Section A: Overview of the Research Project

1. *Title of the research project*
   Optimization of Single Element Radio Astronomy Antennas

2. *Broad area of research (Engineering or Science):* Engineering

3. *Academic level of research project (Masters or Doctoral):* Doctoral

4. *Abstract of research project*
   This project will develop full pipeline optimization algorithms for antennas of single element radio astronomy instruments. Physical parameters of the antenna will be tuned, while the resulting beams simulated through a pipeline that estimates the performance of the actual system on a real sky. Several simplifications and surrogate models must be developed to make the simulation time tractable. It is foreseen that such a full pipeline method can produce improved antenna systems over those designed by traditional methods where antenna beam patterns act as surrogates for the actual system performance.

5. *Primary supervisor's details:*
   a. *Full name of primary supervisor:* Dirk Izak Leon de Villiers

   b. *Primary supervisor's email address (please note that if this project is approved, this email address will be made available to students to contact the primary supervisor)*
   ddv@sun.ac.za

   c. *University where primary supervisor is employed:* Stellenbosch University

Section B: Details of Research Project

1. *Scientific/Engineering merit: describe the objectives of the research project, placing them in the context of the current key questions and understanding of the field.*
   Design of radio astronomy antennas mostly relies on optimization of the antenna reflection coefficient and beam pattern so that they adhere to a set of constraints defined in terms of traditional antenna parameters (beamwidth, sidelobe level, etc). During design of MeerKAT and SKA, more advanced methods were employed where direct maximization of the receiving sensitivity was pursued, with no mind given to the final feed antenna pattern during the calculation of the optimization goal function. This proved a successful strategy, as better systems were produced than could have been done if only the feed pattern shape was optimized. In this project we will extend this idea to more sophisticated optimization goal functions – specifically focused on single element radio astronomy systems. Examples are the REACH and X-BASS experiments, which will both use only a single antenna to measure power spectra. Their total performance metric is not only a strong function of the antenna beam pattern, but also of how the pattern interacts with the radio sky. Normally performance prediction is done through computationally expensive astronomical observation simulation pipelines, which take as their input the antenna beam pattern. Here, we will attempt to develop simplified pipelines, specifically tailored to the experiments at hand, which can be tightly integrated with the antenna simulation and design software. As such, the optimization goal function becomes more closely aligned to the final goal of the experiment, and better antenna systems (which possibly performs worse according to traditional generic antenna pattern metrics) will likely result.

2. *Feasibility: outline the methods that will be used to achieve the objectives. Provide details on the availability of required data / access to required equipment / availability of research facilities and other resources required. Include any relevant expected intermediate milestones and associated timeframes towards attaining the overall objectives of the project.*
   Most of the work will be simulation driven, so physical infrastructure required is mainly computers and simulation software. It is foreseen that close collaboration with the REACH group (already established, since the supervisor is co-PI), as well as the C(X)-BASS development group (already in place, since the supervisor is supervising a PhD student developing the X-BASS system), will provide both required real-world data as well as expertise in radio sky modelling pipelines. A rough timeline can be the first year is used for background study and model development, the next 3 semesters for implementation of the models into optimization loops and design of actual antennas, and the final semester on dissertation write-up.

3. *Link the proposed project to one or more of the SARAO research priority areas for 2023 (refer to Section 5 of the Application Guide), and explain in some detail how the proposed research will contribute to the priority area(s).*
   (1) Radio astronomy antennas and receiver systems (including digitisation) associated with supported and hosted instruments.

4. This project is most suited to a student with interest in both mathematical modelling as well as antenna design. Experience in radio astronomy related projects would be helpful.

