa, 24 to 28 September 2012 (peer reviewed).
 63. Hamersma, H.A. and Els, P.S., 2012, A Multi-body Longitudinal Dynamics Model of a Sports

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64. Becker, C.M. and Els, P.S., 2012, Wheel Force Transducer Measurements on a Vehicle in Transit, Proceedings of the 12th European Regional Conference of the ISTVS, Pretoria, South Africa, 24 to 28 September 2012 (peer reviewed).
 65. Faure, D., Theron, N.J. and Els, P.S., 2012, Vehicle Rollover Prevention using Rear Wheel Steering Control, Proceedings of the 12th European Regional Conference of the ISTVS, Pretoria, South Africa, 24 to 28 September 2012 (peer reviewed).
 66. Kat, C. and Els, P.S., 2012, Effect of Hysteresis in Steel Leaf Springs on Ride and Suspension Forces – Preliminary Study, Proceedings of the 12th European Regional Conference of the ISTVS, Pretoria, South Africa, 24 to 28 September 2012 (peer reviewed).
 67. Stallmann, J. and Els, P.S., 2012, Validation of Mathematical Tyre Models used in Vertical Vehicle Dynamics Simulations, Proceedings of the 12th European Regional Conference of the ISTVS, Pretoria, South Africa, 24 to 28 September 2012 (peer reviewed).
 68. Botha, T.R., Els, P.S. and Becker, C.M., 2012, Measuring Tyre Contact Patch Deformation using Stereography, Proceedings of the 12th European Regional Conference of the ISTVS, Pretoria, South Africa, 24 to 28 September 2012 (peer reviewed).
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 72. Botha, T.R. and Els, P.S., 2011, Profile optimisation of table top speed hump for speed control, Proceedings of the ASME IDETC/CIE 2011, Washington, DC, 28 to 31 August 2011 (peer reviewed).
 73. Els, P.S. and Becker, C.M., 2011, Characterisation of off-road tyres, Proceedings of the 17th International Conference of the ISTVS, Blacksburg, USA, 18 to 22 September 2011 (peer reviewed).
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 88. Uys, P.E., Els, P.S. and Thoresson, M.J., 2003, Validation of Handling Criteria, Proceedings of the 9th European Conference of the International Society for Terrain Vehicle Systems (ISTVS), Harper Adams, UK, 8-11 September, pp 532-553.

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92. Els, P.S. and Nell, S., 1999, Comparison Between Subjective and Objective Ride Comfort for Military Off-Road Vehicles , Proceedings of the 13th International Conference of the ISTVS, 14-17 September 1999, Munich, Germany.
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99. Els, P.S. and Grobbelaar, B., 1993, Investigation of the Time- and Temperature Dependency of Hydropneumatic Suspension Systems, SAE Technical Paper Series no. 930265, Presented at the International Congress and Exposition, Detroit, Michigan, 1-5 March.

Conference abstracts/papers accepted

1. Maake, K., Hamersma, H.A., Botha, T.R. and Els, P.S., Evaluation of cooperative collision avoidance algorithms for sensor selection by Monte Carlo simulation, Abstract submitted for the ISTVS-2019-PRAGUE Conference, 10 April 2019.

2. Botha, T.R., Feldesi, F. and Els, P.S., Full-field strain measurements of the inside of an agricultural tyre during static tests, Abstract submitted for the ISTVS-2019-PRAGUE Conference, 26 March 2019. Becker, C.M. and Els, P.S., Motion resistance measurements on large lug tyres, Abstract accepted for the ISTVS-2019-PRAGUE Conference, 1 April 2019.
3. He, R., Shenvi, M.N., Mousavi, H., Sandu, C., Braun, K., Kruger, R and Els, P.S., Updates of International Society for Terrain-vehicle Systems Standards, Abstract accepted for the ISTVS-
4. Hamersma, H.A., Dorin, C. and Els, P.S., Evaluation of trackless mobile machine collision management systems, paper accepted for the APCOM 2019 conference in Wroclaw
5. Albinsson, A., Bruzelius, F., Els, P.S., Jacobson, B. and Bakker, E., Tire Vibration Considerations in Vehicle Based Tire Testing, paper accepted for the 2017 Tire Society Conference, 12 and 13 Sept 2017, Akron, OH.
6. Valentin Ivanov, Klaus Augsburg, Dzmitri Savitski, Viktor Schreiber Schalk Els Miguel Dhaens Collaborative Engineering of Integrated Chassis Control for Ground Vehicle - Case study of lifelong learning technologies in automotive mechatronics" accepted for the IEEE ICM 2017 Australia, International Conference on Mechatronics, 13-15 Feb 2017, Federation University Australia, Gippsland.
7. Heymans, G.S., Els, P.S. and Grobler, J.F., Physics Based Modeling of a 4-State Semi-Active Suspension System based on MR Fluid Technology, abstract accepted for ASME IDETC 2016
8. Shoop, S., Sopher, A., Botha, T.R., Becker, C.M. and Els, P.S., Digital Image Correlation for Off-Road Mobility, 2016 Ground Vehicle Systems Engineering and Technology Symposium (GVSETS)

