UNIVERSITY OF PRETORIA

CURRICULUM VITAE

1. BIOGRAPHICAL SKETCH

1.1 GENERAL INFORMATION

Surname	Heyns						
First names	Philippus Stephanus						
Citizenship	South African	**Title**	Prof	**Female**		**Male**	X
Department	Mechanical and Aeronautical Engineering	**Position**		Professor Director Centre for Asset Integrity Management			
Direct Telephone	+2712 420 2432	**Direct Telefax**		N.A.			
E-mail	stephan.heyns@up.ac.za						

1.2 ACADEMIC QUALIFICATIONS OBTAINED

Degree/ Diploma	Field of study	Higher education institution	Year	Distinctions
BSc(Eng)	Mechanical Engineering	University of Pretoria	1977	Cum Laude
BSc(Eng) (Hons)	Mechanical Engineering	University of Pretoria	1978	Cum Laude
MEng	Mechanical Engineering	University of Pretoria	1982	Cum Laude
PhD	Mechanical Engineering	University of Pretoria	1988	N.A.

1.3 WORK EXPERIENCE TO DATE

Name of employer	Capacity and/or type of work	Period
CSIR (NIAST)	Chief Engineer	Jan 1979 – Mar 1982
University of Pretoria	Senior Lecturer – Professor Director Centre for Asset Integrity Management	Apr 1982 – present July 2014 - present

2. TEACHING ACTIVITIES

2.1 Courses presented

Course	Level	Self developed
Dynamics 210	BEng (2nd year)	No
Turbomachinery 410	BEng (4th year)	Yes
Vibrations and Noise 320	BEng (3rd year)	Yes
Project 400	BEng (4th year)	No
Design 410	BEng (4th year)	No
Structural Dynamics 780	BEng(Hons) (Post-graduate)	Yes
Dynamics 780	BEng(Hons) (Post-graduate)	Yes
Vibration 732	BEng(Hons) (Post-graduate)	Yes
Condition Based Maintenance 732	BEng(Hons) (Post-graduate)	Yes
Vibration based condition monitoring MEV781	BEng(Hons) (Post-graduate)	Yes
Experimental Structural Dynamics MSY783	BEng(Hons) (Post-graduate)	Yes
Life Cycle Management	EPPEI Post-graduate programme	Yes

3. TEACHING OUTPUTS

3.1 Educational publications and products

Heyns,P.S. Transient dynamics of rigid rotors on flexible bearings. *International Journal of Mechanical Engineering Education*, vol.17, no.3, 1989, pp.197-204.

Heyns,P.S. An optimization approach to vibration isolation of rigid bodies. *International Journal of Mechanical Engineering Education*. vol.25, no.3, 1997, pp.165-175.

4. OTHER TEACHING CONTRIBUTIONS

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

Member of ECSA Aeronautical Professional Advisory Committee, 2000 – 2017

5. POSTGRADUATE SUPERVISION

Name of student	Degree	Year	Supervisor	Co-supervisor
Post- Doctoral				
1. Pal S	Post doc	2007	Prof PS Heyns	
2. Aye SA	Post-doc	2017	Prof PS Heyns	
3. Asaadi E	Post-doc	2017	Prof PS Heyns	
4. Diamond DH	Post-doc	2017	Prof PS Heyns	
5. Schmidt S	Post-Doc	2019	Prof PS Heyns	
6. Hoseinzadeh S	Post-Doc	2019	Prof PS Heyns	
Doctoral				
1. Raath AD	PhD	1993	Prof PS Heyns	
2. Heyns M	PhD	1994	Prof PS Heyns	
3. Nel CB	DTech	1998	Prof K Vorster	Prof PS Heyns
4. Scheffer C	PhD	2003	Prof PS Heyns	Prof Z Katz
5. Du Plooy NF	PhD	2004	Prof PS Heyns	
6. Stander CJ	PhD	2005	Prof PS Heyns	
7. Wannenburg J	PhD	2007	Prof PS Heyns	Prof AD Raath
8. Oberholster A.J.	PhD	2010	Prof PS Heyns	
9. Wang K.S.	PhD	2011	Prof PS Heyns	
10. Aye SA	PhD	2014	Prof PS Heyns	
11. Dymond ASD	PhD	2014	Prof PS Heyns	Prof S Kok
12. Eksteen JJA	PhD	2014	Prof PS Heyns	
13. Ngwangwa HM	PhD	2015	Prof PS Heyns	
14. Mbawalla SJ	PhD	2016	Prof G Heymann	Prof PS Heyns
15. Freyer B	PhD	2016	Prof NJ Theron	Prof PS Heyns
16. Asaadi E	PhD	2016	Prof PS Heyns	
17. Diamond DH	PhD	2017	Prof PS Heyns	Dr AJ Oberholster
18. Talai S	DTech	2017	Dr DA Desai	Prof PS Heyns