CURRICULUM VITAE

DIRK IZAK LEON DE VILLIERS

BIOGRAPHY

Dirk de Villiers started his research as a PhD student at Stellenbosch University working on wideband conical transmission line combiners in the microwave frequency range. After completion of the PhD he was appointed as a Post Doctoral fellow at Stellenbosch University by the South African Square Kilometer Array (SKA) project. He worked on several types of passive microwave devices and antennas, including the development of an improved type of orthomode transducer, the design and performance analysis of focal plane array feeds for reflector antennas, and the development of very wide band reflector antenna feeds. On completion of the fellowship he was subsequently employed full-time as a lecturer at Stellenbosch University. Here he continued research work on reflector antennas through design of offset Gregorian reflectors for the MeerKAT radio telescope as well as the shaped dishes for the SKA and ngVLA radio telescopes (in collaboration with and on contract for EMSS Antennas (Pty) Ltd in Stellenbosch, South Africa), and was promoted to Senior Lecturer in 2012 and Associate Professor in 2015. In 2018 he was promoted to Professor and appointed as the SARChI research chair in Antenna Systems for the SKA at Stellenbosch University.

During 2014 he spent six months on sabbatical as visiting researcher at Chalmers University of Technology in Gothenburg, Sweden where he started applying some formal model driven design and optimization techniques on the design of reflector antenna systems (in collaboration also with Reykjavik University in Reykjavik, Iceland). His current research interest is mainly in antenna design through model driven optimization (with applications in reflector antennas and feeds as well as arrays), but he still remains actively involved in research on other passive microwave devices such as filters and combiners through graduate student supervision.

He has received several academic awards including the ECSA Medal of Merit for the top final year engineering student at Stellenbosch University in 2004, the ESKOM award for the top final year electrical and electronic engineering student in South Africa in 2005, and the Chancellors' Medal from Stellenbosch University in 2007. The Chancellors' medal is awarded annually to the top graduating student in the university across all disciplines. Furthermore, he has received the deans award for exceptional general performance every year between 2011 and 2016, as well as the Vice-Rectors' award for research and its outputs every year from 2015 to 2017.

He serves as a reviewer for, among others, the IEEE Transactions on Antennas and Propagation, Transactions on Microwave Theory and Techniques, Antennas and Propagation Magazine, Microwave and Wireless Components Letters, and Antennas and Wireless Propagation Letters, the IET Microwaves, Antennas and Propagation, and International Journal of RF and Microwave Computer-Aided Engineering, as well as the Wiley International Journal of Numerical Modelling: Electronic Networks, Devices and Fields, and Electronics Letters, along with several international conferences in the Antennas and Propagation fields. He regularly organizes special sessions on antenna modelling and optimization, as well as antennas for radio astronomy, at international conferences, and served on the organizing committee of the 2011, 2016, and 2018 editions of the South African IEEE AP/MTT/EMC conference as well as the 2022 ICEAA conference. He is a senior member of URSI and the IEEE, and serves as rotating chair and vice-chair of the South

African IEEE joint chapter for AP/MTT/EMC since 2016. He is the main organizer of the European School of Antennas (ESoA) course on Antennas for Radio Telescopes, held in Stellenbosch, South Africa, in November 2016 and 2019, and is a regular lecturer in the ESoA Reflector and Lens Antennas course at Chalmers University in Gothenburg, Sweden (2011, 2014, 2017, and 2022 editions).
He has authored or co-authored more than 125 publications in international peer reviewed journals and conference proceedings, which has garnered more than 700 citations according to the Scopus database (excluding self-citations). His current h-index, according to the same database, is 12 (excluding self-citations).
The combiner he developed for his PhD work has been included in a textbook on high power solid state amplifiers as a standard combination network used in such systems (Solid-State Microwave High-Power Amplifiers by Franco Sechi and Marina Bujatti: Artech House).

PERSONAL INFORMATION

Birth Date	1982-10-13
Address	13 Bergpiek street Capolavoro Estate Kylemore Stellenbosch 7600 South Africa
Cell	+27 (0)83 562 8721
ID no	821013 5061 08 0
Nationality	South African
Languages	Afrikaans and English

EDUCATION

2007 **PhD (Electronic Engineering),** Stellenbosch University
2004 **BEng (Electric and Electronic) – Cum Laude,** Stellenbosch University
2000 **Senior Certificate,** Paul Roos Gymnasium, Stellenbosch