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- 1.

7.4 Non-refereed publications or popular articles

1. Els, P.S. and Nell, S., 1996, Better Mobility for Armoured Vehicles - Developing a Semi-Active Rotary Damper, SALVO - Armscor's Corporate Journal, 3/96, pp. 26-28.
2. Several SASOL Mini Baja Press releases and other general media documents
3. Stallmann, M.J. and Els, P.S., 2014, University focus: Rough calculations - Evaluation of tire models for large off-road truck simulations, Tire Technology International, November 2014, www.tiretechnologyinternational.com, pp.66-69.

7.5 Patents

1. Method of Determining Suspension Movement, Application Number 96/8546, 10 October 1996 (with S Nell).
2. Damper, Application Number 96/8545, 10 October 1996 (with S Nell).
3. Height Adjustment for a Vehicle Suspension, Application no. 96/9719, 20 November 1996 (with CL Giliomee)

7.6 Technical reports

1. Project 08210: JOHN DEERE Tire Tests - Part 1, October 2014
2. DARPA C2M2L-1: Terrain characterisation report, CSIR Document No GLBL-TBC-12-001, November 2012.
3. Seeker nosewheel characterisation, September 2009.
4. Dynamic modeling of the SEEKUR Autonomous Vehicle Platform (Authors: HGA Breytenbach, CJ Barnard and PS Els), January 2009.
5. Tests performed on an AFRIT tandem-tandem interlink combination, BE at UP Report number MA4080, December 2007.
6. Braking and Cornering Tests Performed on a Caterpillar 793D Dump Truck, April 2007.
7. Controllable Wheeled Vehicle Suspension Research Phase III – Final Technical Report, July 2005.
8. Fatal risk analysis protocol: Light vehicles: Making rollover ratings operational, Document No: MegO_0501, Revision 0, July 2005, Co-authored by Dr PE Uys.
9. Controllable Wheeled Vehicle Suspension Research Phase II – Final Technical Report, November 2003, (co-authored by Prof NJ Theron)
10. Controllable Wheeled Vehicle Suspension Research – Final Technical Report, August 2002, (co-authored by Prof NJ Theron)
11. Unitrans timber trailer stress test report, July 1999.
12. User's manual: Tyre contact software, October 1999.
13. Test report: Handling measurements on the HSEV, November 1999.
14. Test report: Handling measurements on Fireking, November 1999.
15. Report: BLV front axle failure investigation (phase 1), February 1999.
16. Report: BLV front axle failure investigation (phase 2), February 1999.
17. Evaluation of ride comfort criteria Phase 2: Experimental design, February 1998.
18. Evaluation of ride comfort criteria Phase 3: Test report, July 1998.
19. Test report: Trailer handling and stability tests for Unitrans, October 1998.
20. Feasibility study: Hydropneumatic suspension for the G6-52, September 1998.
21. Test instruction: Mamba "No-spin" differential tests, January 1998.
22. Test report: Mamba "No-spin" differential, May 1998.
23. The Bevameter technique for determining soil characteristics, May 1998.
24. Development of a test procedure to determine ride comfort limited lap times, February 1998.
25. Test report: Validation of tyre test procedures, October 1998.
26. Opmeet van bane fase 1: Identifikasie van terreine (Terrain measurement phase 1: Terrain identification), Februarie 1998.
27. RSA-MIL-STD for mobility – Phase 2: Mobility model, May 1998.
28. RSA-MIL-STD for mobility phase 1: Definitions, standards and software, March 1998.
29. Verslag: Verbetering van semi-aktiewe dempers (Report: Improvement of semi-active