19. Omoregbee HO	PhD	2018	Prof PS Heyns	
20. Fourie D	PhD	2018	Prof PS Heyns	
21 Crous J	PhD	2019	Prof S Kok	Prof PS Heyns
22. Schmidt S	PhD	2019	Prof PS Heyns	
23. Chen JS	DEng	2019	Dr DA Desai	Prof PS Heyns
Masters				
1. Velleman DH	MEng	1985	Prof PS Heyns	
2. Nieuwoudt MC	MEng	1986	Prof PS Heyns	
3. Benadé JG	MEng	1986	Prof PS Heyns	
4. Petzer CA	MEng	1990	Prof PS Heyns	
5. McGrath JH	MEng	1989	Prof PS Heyns	
6. Van Niekerk JL	MEng	1989	Prof PS Heyns	
7. Lippert KG	MEng	1989	Prof PS Heyns	
8. Van der Walt JC	MEng	1990	Prof PS Heyns	
9. Benadé W	MEng	1993	Prof PS Heyns	
10. Bahneman WF	MEng	1992	Prof PS Heyns	
11. Heyns M	MEng	1991	Prof PS Heyns	
12. Neethling P	MEng	1991	Prof PS Heyns	
13. Starker E	MEng	1994	Prof PS Heyns	
14. Van Wyk AJ	MEng	1993	Prof PS Heyns	Prof JA Snyman
15. Fröhling R	MEng	1992	Prof PS Heyns	Dr HS Scheffel
16. Grobler DZ	MEng	1994	Prof PS Heyns	
17. Vári LM	MEng	1996	Prof PS Heyns	
18. Marwala T	MEng	1997	Prof PS Heyns	
19. Engelbrecht A	MEng	2000	Prof PS Heyns	
20. Scheffer C	MEng	2000	Prof PS Heyns	Prof JA Snyman
21. Du Plooy NF	MEng	2000	Prof PS Heyns	
22. Stander CJ	MEng	2000	Prof PS Heyns	
23. Strydom JPD	MEng	2000	Prof PS Heyns	

24. Kriel TES	MEng	2000	Prof PS Heyns	
25. Smit WG	MEng	2002	Prof PS Heyns	
26. Cronjé J	MEng	2003	Prof PS Heyns	Dr P Loveday Prof NJ Theron
27. Oberholster AJ	MEng	2004	Prof PS Heyns	
28. Van der Hoven M	MEng	2004	Prof PS Heyns	Prof KJ Craig
29. Mdlazi LMZ	MEng	2004	Prof PS Heyns	Prof T Marwala Dr CJ Stander
30. Van den Berg G	MEng	2004	Prof PS Heyns	
31. Ngwangwa HM	MEng	2005	Prof PS Heyns	F van Tonder
32. Hugo D	MEng	2005	Prof PS Heyns	Prof RJ Thompson Prof A Visser
33. Schön PP	MEng	2006	Prof PS Heyns	
34. Wolfaardt HJ	MEng	2006	Prof PS Heyns	
35. Grove AP	MEng	2007	Prof PS Heyns	F van Tonder
36. Herzog M	MEng	2007	Prof PS Heyns	Prof T Marwala
37. Eggers B	MEng	2008	Prof PS Heyns	Dr CJ Stander
38. Wang K	MSc	2008	Prof PS Heyns	
39. Buys B	MEng	2009	Prof PS Heyns	Dr P Loveday
40. De Smidt M	MEng	2009	Prof PS Heyns	Dr CJ Stander
41. Aye SA	MSc	2010	Prof PS Heyns	
42. Spangenberg U	MEng	2011	Prof PS Heyns	
43. Sambayi P	MSc	2013	Prof PS Heyns	
44. Bhana V	MEng	2013	Prof PS Heyns	
45. Prinsloo T	MEng	2013	Prof PS Heyns	
46. Scheepers, R.	MEng	2014	Prof PS Heyns	
47. Booysen C	MEng	2014	Prof PS Heyns	
48. Crous J	MEng	2014	Prof PS Heyns	Prof J Dirker
49. Conradie JM	MEng	2015	Prof PS Heyns	Prof PS Els
50. Kruger A	MEng	2015	Prof PS Heyns	
51. Kroch RJ	MEng	2015	Prof PS Heyns	
52. Möller MJ	MEng	2015	Prof JL Coetzee	Prof PS Heyns
53. Diamond D	MEng	2015	Prof PS Heyns	Dr AJ Oberholster
54. Vinson RG	MEng	2015	Prof PS Heyns	Dr T Heyns

55. Gwashavanhu B	MEng	2015	Prof PS Heyns	Dr AJ Oberholster
56. Masenya M	MEng	2015	Prof PS Heyns	
57. Church C	MEng	2016	Prof PS Heyns	
58. Jami A	MSc	2016	Prof PS Heyns	
59. Xivambu L	MTech	2016	Dr D Desai	Prof PS Heyns
60. Smit JC	MEng	2017	Prof PS Heyns	
61. Brits J	MEng	2017	Prof PS Heyns	Dr HM Inglis
62. Schmidt S	MEng	2017	Prof PS Heyns	Dr P de Villiers
63. De Waal R	MSc(Ing)	2017	Dr A Bekker	Prof PS Heyns
64. Qin C	MTech	2017	Dr D Desai	Prof PS Heyns
65. Van Niekerk PJ	MIng	2018	Prof PS Heyns	
66. Du Toit RG	MIng	2018	Prof PS Heyns	Dr DH Diamond
67. Hayes AJJ	MIng	2018	Prof PS Heyns	
68. Van der Walt JN	MIng	2018	Prof PS Heyns	Dr DN Wilke
69. Van Niekerk JL	MIng	2018	Prof PS Heyns	Dr M Hindley
70. Roos WA	MEng	2018	Prof PS Heyns	
71. Pyper A	MEng	2018	Prof PS Heyns	
72. Van Zyl J	MEng	2018	Prof PS Heyns	Prof J Wannenburg
73. Lelo NA	MSc(App Sci)	2018	Prof PS Heyns	Prof J Wannenburg
74. Mofoka TK	MTech	2018	Dr D Desai	Prof PS Heyns
75. Armfield D	MEng	2019	Prof S Kok	Prof PS Heyns
76. Browne R	MEng	2019	Prof J Wannenburg	Prof PS Heyns
77. Booyse W	MEng	2019	Prof PS Heyns	Prof DN Wilke
78. Louw C	MEng	2019	Prof PS Heyns	
79. Deetlefs R	MEng	2019	Prof PS Heyns	Prof DN Wilke
80. Mare C	MEng	2019	Prof PS Heyns	Dr D Dunn
81. Brits L	MEng	2019	Prof PS Heyns	Dr HM Inglis