AWARDS AND ACHIEVEMENTS

2022
- **IEEE APS Harold A. Wheeler Applications Prize Paper Award**

2019
- **Vice Rectors' Award for Research Outputs**, Stellenbosch University

2017
- **Vice Rectors' Award for Research Outputs**, Stellenbosch University

2016
- **Vice Rectors' Award for Research Outputs**, Stellenbosch University

2015
- **Rectors' Award for General Performance**, Stellenbosch University
- **Vice Rectors' Award for Research Outputs**, Stellenbosch University

2014
- **Rectors' Award for General Performance**, Stellenbosch University

2013
- **Rectors' Award for General Performance**, Stellenbosch University

2012
- **Best Upcoming Researcher**, Engineering Faculty, Stellenbosch University
- **Rectors' Award for General Performance**, Stellenbosch University

2007
- **Chancellors' Medal**, Stellenbosch University (Awarded annually to the top student in the university, based on excellent academic achievement as well as extra-curricular activities)
- **Best Student Paper Using CST Microwave Studio,** Computer Simulation

Technology (CST), Darmstadt, Germany

2005
- **Merit Award for Academic Excellence for the Top Electrical & Electronic Engineering Final Year Student in South Africa,** ESKOM

2004
- **ECSA Medal of Merit for the Top Final Year Engineering Student,** Stellenbosch University
- **Academic Colours**, Stellenbosch University
- **Jac van der Merwe Prize for Innovation for the Most Innovative Final Year Engineering Project,** Engineering Faculty of Stellenbosch University

PROFESSIONAL EXPERIENCE

Jan 2018 – Present **NRF SARChI Research Chair in Antenna Systems for SKA, Stellenbosch University**

Jan 2018 – Present **Full Professor, Stellenbosch University**
- Teach graduate Electromagnetics and Antennas courses
- Supervisor for Masters and PhD projects in the Electronics and Electromagnetics group
- Line Manager of Junior Lecturer, Lecturer and Senior Lecturer positions

Jan 2016 – Dec 2017 **Associate Professor, Stellenbosch University**
- Teach graduate Electromagnetics and Antennas courses
- Teach 2nd year Electronics courses
- Development of a new Electronics course (344) for third year Mechanical and Industrial Engineering students, in addition to streamlining the Electronics chain of courses for E&E Engineering students
- Supervisor for Masters and PhD projects in the Electronics and Electromagnetics group
- Line Manager of Junior Lecturer and Lecturer positions

Jan 2012 – Dec 2015 **Senior Lecturer, Stellenbosch University**
- Teach graduate Electromagnetics and Antennas courses
- Teach 2nd year Electronics courses
- Supervisor for Masters and PhD projects in the Electronics and Electromagnetics group

Feb 2010 – Present **Contract Research, EMSS Antennas (Pty) Ltd., Stellenbosch**
- Investigation of wideband feed performance for possible use in the MeerKAT radio telescope
- Design of the offset dual reflector system for the MeerKAT, SKA and ngVLA radio telescopes
- Design of wideband feeds for the ngVLA radio telescope

Feb 2010 – Dec 2011 **Lecturer, Stellenbosch University**
- Teach 2nd year Electronics courses
- Supervisor for Masters projects in the Electronics and Electromagnetics group

Jan 2008 – Dec 2009 **Post-Doctoral Fellow, Stellenbosch University**
- Wideband Orthomode Transducer (OMT) design for radio astronomy applications
- Radio telescope Focal Plane Array (FPA) research
- UWB reflector feed design

Feb 2008 – Jun 2009 **Part Time Lecturer, Cape Peninsula University of Technology**
- Teach the final year BTech and MTech Electric and Magnetic Field Theory Course

Jun 2001 – Jul 2004 **Student Vacation Work, Advanced Technologies and Engineering (Pty) Ltd.**
- MATLAB implementation of UAV flight model (2002 - 2004)
- System Integration Assistant (2001 - 2002)

RESEARCH FOCUS AREAS

- Antenna design through surrogate modelling
- Reflector antennas
- Antennas for radio telescope applications
- Axially symmetric microwave power combiners

RESEARCH OUTPUTS

CITATION METRICS

Database	Citation Count		h-index	
	All	Excl. Self-Cite	All	Excl. Self-Cite
Scopus	735	~	15	12
Web of Science	550	393	~	12
Google Scholar	1081	~	18	~