- dampers), October 1997.
30. Test Report: Semi-active dampers for the Olifant 1B MBT, September 1997.
 31. Verslag: Beheerstrategieë vir semi-aktiewe hidropneumatiese veer- en demperstelsel (Report: Control strategies for semi-active hydropneumatic spring-damper system), September 1997.
 32. Projekstudieverslag: Ontwikkeling van semi-aktiewe dempers vir PTD (Project study report: Development of semi-active dampers for PTD), March 1997.
 33. Evaluation of ride comfort criteria Phase 1: Literature study, December 1997.
 34. Toetsverslag: Pantser tegnologiedemonstrator (Ratel Lobo), November 1997.
 35. Test instruction: Semi-active rotary dampers for the G6-52, June 1997.
 36. Test report: Semi-active rotary dampers for the G6-52, August 1997.
 37. Toetsverslag: Ratel stuurdemper ondersoek (Test report: Ratel steering damper investigation), Januarie 1997.
 38. Simulation study: Semi-active rotary dampers for the Alvis Stormer tracked vehicle, July 1997.
 39. Feasibility study: Semi-active rotary dampers fir the G6-52, January 1997.
 40. Feasibility study: Hydropneumatic suspension for Warrior, May 1997.
 41. Test report: Semi-active rotary damper, March 1996.
 42. Verslag: Ontwikkeling van 'n semi-aktiewe hidropneumatiese veer- en demperstelsel (Report: Development of a semi-active hydropneumatic suspension system), November 1996.
 43. Test report: Semi-active rotary damper, March 1996.
 44. Toetsverslag: Wielspringstoetse op Mamba Mk 2 (Test report: Wheel alignment tests on Mamba Mk 2), February 1996.
 45. Verslag: Ontwikkeling van 'n semi-aktiewe hidropneumatiese veer- en demperstelsel (Report: Development of a semi-active hydropneumatic spring-damper system), November 1996.
 46. Toetsverslag: Rooikat 105 remstuurtoetse (Test report: Rooikat 105 brake steer tests), July 1996.
 47. Toetsinstruksie: Ambition versnellingsmetings tydens lugneerlating (Test instruction: Ambition acceleration measurements during air-drop) September 1995.
 48. Toetsverslag: Ambition versnellingsmetings tydens lugneerlating (Test report: Ambition acceleration measurements during air-drop), October 1995.
 49. Toetsverslag: Kwalifikasietoetse vir alternatiewe Rooikat dempers (Test report: Qualification tests for alternative Rooikat dampers), July 1995.
 50. Verslag: Mamba Mk 2 suspensie-optimering (Report: Mamba Mk 2 suspension optimisation), October 1995.
 51. Feasibility study: Semi-active rotary dampers for the Olifant 1B MBT, April 1995.
 52. Toetsverslag: Falcon ewenaar (Test report: Falcon differential), May 1995.
 53. Toetsinstruksie: 1B HGT semi-aktiewe demper suspensietoetse (Test instruction: 1B MBT semi-active damper suspension tests), March 1995.
 54. Simulasie en eksperimentele ondersoek na semi-aktiewe demping vir die Olifant 1B HGT (Simulation and experimental investigation of semi-active damping for the Olifant 1B MBT), June 1994.

55. Rusperloopstelseltechnologie: Automatische rusperspanmeganisme (Tracked vehicle running gear technology: Automatic track tensioner mechanism), March 1994.

8. OTHER SCHOLARLY RESEARCH-BASED CONTRIBUTIONS

8.1 Participation in conferences, workshops and short courses - specify type of contribution

Provide full details of participation in national and international conferences etc

8.1.1 National

1. SIMTEQ 2019 – presented paper
2. ESTEQ ECC 2018 – presented paper
3. SACAM 2012 – Scientific committee, reviewed 4 abstracts.
4. SACAM 2012 – Session Chair
5. SACAM 2010 – Scientific committee, reviewed 7 abstracts.
6. South African Council for Automation and Computation (SACAC) Post-Graduate Control Systems Day, University of Pretoria, 2 December 2005. Presented a paper.
7. Automotive Noise, Vibration and Harshness, University of Pretoria, 16-17 September 1996. Attended.
8. Mobility short course, October 2001, Pretoria. Presented part of the curriculum.
9. Mathematical optimization short course, University of Pretoria. Attended.
10. Mathematical optimization workshop, University of Pretoria. Attended.