In process:

Name of student	Degree	Supervisor	Co-supervisor(s)
Doctoral			
Gwashavanhu B	PhD	PS Heyns	AJ Oberholster
Edward AB	PhD	PS Heyns	
Jami A	PhD	PS Heyns	
Van der Walt JN	PhD	PS Heyns	DN Wilke
Lelo NA	PhD	PS Heyns	J Wannenburg
Masters			
Visagie J	MEng	PS Heyns	
Dyer R	MEng	PS Heyns	JA Heyns
Collins B	MEng	PS Heyns	S Kok
Pienaar S	MEng	PS Heyns	AJ Oberholster
Ludeke R	MEng	PS Heyns	DN Wilke
Bosch K	MEng	PS Heyns	M Johannes
Robbins S	MEng	PS Heyns	JA Heyns
Baggerohr S	MEng	PS Heyns	DN Wilke
Berrange J	MEng	PS Heyns	
Qambela C	MEng	PS Heyns	H Inglis
Ellis B	BEng(Hons)	PS Heyns	
Janse van Vuuren G	BEng(Hons)	PS Heyns	
Jordaan H	BEng(Hons)	PS Heyns	
Marsden I	BEng(Hons)	PS Heyns	J Wannenburg
Coetzer J	BEng(Hons)	PS Heyns	
Niehaus N	BEng(Hons)	PS Heyns	S Schmidt
Harat R	BEng(Hons)	PS Heyns	
Balshaw R	BEng(Hons)	PS Heyns	
Marx D	BEng(Hons)	PS Heyns	

6. RESEARCH FUNDING

6.1 Obtaining research funds

Origin of research funds	Title of research project or programme	Duration	Money allocated (R)
Eskom	Research projects EPPEI Plant Asset Management Chair (running)	5 years 10 years	R 3 m R 30 m
Exxaro	Chair in Maintenance Engineering (now being renegotiated)	10 years	R 4.5 m
Weir Minerals	Chair in Condition Monitoring (contracting being finalized)	5 years	R 3 m
Rand Water	Chair in Mechanical Engineering (running)	5 years	R 5 m
THRIP	Smart monitoring	3 years	R 5 m

7. RESEARCH OUTPUTS

7.1 Publications in peer-reviewed or refereed journals

Heyns,P.S. 'n Prosedure vir die berekening van vloei deur assimmetriese kanale. S A Tydskrif vir Natuurwetenskap en Tegnologie, vol.2, no.6, 1983, pp.92-103 (English: A procedure for the computation of flow through axi-symmetric channels).

Heyns,P.S. Transient dynamics of rigid rotors on flexible bearings. International Journal of Mechanical Engineering Education, vol.17, no.3, 1989, pp.197-204.

Lippert,K.G.,Heyns,P.S.&McFadyen,I.C. Multi-frequency rotor isolation for heavier helicopters. Aeronautica Meridiana, vol.8, 1990, pp.39-57.

Neethling,P.L. & Heyns,P.S. Launch behaviour of a flexible missile and flexible launcher. Aeronautica Meridiana. vol.9, 1991, pp.45-58.

Hasse,G.W. & Heyns,P.S. 'n Verbeterde laaitempo vir 'n vryhangende mynhysbak. R&D Journal. vol.8, no.2, 1992, pp. 8-11. (English: An improved loading rate for free hanging mine skips.)

Van Wyk,A.J., Snyman,J.A. & Heyns,P.S. Optimization of a vibratory conveyor for reduced support reaction forces. R&D Journal. vol.10, no.1, 1994, pp.12-17.

Snyman,J.A., Heyns,P.S. & Vermeulen,P.J. Vibration isolation of a mounted engine through optimization. Mechanism and Machine Theory. vol.30, no.1, 1995, pp.109-118.

Grobler,D.Z. & Heyns,P.S. Verbetering van numeriese modelle met behulp van eksperimentele data. SA Tydskrif vir Natuurwetenskap en Tegnologie, vol.14, no.1, 1995, pp.4-11. (English: Updating numerical models by means of experimental data.)

Heyns,P.S. Modal testing with natural excitation using a time series approach. R&D Journal, vol.11, no.2, 1995, pp.34-39.

Heyns,P.S. & Benadé,W.N.v.d.S. Optimisation of vibration absorbers for aircraft cannon. The Aeronautical Journal of the Royal Aeronautical Society, vol.100, no.993, March 1996, pp.87-90.

Heyns,P.S. An optimization approach to vibration isolation of rigid bodies. International Journal of Mechanical Engineering Education. vol.25, no.3, 1997, pp.165-175.

Heyns,P.S. & Heyns,M. Simulation of mining conveyance dynamics. Journal of The Institution of Mining and Metallurgy, May-August 1997, vol.106, A77-A83.

Vári,L.M. & Heyns,P.S. Strain modal testing – a critical appraisal. R&D Journal. November 1997, vol.13, no.3, pp.83-90.