Date compiled: 2022/01/18

INTERNATIONAL JOURNAL PAPERS

Most important journals in the fields of Antennas and Microwave Engineering:
IEEE Transactions on Antennas and Propagation (Impact Factor: 2.975)
IEEE Transactions on Microwave Theory and Techniques (Impact Factor: 2.897)
IEEE Antennas and Wireless Propagation Letters (Impact Factor: 2.533)
IEEE Microwave and Wireless Components Letters (Impact Factor: 1.887)
IET Microwaves, Antennas & Propagation (Impact Factor: 1.187)
Wiley Electronics Letters (Impact Factor: 1.155)
Wiley Microwave and Optical Technology Letters (Impact Factor: 0.731)

1. (2023) D.I.L. de Villiers and Z. du Toit, "Generalised feed efficiency factorization of reflector antennas", *IEEE Transactions on Antennas and Propagation*, in preparation.
2. (2023) S.G.H. Kriel and D.I.L. de Villiers, "A Figure of Merit for the X-Band All-Sky Survey", *Radio Science*, in preparation.
3. (2022) D. Crichton, M. Aich, A. Amara, K. Bandura, B. Bassett, C. Bengaly, P. Berner, S. Bhatporia, M. Bucher, T.-C. Chang, H.C. Chiang, J.-F. Cliche, C. Crichton, R. Dave, D.I.L. de Villiers, et al., "The Hydrogen Intensity and Real-time Analysis eXperiment: 256-Element Array Status and Overview", *Journal of Astronomical Telescopes, Instruments, and Systems*, vol. 8, no. 1, Jan. 2022.
4. (2022) R. Louw, F. Knaepkens, A. Cuyt, W.-s. Lee, S.J. Wijnholds, D.I.L. de Villiers and R.-M. Weideman, "Antenna Position Estimation through Sub-Sampled Exponential Analysis of Signals in the Near-Field", *Radio Science Letters*, vol. 3, 2021, pp. 1 - 5.
5. (2022) D.I.L. de Villiers and R. Lehmensiek, "Plate Scale in Shaped Offset Gregorian Reflectors", *Radio Science Letters*, vol. 3, 2021, pp. 1 - 3.
6. (2022) J. Cumner, E. de Lera Acedo, D.I.L. de Villiers and the REACH Collaboration, "Radio antenna design for sky-averaged 21 cm cosmology experiments: the REACH case", *Journal of Astronomical Instrumentation*, vol. 11, no. 1.
7. (2022) E. De Lera Acedo, D.I.L. de Villiers and the REACH Collaboration, "The REACH radiometer for detecting the 21-cm hydrogen signal from redshift $z \approx 7.5–28$", *Nature Astronomy*, vol. 6, pp. 984 - 998.