8.1.2 International

1. Member of Program Committee for the 15th ISTVS European-African Regional Conference, Prague, Czech Republic, 2019
2. Member of Program Committee for 10th Asia-Pacific Conference of ISTVS 2018 (AP ISTVS 2018), Kyoto, Japan, 2018.
3. ASME 19th International Conference on Advanced Vehicle Technologies (AVT) Program co-chair for 2017 ASME IDETC conference in Cleveland.
4. Technical Committee Member and Session chair for the 19th International & 14th European-African Regional Conference of the ISTVS, Budapest, September 25–27, 2017.
5. ASME 18th International Conference on Advanced Vehicle Technologies (AVT) Program co-chair for 2016 ASME IDETC conference in North Carolina.
6. Technical Committee Member and Session chair for the 8th Americas Regional Conference of the ISTVS, Detroit, Michigan, September 12-14, 2016.
7. Technical Committee Member and Session chair at the 18th International Conference of the ISTVS, Seoul, Korea, September 22-25, 2014.
8. Technical Committee Member and Session chair/co-chair for two sessions at the 7th Regional Americas Conference of the ISTVS, Tampa, Florida, USA, 4-7 November 2013.
9. Conference organiser of the 12th European Regional Conference of the ISTVS, Pretoria,

South Africa, 24 to 28 September 2012.

10. Session chair/co-chair for two sessions at the 17th International Conference of the ISTVS, Blacksburg, USA, 18 to 22 September 2011
11. ASME IDETC/CIE 2011, Washington, DC, 28 to 31 August 2011. Attended and co-authored 2 papers.
12. 17th International Conference of the ISTVS, Blacksburg, USA, 18 to 22 September 2011. Attended, co-authored 5 papers, presented 1 paper, received “Best paper award” in the “Vehicle Dynamics, Mobility and Safety” session.
13. Joint 9th Asia-Pacific ISTVS Conference and Annual Meeting of the Japanese Society for Terramechanics, 27 to 30 September 2010, Sapporo, Japan. Attended, co-authored 5 papers, presented 1 paper.
14. 11th European Regional Conference of the International Society for Terrain Vehicle Systems (ISTVS), 5 to 8 October 2009, Bremen, Germany. Attended, co-authored 4 papers, presented 1 paper.
15. 16th International conference of the International Society for Terrain Vehicle Systems (ISTVS), 25 to 28 November 2008, Torino, Italy. Attended.
16. 20th IAVSD International Symposium: Dynamics of Vehicles on Roads and Tracks, Berkeley, California, 13-17 August 2007, Co-authored 2 papers
17. Advances in Off-road Vehicle Mobility Evaluation, Carleton University, Ottawa, 18-21 August 1997. Attended
18. Fundamentals of Terramechanics and Soil Vehicle Interaction, Cranfield University and Royal Military College of Science, Shrivenham, United Kingdom, 7-8 September 1998. Attended.
19. Workshop on ‘Passive and Active Damping – Prospects for the Next Decade’, Neu-Ulm/Germany from June 18 to 20, 2001. Presented 1 paper.

8.2 Teamwork and collaboration with others:

Other researchers (national and international)

1. Dr Sally Shoop - Cold Regions Research and Engineering Laboratory (CRREL) of the US Army
2. Prof Corina Sandu – Virginia Polytechnic Institute and State University (Virginia Tech)
3. Prof Valentin Ivanov, Ilmenau University of Technology, Germany
4. Many other international researchers at Chalmers, TU Delft, TU Ilmenau, Tenneco Automotive etc. through EU project participation.