Marwala,T. & Heyns,P.S. Multiple criterion method for determining structural damage. AIAA Journal, August 1998, vol.36, no.8, pp.1494-1501.

Marwala,T. & Heyns,P.S. New criteria for comparing frequency response functions, R&D Journal, vol.14, no.3, 1998, pp.49-55.

Heyns,M. & Heyns,P.S. Guidelines for the design of guide-roller assemblies for mining conveyances. Transactions of the Institution of Mining and Metallurgy. Section A. Mining Industry. September-December 1998, pp.A137-A145.

Van Niekerk,J.L., Heyns,P.S. & Heyns,M. Human vibration levels in the South African mining industry. Journal of the South African Institute of Mining and Metallurgy, vol.100, no.4, July/August 2000, pp.235-242.

Stander,C.J. & Heyns,P.S. A discrete piezoelectric stack absorber model. R&D Journal, vol.17, no.1, 2001, pp.1-7.

Scheffer,C. & Heyns,P.S. Masjiengereedskap-toestandmonitering en optimering van masjineringsprosesse – 'n Oorsig. SA Tydskrif vir Natuurwetenskap en Tegnologie, vol.20, no.2, June 2001, pp.35-44.

Scheffer,C. & Heyns,P.S. Wear monitoring in turning operations using vibration and strain measurements. Mechanical Systems and Signal Processing, vol.15, no.6, November 2001, pp.1185-1202.

Strydom,J.P.D., Heyns,P.S. & Van Niekerk,J.L. Development of a vibration absorbing handle for rock drills. Journal of the Institute of Mining and Metallurgy, vol.102, no.3, April 2002, pp.167-172.

Stander,C.J., Heyns,P.S. & Schoombie,W. Using vibration monitoring for local fault detection on gears operating under fluctuating load conditions. Mechanical Systems and Signal Processing, vol 16, no 6, November 2002, pp.1005-1024.

Smit,W.G. & Heyns,P.S. Fan blade damage detection using on-line vibration monitoring. R&D Journal, vol.18, no.3 November 2002, pp.77-90.

Scheffer,C., Kratz,H., Heyns,P.S. & Klocke,F. Development of a tool wear monitoring system for hard turning. International Journal for Machine Tools and Manufacture, vol.43, 2003, pp.973-985.

Scheffer,C. & Heyns,P.S. An industrial tool wear monitoring system for interrupted turning. Mechanical Systems and Signal Processing, vol.18, no.5, 2004, pp.1219-1242.

Cronjé,J.M., Heyns,P.S. Theron,N.J. & Loveday,P.W. Development of a variable stiffness and damping tuneable absorber. Journal of Vibration and Control, vol.11, 2005, pp.381-396.

Stander,C.J. & Heyns,P.S. Instantaneous angular speed monitoring of gearboxes under non-cyclic stationary conditions. Mechanical Systems and Signal Processing, vol.19, 2005, pp.817-835.

Du Plooy,N.F., Heyns,P.S. & Brennan,M.J. The development of a tunable vibration absorbing isolator. International Journal of Mechanical Sciences.,vol. 47, 2005, pp.983-997.

Scheffer,C., Engelbrecht,H. & Heyns,P.S. A comparative evaluation of neural networks and hidden Markov models for monitoring turning tool wear. Neural Comput. & Applications. vol. 14, pp.325-336, 2005.

Oberholster, AJ & Heyns,P.S. On-line fan blade damage detection using neural networks. Mechanical Systems and Signal Processing. vol. 20, no. 1, January 2006, pp. 78-93.

Stander, CJ & Heyns, PS. Transmission path phase compensation for gear monitoring under fluctuating load conditions. Mechanical Systems and Signal Processing, vol. 20, no.7, October 2006, pp.1511-1522.

Ngwangwa,HM., Heyns,P.S. & Van Tonder,F. Assessment of structural damage using operational time responses and finite element simulation. Journal of Sound and Vibration, vol. 296, issues 1-2, September 2006, pp.23-45.

Thompson, R.J., Visser, A.T., Heyns, P.S. & Hugo, D. Mine road maintenance management using haul truck response measurements. Institute of Mining, Metallurgy and Materials, Transactions A, vol.115, no.4, December 2006, pp.123-128.

Van Tonder, F., Heyns, P.S. & Wannenburg, J. Dynamic response in the fatigue analysis of a structure due to unknown narrowband stochastic loading. SA Journal of Science, vol.102, 2006, pp.1-6.

Eggers, B.L., Heyns, P.S & Stander, C.J. Using computed order tracking to detect gear condition aboard a dragline. Journal of the Institute of Mining and Metallurgy, vol. 107, February 2007.

Phillips, J.I., Heyns, P.S. & Nelson, G. A comparative study of noise and vibration emitted by rock drills used in South African Mines. Annals of Occupational Hygiene, vol. 51, no. 3, 2007, pp. 305-310.

Hugo, D. Heyns, S.P. Thompson, R.J. & Visser, A.T. Condition-triggered maintenance for mine haul roads with reconstructed-vehicle response to haul road defects. Transportation Research Record: Journal of the Transportation Research Board, no. 1989, Low Volume Roads, vol.2, 2007, pp.254-260.

Heyns, P.S. Tool condition monitoring using vibration measurements – a review. Insight, vol. 49 no 8, August 2007, pp. 447-450.

Grové, A.P., Van Tonder, F & Heyns, P.S. A critical investigation of techniques for stress determination and equivalent static analysis in fatigue life estimation. Fatigue and Fracture of Engineering Materials, vol.30, 2007, pp1030-1043.