8. (2022) D.I.L. de Villiers and R. Lehmensiek, "Multi-level Approximations for Fast and Accurate Antenna Noise Temperature Calculation of Dual-Reflector Antennas", *IEEE Transactions on Antennas and Propagation*, vol. 70, no. 6, pp. 4784-4793, Jun. 2022.
9. (2022) I. Heywood, I. Rammala, F. Camilo, W. D. Cotton, F. Yusef-Zadeh, T. D. Abbott, R. M. Adam, G. Adams, M. A. Aldera, K. M. B. Asad, E. F. Bauermeister, T. G. H. Bennett, H. L. Bester, W. A. Bode, D. H. Botha, A. G. Botha, L. R. S. Brederode, S. Buchner, J. P. Burger, T. Cheetham, D. I. L. de Villiers, et al., "The 1.28 GHz MeerKAT Galactic Center Mosaic", *The Astrophysical Journal*, vol. 925, no. 2, pp. 1 – 20, Feb. 2022.
10. (2022) K. Knowles, W. D. Cotton, L. Rudnick, F. Camilo, S. Goedhart, R. Deane, M. Ramatsoku, M. F. Bietenholz, M. Brüggen, C. Button, H. Chen, J. O. Chibueze, T. E. Clarke, F. de Gasperin, R. Ianjamasimanana, G. I. G. Józsa, M. Hilton, K. C. Kesebonye, K. Kolokythas, R. C. Kraan-Korteweg, G. Lawrie, M. Lochner, S. I. Loubser, P. Marchegiani, N. Mhlahlo, K. Moodley, E. Murphy, B. Namumba, N. Oozeer, V. Parekh, D. S. Pillay, S. S. Passmoor, A. J. T. Ramaila, S. Ranchod, E. Retana-Montenegro, L. Sebokolodi, S. P. Sikhosana, O. Smirnov, K. Thorat, T. Venturi, T. D. Abbott, R. M. Adam, G. Adams, M. A. Aldera, E. F. Bauermeister, T. G. H. Bennett, W. A. Bode, D. H. Botha, A. G. Botha, L. R. S. Brederode, S. Buchner, J. P. Burger, T. Cheetham, D. I. L. de Villiers, et al., "The MeerKAT Galaxy Cluster Legacy Survey I. Survey Overview and Highlights", *Astronomy and Astrophysics*, vol. 657, no. A56, pp. 1 – 41, Jan. 2022.
11. (2021) R. Lehmensiek and D.I.L. de Villiers, "An optimal 18-meter shaped offset Gregorian reflector for the ngVLA radio telescope", *IEEE Transactions on Antennas and Propagation*, vol. 69, no. 12, pp. 8282-8290, Dec. 2021.
12. (2021) K.M.B. Asad, J.N. Girard, M. de Villers, R. Lehmensiek, T. Ansah-Narh, K. Iheanetu, O. Smirnov, M.G. Santos, J. Jonas, D.I.L. de Villiers, K. Thorat, B. Hugo, S. Makhathini, F. Camilo, G.I.G. Jozsa, S.K. Sirothia, "Primary beam effects of radio astronomy antennas - II. Modelling the MeerKAT L-band beams", *Monthly Notices of the Royal Astronomical Society*, stab104, 2021, pp. 2970 – 2983.
13. (2021) F. Mokhupuki and D.I.L. de Villiers, "Efficient optimisation of wideband reflector feed antennas for optimal receiving sensitivity", *Wiley International Journal of Numerical Modelling: Electronic Networks, Devices and Fields*, vol. 34, no. 3, 2021; pp. e2849.
14. (2021) J.-G. Bij de Vaate, D.I.L. de Villiers, D.B. Davidson and W. van Cappellen, "Expanding the Field of View: Station Design for the AAMID SKA Radio Telescope", *Experimental Astronomy*, vol. 51, 2021, pp. 1 - 16.
15. (2021) T. Marinovic, D.I.L. de Villiers, D.J. Bekers, M.N. Johansson, A. Stjernman, R. Maaskant, and G.A.E. Vandenbosch, "Fast Characterization of Mutually-Coupled Array Antennas Using Isolated Antenna Far-field Data", *IEEE Transactions on Antennas and Propagation*, vol. 69, no. 1, pp. 206-218, Jan. 2021, doi: 10.1109/TAP.2020.3016395.
16. (2021) S.G.H. Kriel and D.I.L. de Villiers, "Mutual Coupling Effects between Test and Reference Antennas in Near-field Measurements", *Radio Science Letters*, vol. 2, 2020, pp. 1 - 4.
17. (2020) H.J. du Toit and D.I.L. de Villiers, "A Fully Isolated 16-way Radial Power Combiner", *IEEE Transactions on Microwave Theory and Techniques*, vol. 68, no. 7, pp. 2531-2538, July 2020.
18. (2020) F. Knaepkens, A. Cuyt, W-s Lee and D.I.L. de Villiers, "Regular Sparse Array Direction of Arrival Estimation in One Dimension", *IEEE Transactions on Antennas and Propagation*, vol. 68, no. 5, pp. 3997-4006, May 2020.
19. (2019) I. Heywood, et al., "A major outburst event inflating 430 pc bipolar radio bubbles in the Galactic Centre", *Nature*, vol. 573, no. 7773, pp. 235 – 237, September, 2019.
20. (2019) B. Klopper and D.I.L. de Villiers, "Efficient Impedance Response Modeling of Broadband Antenna Elements in Large Sparse-Regular Phased Arrays", *IEEE Transactions on Antennas and Propagation*, vol. 67, no. 4, pp. 2809 – 2812, 2019.
21. (2019) A. Cuyt, R. Louw, C. Segers and D.I.L. de Villiers, "Rapid design of wideband unidirectional sinuous antennas through blended rational interpolation", *Wiley*