Other research institutions (national and international)

1. Collaboration with the Tank Automotive Command (TACOM) of the United States Army on advanced road vehicle suspension research
2. Collaboration with BHP Billiton on rollover assessment
3. CSIR DPSS on vehicle mobility
4. CSIR MIAS on Autonomous vehicle modeling and control

5. Bloodhound SSC (supersonic car), new British land speed record attempt, on terrain profiles and tyre characteristics.
6. ARMSCOR on wheeled vehicle mobility
7. Cold Regions Research and Engineering Laboratory (CRREL) of the US Army ERDC
8. Geotechnical and Structures Laboratory (GSL) of the US Army ERDC
9. Virginia Polytechnic Institute and State University (Virginia Tech)
10. KTH Royal Institute of Technology, Sweden
11. Ilmenau University of Technology, Germany
12. Cosin (Developers of F-Tire), Esslingen, Germany

Industry

1. DCD Rolling Stock
2. Bell equipment
3. Horstman Defense
4. BHP Billiton
5. AFRIT
6. De Beers
7. Denel
8. Gerotek
9. Armscor
10. CSIR DPSS
11. ESTEQ Engineering

Participation in EU Projects

- 1) Award of EU Project, OWHEEL, that started in August 2019
- 2) External Academic Advisor for EU ITEAM project (2018)
- 3) Partner organisation for EU RISE Project, EVE. This project resulted in large scale exchange of staff and students. A total of 28 months of visits to South Africa (inbound) and 36 months of *International Visits (outbound) where VDG staff and students performed research at TU Delft (Netherlands), TU Ilmenau (Germany), Virginia Tech (USA), ITA (Spain) and Tenneco Automotive (Belgium).*

8.3 Membership in national and international bodies

1. Editor for Journal of Terramechanics (from August 2014)
2. Member of the Vehicle Design committee (VDC) of the ASME Design Engineering Division (DED), 2012 to present.
3. American Society of Mechanical Engineers (ASME): Member (2011 to present)

4. International Society for Terrain Vehicle Systems (ISTVS):

Deputy General Secretary for Europe-Africa (From 2017)

Member of Board of Directors and Regional Secretary for Africa (from August 2009)

Member 2008 to present

5. Member of the Editorial board of International Journal of Vehicle Systems Modelling and Testing (IJVSMT), (June 2010)

6. SAIMEchE (1990 to present)

7. SAE International:

Member (1993 to present)

Baja SAE rules committee (2001 to present)

8.4 Visits to local and overseas universities or research institutes as guest professor or researcher

1. Guest Professor lecturing the vehicle dynamics module of the Masters degree course in Race Car Engineering, Ismans, Le Mans, France, 2008 (2 weeks) and 2009 (2 weeks)
2. Collaborative research with Prof C Sandu at Virginia Polytechnic Institute and State University, 2011 (2 weeks)

9. ARTISTIC OUTPUTS (if applicable)

Not applicable

10. MANAGEMENT AND ADMINISTRATIVE DUTIES

Departmental activities

1. Vehicle Dynamics Group (VDG) research group leader (2011 to present)
2. SASOL Baja SAE Challenge / Competition organiser (1999 to 2009)
3. SASOL Baja SAE Faculty Advisor (1999 to present)
4. Vehicle Engineering Laboratory (1999 to present)
5. Management of workshop (2011 to present)
6. Undergraduate portfolio (2010 to 2012)

11. COMMUNITY SERVICE OR PROFESSIONAL SKILLS

11.1 Outreach projects

SASOL Mini Baja competition – Involves Mechanical Engineering students from Universities and Universities of Technology in South Africa, as well as international competitors from the USA, India, Iran and Botswana, Russia, Turkey.

11.2 Professional service performed

Professional registration (e.g. ECSA), Pr Eng (22 May 2003)

Professional Societies, SAE Mini Baja rules committee (2001 to present)

*TV appearances: Mini Baja Topcar programme
Kyknet Mini Baja (24 minutes) (2004, 2005)
e-tv Morning edition Mini Baja (2003, 2004, 2005, 2006)
SABC Morning Live (2003)
Rapid Motion on Supersport (2006,2007,2008,2009)*

*Radio appearances: SABC RSG Interview on Mini Baja Competition
SABC Radio Interview on Mini Baja Competition
SABC SAfm interview on suspension and autonomous vehicles
research (2008)*

Mobility Course presented to members of the SANDF and ARMSCOR personnel

11.3 Clinical service

Not applicable

11.4 Involvement with other universities/scientific institutions

1. Opponent for PhD student, Aalto University, Finland, 2016
2. Examiner for M.Eng dissertation, University of Stellenbosch, 2016
3. Examiner for M.Eng dissertation, University of Stellenbosch, 2015
4. Member of PhD committee for a PhD student at Virginia Tech, 2013.
5. Collaborative research with Ilmenau University of Technology, 2011-present
6. Collaborative research with Virginia Polytechnic Institute and State University, 2011-present.
7. Examiner for PhD thesis, Indian Institute of Technology, Bombay, September 2010
8. Examiner for M.Eng dissertation, University of Stellenbosch, February 2009.
9. Examiner for a final year project for University of the Witwatersrand, 2007.
10. Examiner for a final year design for University of the Witwatersrand, 2007.
11. Examiner for M.Eng dissertation, University of Stellenbosch, July 2005.
12. Baja SAE– see above, 1999 to present