Wolfaardt, H.J. & Heyns, P.S. Dynamic modelling of a novel microfluidic channel angular accelerometer. Journal of Vibration and Control, vol.14, no.4, pp.451-467, 2008.

Freyer, B.H., Theron, N.J. & Heyns, P.S. Simulation of tool vibration control in turning using a self-sensing actuator. Journal of Vibration and Control, vol.14, pp.999-1019, 2008.

Wannenburg, J. & Heyns, P.S. The derivation of structural usage profiles for vehicles from failure statistics, International Journal of Vehicle Design, vol.47, nos1/2/3/4, pp.269-289, 2008.

Hugo, D., Heyns, P.S., Thompson, R.J. & Visser, A.T. Haul road defect identification and condition assessment using measured truck response. *Journal of Terramechanics,* vol.45, no.3, pp.79-88, 2008.

Herzog, M.A. Marwala, T. & Heyns, P.S. Machine and component residual life estimation through the application of neural networks. *Reliability Engineering and System Safety,* 94, no.2, pp.479-489, 2009.

Oberholster, A.J & Heyns, P.S. Online condition monitoring of axial-flow turbomachinery blades using rotor-axial Eulerian laser Doppler vibrometry. *Mechanical Systems and Signal Processing.* vol.23, no.5, July 2009, pp. 1634-1643.

Buys, B.J., Heyns, P.S. & Loveday, P.W. Rock bolt condition monitoring using ultrasonic guided waves. *South African Journal of the Institute of Mining and Metallurgy*. vol.108, Feb 2009.

Wang, K. & Heyns, P.S. Vold-Kalman filter order tracking in vibration monitoring of electrical machines. *Journal of Vibration and Control,* vol.15, no.9, 1325-1347, 2009.

Wannenburg, J., Heyns, P.S. & Raath, A.D. Application of a fatigue equivalent static load methodology for the numerical durability assessment of heavy vehicle structures. *International Journal of Fatigue,* vol.31, 2009, pp.1541-1549.

Ngwangwa, H.M., Heyns, P.S., Labuschagne, F.J.J and Kululanga, G.K. Reconstruction of road defects and road roughness classification using vehicle responses with artificial neural networks simulation. Journal of Terramechanics, vol.47, pp.97-111, 2010.

Wannenburg, J, & Heyns, P.S. An overview of numerical methodologies for durability assessment of vehicle and transport structures. International Journal of Vehicle Systems Modelling and Testing, vol. 5, no. 1, June 2010, pp.72-101.

Oberholster, A.J. & Heyns, P.S. Online blade damage identification on a multi-blade test rotor using rotor-axial Eulerian laser Doppler vibrometry. *Mechanical Systems and Signal Processing,* vol.25, 2011, pp.344-359.

Wang, K.S. & Heyns, P.S. Application of computed order tracking, Vold-Kalman filtering and EMD in rotating machine vibration. *Mechanical Systems and Signal Processing,* vol.25, 2011, 416-430.

Wang, K.S. & Heyns, P.S. The combined use of order tracking techniques for enhanced Fourier analysis of order components. *Mechanical Systems and Signal Processing,* vol.25, 2011, pp.803-811.

Pal, S. Heyns, P.S. Freyer, B.H., Theron, N.J. & Pal.S.K. Tool wear monitoring and selection of optimum cutting conditions with progressive tool wear effect and input uncertainties. Journal of Intelligent Manufacturing, vol.1, no.4, 2011, pp.491-504.

Aye, S.A. & Heyns, P.S. Effect of speed and torque on statistical parameters in tapered bearing fault detection. World Academy of Science, Engineering and Technology, vol.78, 2011, pp.759-761.

Wang, K.S. and Heyns, P.S. An empirical re-sampling method on intrinsic mode function to deal with speed variation in machine fault diagnostics. Applied Soft Computing, vol.11, no.8, 2011, pp.5015-5027.

Aye, S.A. & Heyns, P.S. The evaluation of whole-body vibration in a South African open cast mine. *Journal of the South African Institute of Mining and Metallurgy, v*ol.111, November 2011, p751-757.

Heyns, T., Godsill, S.J., De Villiers, J.P. and Heyns, P.S. Statistical gear health analysis which is robust to fluctuating loads and operating speeds. *Mechanical Systems and Signal Processing,* vol.27, 2012, pp.651-666.

Wang, K.S. Guo, D. and Heyns, P.S. The application of order tracking for vibration analysis of a varying speed rotor with a propagating transverse crack. Engineering Failure Analysis. 21, 2012, pp.91-101.

Heyns, T, Heyns, P.S. and De Villiers, J.P. A method for real-time condition monitoring of haul roads based on Bayesian parameter estimation. Journal of Terramechanics, 49, 2012, pp.103-113.

Heyns, T, De Villiers, J.P. and Heyns P.S. Consistent haul road condition monitoring by means of vehicle response normalisation with Gaussian Processes. Engineering Applications of Artificial Intelligence, vol.25, 2012, pp.1752-1760.

Heyns, T., Heyns, P.S. and De Villers, J.P. Combining synchronous averaging with Gaussian mixture model novelty detection scheme for vibration-based condition monitoring of a gearbox. vol.32, 2012, pp.200-215.

Heyns, T., Heyns, P.S. and Zimroz, R. Combining discrepancy analysis with sensorless signal resampling for condition monitoring of rotating machines under fluctuating operations. *International Journal of Condition Monitoring*, vol.2. no.2, 2012, pp.1-7.

Ngwangwa, H.M., Heyns, P.S., Breytenbach, H.G.A. and Els, P.S. 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, 2014, pp.1-18.

Heyns, T, Heyns, P.S. and De Villiers, J.P. A method for real-time condition monitoring of haul roads based on Bayesian parameter estimation. Journal of Terramechanics, 49, 2012, pp.103-113.

Freyer, B.K., Heyns P.S & Theron, N.J. Comparing orthogonal and unidirectional strain component processing for tool condition monitoring. *Journal of Intelligent Manufacturing,* vol. 25, 2014, pp. 473-487.

Booysen, C., Heyns, P.S., Hindley, M.P. & Scheepers, R. Fatigue life assessment of a low pressure steam turbine blade during transient resonant conditions using a probabilistic approach. *International Journal of Fatigue,* vol.73, 2015, pp. 17-26.

Dymond, A.S., Engelbrecht, A.P., Kok, S. and Heyns P.S. Tuning optimization under multiple objective function evaluation budgets*. IEEE Transactions on Evolutionary Computation*, vol.19, no.3, June 2015, pp. 341-358.

Aye, S.A. and Heyns, P.S. Acoustic emission-based prognostics of slow rotating bearing using Bayesian techniques under dependent and independent samples. Applied Artificial Intelligence. vol. 29, no 6, 2015, 563-596.

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Aye, S.A. Heyns, P.S. Condition monitoring of tapered roller bearings: A photogrammetric approach. Proceedings of SPIE vol 8351, Third Asia Pacific Optical Sensors Conference. 31 January – 3 February 2012, Sydney, Australia.

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Asaadi, E., Kok S and Heyns P.S. Using inverse mapping to directly solve inverse problems. 4th International Conference on Engineering Optimization. Lisbon, Portugal. 8-11 September 2014.

Diamond, D.H., Heyns, P.S. and Oberholster, A.J. A comparison between three blade tip timing algorithms for estimating synchronous turbomachine blade vibration. World Conference of Engineering Asset Management, Pretoria, October 2014.

Aye, S.A, Heyns, P.S. and Thiart, C.J.H. Diagnostics of slow rotating bearings using a novel DAI based on acoustic emission. Proceedings of the 4th International Conference on Condition Monitoring of Machinery in Non-stationary Operations. Lyon, France, December, 15-16, 2014.

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Brits, J.C.P., Heyns, P.S. Inglis, H.M. Fatigue crack life estimation of a notched blade-like component using finite element modelling. 10th South African Conference on Computational and Applied Mechanics, Potchefstroom, 2016.

Crous, J.M., Kok, S. and Heyns, P.S. An alternative approach to system identification. 10th South African Conference on Computational and Applied Mechanics, Potchefstroom, 2016.

Heyns, P.S., Vinson, R. and Heyns, T. Rotating machine diagnostics using smart feature selection under non-stationary operating conditions. 19th World Conference on non-destructive testing, Munich, 2016.

Fourie, D.J., Grabe, P.J. Heyns and Frohling, R.D. Analysis of railway wheel squeal due to unsteady longitudinal creepage using the complex eigenvalue method. International Workshop on Railway Noise, 12-16 September 2016.

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Armfield, D., Ludeke, R., Heyns, S. Pietra, F. and Glaser, D. Conceptual uncertainties with respect to finite element modelling of laser shock peening. 6th International Conference on laser peening and related phenomena. 6 – 11 November 2016. South Africa.

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De Waal, R.J.O., Bekker, A. and Heyns, P.S. Bi-polar full-scale measurements of operational loading on polar vessel shaft-lines. Proceedings of the 24th International Conference on Port and Ocean Engineering under Arctic Conditions, 11-16 June 2017, Busan, Korea.

Edward, A.B., Heyns, P.S. and Pietra, F. Shotpeening modelling and simulation for RCS assessment. International conference on sustainable material processing and manufacturing, SMPM 2017, 23-25 January 2017, Kruger National Park, South Africa.

Schmidt, S., Heyns, P.S. and De Villiers, J.P. Discrepancy signal processing techniques for gearbox condition monitoring applications. 1st World Congress on Condition Monitoring, 13-16 June 2017, London, UK.

Heyns, P.S. and Church, C.B. An improved blade force response model for non-intrusive blade vibration monitoring and signal simulation. 1st World Congress on Condition Monitoring, 13-16 June 2017, London, UK.

Heyns, P.S., Kruger, A. and Oberholster, A.J. Transient dynamic finite element modelling of flexible rotor systems with non-linear fluid film bearings and faults. 1st World Congress on Condition Monitoring, 13-16 June 2017, London, UK.

Gwashavanhu, B., Heyns, S.P. and Oberholster, A.J. Statistical shape analysis as a non-contact method for condition monitoring of turbomachines – a sensitivity analysis. IncoME-II 2017, Proceedings of 2nd International Conference on Maintenance Engineering, 5-6 September 2017, Manchester, UK.

Wei, D., Wang, K.S., Heyns, P.S. and Zuo, M.J. Convolutional neural networks for fault diagnosis using rotating speed normalised vibration. IEEE International Conference on Prognostics and Health Management. 11-13 June 2018, Seattle, USA.

Schmidt, S., Heyns, P.S., Gryllias, K. A probabilistic novelty detection methodology based on the order frequency spectral coherence. CMMNO 2018, Santander, Spain, 20 – 22 July 2018.