11.5 Referee duties

2019:

- 1) Refereed 1 paper for Vehicle System Dynamics
- 2) Refereed 2 papers for Proc. IMechE, Part D: Journal of Automobile Engineering

3) Refereed 2 papers for ASME IDETC2019 Conference

2018:

- 1) Refereed 1 paper for Vehicle System Dynamics
- 2) Refereed 1 paper for International Journal of Vehicle Performance
- 3) Refereed 3 papers for Proc. IMechE, Part D: Journal of Automobile Engineering

2017:

- 1) Refereed 1 paper for Journal of Intelligent Material Systems and Structures
- 2) Refereed 1 paper for Journal of Advanced Transportation
- 3) Refereed 1 paper for Shock and Vibration
- 4) Refereed 1 paper for Tire Science and Technology
- 5) Refereed 1 paper for Measurement
- 6) Refereed 1 paper for Vehicle System Dynamics
- 7) Refereed 1 paper for Mechanical Systems and Signal Processing
- 8) Refereed 4 papers for ISTVS conference
- 9) Refereed 4 papers for ASME IDETC conference

2016:

- 1) Refereed 1 paper for Vehicle System Dynamics
- 2) Refereed 4 papers for ISTVS Conference
- 3) Refereed 2 papers for ASME IDETC
- 4) Refereed 1 paper for Journal of Low Frequency Noise, Vibration and Active Control

2015:

- 1) Refereed 1 paper for Vehicle System Dynamics

2014:

- 1) Refereed 1 paper for International Journal of Acoustics and Vibration
- 2) Refereed 1 paper for ASME Journal of Vibration and Acoustics
- 3) Refereed 4 papers for Journal of Terramechanics
- 4) Refereed 1 paper for Journal of Dynamic Systems, Measurement and Control
- 5) Refereed 1 paper for Nonlinear Dynamics
- 6) Refereed 1 paper for International Journal of Automotive Engineering and Technologies
- 7) Refereed 1 paper for SAE International Journal of Commercial Vehicles

2013:

- 1) Refereed 1 paper for Journal of Terramechanics
- 2) Served on 1 NRF Panel

2012:

1. Refereed 2 papers for Journal of Terramechanics
2. Refereed 4 proposals and served on NRF panel

3. Refereed 1 paper for ASME Journal of Dynamic Systems, Measurement and Control,
4. Refereed 1 paper for British Journal of Applied Science & Technology

2011:

1. Refereed 4 papers for Journal of Terramechanics
2. Refereed 1 paper for International Journal of Vehicle Design
3. Refereed 1 paper for International Journal of Heavy Vehicle Systems
4. Refereed proposals and served on an NRF panel

2010:

1. Examiner for PhD thesis, Indian Institute of Technology, Bombay, September 2010
2. Refereed 4 papers for Journal of Terramechanics
3. Refereed 1 paper for International Journal of Reliability and Safety
4. Refereed 1 paper for CSIR Science real and relevant conference
5. Refereed 1 paper for International Journal of Vehicle Systems Modelling and Testing
6. Refereed 3 papers for SACAM 2010 proceedings.

2009:

1. Refereed a paper for ASTM International Journal of Testing and Evaluation
2. Refereed a paper for Applied Mathematics and Computation (AMC) journal
3. Refereed a paper for Journal of Terramechanics
4. Refereed 7 abstracts for SACAM 2010 conference

2008:

1. Refereed a paper for the "SENSORS" Journal published by "Molecular Diversity Preservation International (MDPI, <http://www.mdpi.org>), Basel, Switzerland.
2. Refereed a paper for International Journal of Vehicle Systems Modelling and Testing (IJVSMT).
3. Refereed 2 papers for Journal of Terramechanics.