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Baggerohr, S., Booyse, W., Heyns and Wilke, D.N. Novel bearing fault detection using generative adversarial networks. Comadem 2018, Sun City, South Africa, 3-5 July 2018.

Desai, D.A., Talai, S.M. and Heyns, P.S. Investigation of infrared thermography as a dual online diagnostic tool for dynamic structural health monitoring. Comadem 2018, Sun City, South Africa, 3-5 July 2018.

Louw, P.S. and Heyns, P.S. Remaining useful life prediction and uncertainty modelling with Bayesian deep learning. Comadem 2018, Sun City, South Africa, 3-5 July 2018.

Schmidt, S., Heyns, P.S. and Gryllias, K.C. Discrepancy analysis for gearbox condition monitoring: A comparison of different healthy data models. Comadem 2018, Sun City, South Africa, 3-5 July 2018.

Van der Walt, J.C., Heyns, P.S. and Wilke, D.N. Pipe network leak detection: Sensor placement optimisation using support vector machines and a model-based leak detection technique. Comadem 2018, Sun City, South Africa, 3-5 July 2018.

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Heyns, P.S., Deetlefs, R., Oberholster, A.J. Botha, T. Els, P.S. and Diamond, D.H. Computer vision for rail surface defect detection. The Sixteenth International Conference on Condition Monitoring and Asset Management, Glasgow, 25-27 June 2019.

Schmidt, S., Mauricio, A.R., Heyns, P.S. Gryllias, K.C. A new method for identifying diagnostic rich frequency bands under varying operating conditions. SURVISHNO, Lyon, 8010 July 2019.

Heyns, P.S., Ellis, B. Diamond, D.H., Du Toit, R.G. and Scheepers, R. Towards the use of hybrid models for diagnosis and prognosis in turbomachinery health management, SURVISHNO, Lyon, 8010 July 2019.

7.4 Keynote papers

Heyns, P.S. and Oberholster, A.J. Laservibrometry in asset integrity management. Measuring by Light. International Meeting on Optical Measurement Techniques and Industrial Applications. 20-21 November 2013, Shell Rijswijk, The Netherlands.

Heyns, P.S. & Eksteen, J.J.A. Asset integrity testing using response reconstruction in the time domain. South African Conference on Computational and Applied Mechanics, SACAM, 14 – 16 January 2014, Somerset-West, South Africa.

Heyns, P.S. Perspectives on condition monitoring in an asset integrity context. Condition Monitoring 2014, 10-12 June 2014, Manchester, United Kingdom.

Heyns, P.S. Variable operating condition monitoring research at the University of Pretoria. Workshop on 'Reliability design and fault diagnosis for gearbox of wind turbines', Zhejiang Sci-Tech University, 15-16 July 2017.

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Heyns, P.S. Reflections on vibration monitoring under variable speed and load conditions. 2 nd World Conference of Condition Monitoring, Singapore, December 2019.

Heyns, P.S. Title to be finalised. The 5th International Conference on Maintenance Engineering IncoME-V 2020. Zhuhai, China. 15 – 17 April 2020.

7.5 Non-refereed publications or popular articles

Heyns,P.S. Tools for vibration troubleshooting. *The South African Mechanical Engineer*, vol.45, no.7, 1995, pp.15-18.

Stander, C.J. & Heyns, P.S. Mechanical fault diagnostics through time frequency analysis. Mechanical Technology, July 2004, pp.22-25.

Heyns, P.S., Oberholster, A.J. & Thoresson, M. Measuring vibration with lasers? *The South African Mechanical Engineer*, vol.56, no.11, 2006, pp.25-26.

Heyns, P.S. & Oberholster, A.J. Laser vibrometry in asset integrity management,
International Meeting on Optical Measurement Techniques and Industrial Applications, Rijswijk, Netherlands, 20-21 November 2013.

7.6 Patents

Vibration Isolator. Canadian patent No.2, 489,103. WO/2003/104675, CA2489103, AU3240160, ZA2002/4586.

Vibration Isolator. South African patent No 2004/9891

A method and system for monitoring rotor blades of a turbomachine using blade tip timing. BTT reduced sampling method. PCT/IB2017/053827. World Intellectual Property Organisation. WO 2018/002818A1.

A method and system for measuring rotor blade tip deflection using blade tip timing (BTT). BTT Instantaneous resonance detection. PCT/IB2017/053828. World Intellectual Property Organisation. WO 2018/002819A1.

7.6 Technical reports

Several hundred Laboratory for Advanced Engineering, Research Enterprises at University of Pretoria, Business Enterprises at University of Pretoria and Enterprises at University of Pretoria.

8. OTHER SCHOLARLY RESEARCH-BASED CONTRIBUTIONS

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

8.1.1 National

N&V93 Chairman of Technical Committee, N&V95 Chairman of Organizing Committee SACAM2004, SACAM2014 Member of Advisory Committee.

8.1.2 International

Session chairman at Comadem, Condition Monitoring, SURVISHNO, ISMA and IMAC conferences.

Member of international scientific advisory board, *The International Conference on Structural Engineering, Mechanics and Computation, SEMC2001*, Cape Town 2001, 2004, 2007, 2010, 2013, 2016.
Member of International Scientific Advisory Committee, Condition Monitoring: Cambridge 2005, Harrowgate 2008, Dublin 2009, Stratford-upon-Avon 2010, London 2012, Krakow 2013, Manchester 2014.
Vice chairman of Condition Monitoring: 2009 - 2015.
Member of International Advisory Committee: ACAM6 Australia 2010.
Member of Scientific Committee: CMMNO 2012 Tunisia, CMMNO 2013 Ferrara, CMMNO14 Lyon.
Member of Editorial Board ISRN Mechanical Engineering Hindawi.
Member of Editorial Advisory Board International Journal of Condition Monitoring and Diagnostic Engineering Management
Member of the Scientific Committee of the Seventh International Congress on Design and Modelling of Mechanical Systems CMSM2017, 27 to 29 March 2017, Hammamet, Tunisia.