2007:

1. Appointed Guest Editor (with N.J. Theron and J.L. Steyn) for International Journal of Vehicle Design (IJVD) Special Issue on: "Extending the Envelope of the Ride-Handling Trade-off".
2. Refereed 2 papers for Journal of Terramechanics.
3. Refereed a paper for HEFAT2007 (5th International Conference on Heat Transfer, Fluid Mechanics and Thermodynamics) conference.
4. Refereed a paper for Journal of Zhejiang University SCIENCE (A&B).

2005:

1. Examiner for M.Eng dissertation, Mr N Behari, Comparison of dynamic models of humans sitting on seats, University of Stellenbosch, July 2005.

2. Refereed Innovation Fund proposal for NRF (Jan 2005).

2001:

1. Refereed a paper for ASME Journal of Dynamic Systems, Measurement and Control.

12. AWARDS AND SCIENTIFIC/SCHOLARLY RECOGNITION

12.1 Evaluation status as scientist/scholar

NRF Rating B2, January 2019.

12.2 Research awards and prizes

1. "Best paper award" at ISTVS 2017, Budapest, for paper: He, R., Khan, A.K., Guthrie, A.G., Sandu, C. and Els, P.S., 2017, A Technical Survey on Terminology, Testing Methodologies, and Equipment Used in Modelling and Parameterization of Soft Soil for Vehicular Applications, Proceedings of the 19th International & 14th European-African Regional Conference of the ISTVS, Budapest, September 25–27.
2. "Best Student Paper" was awarded to 'Measurement of Tire Carcass inside Deformation' by Glenn Guthrie, Theunis Botha, Carl Becker, Schalk Els, Ariana Sopher & Sally Shoop, 8th Americas Regional Conference of the ISTVS, Detroit, USA, 12-14 September 2016
3. "Best paper award" for: Penny, W.C.W. and Els, P.S., Anti-Lock Braking Systems on Rough Terrain, Proceedings of the 13th European Conference of the ISTVS, Rome, Italy, 2015
4. "Best paper award" for: Botha, T.R. and Els, P.S., Kinematic analysis of a tyre rolling over rough terrain using digital image correlation, Proceedings of the 13th European Conference of the ISTVS, Rome, Italy, 2015
5. Best paper award for Bosch, H.B, Hammersma, H.A. and Els, P.S., FTire parameterisation of an SUV tyre, The 18th International Conference of the ISTVS, Seoul, Korea, September 22-25, 2014.
6. ASME Design Engineering Division, Vehicle Design Technical Committee presented the 2014 AVT Best Student Paper Award to Anria Strydom and Schalk Els for their paper entitled "The Applicability of Hybrid Control to a Small Off-Road Vehicle Without a Differential" at the 16th International Conference on Advanced Vehicle Technologies, Buffalo, NY, USA, 18 August 2014.
7. "High recommendation for presentation" at the 7th Regional Americas Conference of the ISTVS, Pretoria, Tampa, Florida, USA, 4-7 November 2013
8. Anria Strydom received the "Best student award" for 2013 from the CSIR DPSS for her research as a CSIR bursar.
9. "Best presentation award" at the 12th European Regional Conference of the ISTVS, Pretoria, South Africa, 24-28 September 2012 for the paper: Kat, C. and Els, P.S., Effect of Hysteresis

in Steel Leaf Springs on Ride and Suspension Forces – Preliminary Study.

10. "High recommendation for presentation" at the 12th European Regional Conference of the ISTVS, Pretoria, South Africa, 24-28 September 2012 for the paper: Stallmann, M.J. and Els, P.S., Validation of Mathematical Tyre Models used in Vertical Vehicle Dynamics Simulations.
11. "Best paper award" in the "Vehicle Dynamics, Mobility and Safety" session of the 17th International Conference of the ISTVS, Blacksburg, USA, 18 to 22 September 2011 for the paper: Van Der Westhuizen, S.F. and Els, P.S., Slow active suspension control for rollover prevention (peer reviewed conference proceedings).
12. "Best presentation award" the 11th European Regional Conference of the International Society for Terrain Vehicle Systems (ISTVS), 5 to 8 October 2009, Bremen, Germany. For the paper: Breytenbach, H.G.A. and Els, P.S., Off-road vehicle suspension optimisation for increased structural fatigue life.

12.3 Teaching awards and prizes

Departmental (Mechanical and Aeronautical Engineering) Teaching and Learning Award for 2018 (awarded in 2019)

12.4 Artistic awards and prizes

Not applicable