8.2 Teamwork and collaboration with others:

University of Aachen, Tool vibration monitoring, 2001-2002
North-West University, Vibration monitoring, 2000-2001
Vaal University of Technology, Vibration monitoring, 2000 – 2005
Institute of Sound and Vibration, University of Southampton, Vibration attenuation, 2001 - 2005
University of the Witwatersrand, Artificial intelligence in monitoring, 2003 – 2009
Indian Institute of Technology Kharagpur, 2006 – 2010
University of Malawi, Blantyre, 2006 – 2010
Tsinghua University, Beijing, 2008 – 2011
University of Electronic Science and Technology of China, 2011 - present
University of Johannesburg, Johannesburg, 2009 – 2016
UNISA, Pretoria, 2010 – 2017
Tshwane University of Technology, Pretoria, 2012 – present
Lulea University of Technology, Lulea, 2012 - 2014
University of Stellenbosch: 2014 – 2017
Catholic University of Leuven, 2016-present.
University of Lyon, 2019.
University of Huddersfield, 2019.
University of Alberta, 2019.

8.3 Membership in national and international bodies

Hon Fellow: SA Institute for Mechanical Engineering.
Fellow: SA Academy of Engineering (previous Exco member 2012 - 2016)
Fellow: Southern African Acoustics Institute (President: 1996/1997)
Fellow: International Society of Engineering Asset Management
Fellow: Royal Aeronautical Society.
Member: South African Academy for Science and Art (Chairman: Engineering Division and member Faculty Board for several terms.)
Member: Society for Experimental Mechanics
Member: International Society for Condition Monitoring
Member: International Institute of Acoustics and Vibration
Member: Southern African Asset Management Association

9. COMMUNITY SERVICE OR PROFESSIONAL SKILLS

9.1 Professional service performed

Registered as professional engineer

Responsible for the development of a turbine for a low-cost turbojet engine, as well as several projects relating to the protection of aircraft from infrared missiles (1979-1982).
Since 1982 when joining the University of Pretoria maintained very active links with industry, through the Laboratory for Advanced Engineering, REatUP, and currently BEatUP at the University of Pretoria. This work has led to broad exposure to South African industry and abroad, ranging from the military and aeronautical industries to mining and manufacturing. Most of this work was in the vibrations and structural dynamics fields. Clients include: Aerosud, Amcoal, Anglo American Corporation, Autocar, Armscor, Anglo American Corporation, Bell Equipment, Bombela, BKS, Caterpillar, CSIR, Cummins Diesel Engines, Denel, Engart Africa, Eskom, Joy Mining Machinery, Lemförder, PetroSA, Nissan, Robor Cold Form, Paramount, Samcor, Sasol, Sasol Mining, SIMRAC, TES, Thales Defence Systems, Transnet and many others, as well as conducted and managed analysis and testing projects to the value of millions of Rand. Current focus is on Asset Integrity Management over the entire life cycle.

9.5 Referee duties

Refereed articles for:
Advances in Acoustics and Vibration, Applied Soft Computing, Engineering Asset Management Review, International Journal of Acoustics and Vibration, International Journal of Condition Monitoring, International Journal of Systems Science, Insight, International Journal of Vehicle Design, IEEE Transactions on Instrumentation and Measurement, Journal of Intelligent Material Systems and Structures, Journal of Mechanical Engineering, Journal of the Operational Research Society, Journal of Sound and Vibration, Journal of Quality in Maintenance Engineering, Journal of Terramechanics, Measurement, Mechanical Systems and Signal Processing, R&D Journal, SA Tydskrif vir Natuurwetenskap en Tegnologie, SAICE Journal, Scientia Iranica, Shock and Vibration, Structural Engineering and Mechanics, Technical Acoustics, Transactions of the Institution of Mining and Metallurgy, The ASME Journal of Manufacturing Science and Engineering, The Royal Society: Proceedings Mathematical, Physical and Engineering Sciences, World Applied Sciences Journal.

Acted as external examiner for masters and doctoral theses and programs at:
Anna University (India), Blekinge University of Technology (Sweden), Curtin University of Technology (Australia), Northwest University (South Africa), University of New South Wales (Australia), University of Western Australia (Australia), Indian Institute of Technology Guwahati (India), Indian Institute of Technology (Kharagpur), Tshwane University of Technology (South Africa), University of Kwa-Zulu Natal (South Africa), University of the Witwatersrand (South Africa), University of Johannesburg (South Africa), Stellenbosch University (South Africa).

10. AWARDS AND SCIENTIFIC/SCHOLARLY RECOGNITION

10.1 Evaluation status as scientist/scholar

B3 NRF researcher

10.2 Research awards and prizes

Mellon Foundation grants.
Rand Coal Award for research paper in R&D Journal.
South-African Institute of Mechanical Engineering Bronze Medals for research papers in R&D Journal.
South-African Institute of Mechanical Engineering Silver Medal for research paper in R&D Journal.
Best Paper Award Theme 4 6th International Conference on Managing Pavement
Best Paper:Transportation Engineering Division SAICE.

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