International Journal of Numerical Modelling: Electronic Networks, Devices and Fields, vol. 32, no. 1, Jan/Feb 2019.
22. (2018) F. Camilo, et al., "Revival of the Magnetar PSR J1622–4950: Observations with MeerKAT, Parkes, XMM-Newton, Swift, Chandra, and NuSTAR", *The Astrophysical Journal*, vol. 856:180, no. 2, pp. 1 – 11, April, 2018.
23. (2018) R. Lehmensiek and D.I.L. de Villiers, "Noise Temperature Approximations for Offset Gregorian Reflector Systems", *IEICE Transactions on Communication*, vol. E101-B, no. 2, pp. 332 – 339, 2018.
24. (2018) D.I.L. de Villiers, R. Lehmensiek and M.V. Ivashina, "Effects of Diffraction and Feed Pattern Variation in Shaped Offset Gregorian Reflectors", *IEICE Transactions on Communication*, vol. E101-B, no. 2, pp. 316 – 323, 2018.
25. (2018) D.I.L. de Villiers and S.M. Koziel, "Fast Multi-Objective Optimisation of Pencil Beam Reflector Antenna Radiation Patterns Responses Using Kriging", *IET Microwaves Antennas and Propagation*, vol. 12, no. 1, pp. 120 – 126, 2018.
26. (2017) N. Mutonkole and D.I.L. de Villiers, "Multivariate Adaptive Sampling of Parameterized Antenna Responses", *IEEE Transactions on Antennas and Propagation*, vol. 65, no. 3, pp. 1073 - 1080, 2017.
27. (2016) R.D. Beyers and D.I.L. de Villiers, 'A General Impedance Tapered Transition for N-way Conical and Coaxial Combiners', *IEEE Transactions on Microwave Theory and Techniques*, vol. 64, no. 12, 2016, pp. 4482 - 4490.
28. (2016) D.I.L. de Villiers, "Fast Parametric Modeling of Radio Astronomy Reflector Antenna Noise Temperature", *IEEE Transactions on Antennas and Propagation*, vol. 64, no. 6, 2016, pp. 2522 - 2526.
29. (2016) N. Mutonkole, E.R. Samuel, D.I.L. de Villiers and T. Dhaene, "Parametric Modeling of Radiation Patterns and Scattering Parameters of Antennas", *IEEE Transactions on Antennas and Propagation*, vol. 64, no. 3, 2016, pp. 1023 - 1031.
30. (2015) R. Lehmensiek, I.P. Theron and D.I.L. de Villiers, "Deriving an optimum mapping function for the SKA shaped offset Gregorian reflectors", *IEEE Transactions on Antennas and Propagation*, vol. 63, no. 11, 2015, pp. 4658 - 4666.
31. (2015) R. Lehmensiek and D.I.L. de Villiers, "Optimization of Log-Periodic Dipole Array Antennas for Wideband Omni-Directional Radiation", *IEEE Transactions on Antennas and Propagation*, vol. 63, no. 8, 2015, pp. 3714 - 3718.
32. (2015) R.D. Beyers and D.I.L. de Villiers, "Corrections to "Compact Conical Line Combiner Design Using Circuit Models"", *IEEE Transactions on Microwave Theory and Techniques*, vol. 63, no. 7, 2015, p. 2391-2391.
33. (2015) D.I.L. de Villiers and R. Lehmensiek, 'Rapid Calculation of Antenna Noise Temperature in Offset Gregorian Reflector Systems', *IEEE Transactions on Antennas and Propagation*, vol. 63, no. 4, April, 2015, pp. 1564 - 1571.
34. (2014) R.D. Beyers and D.I.L. de Villiers, 'Compact Conical Line Power Combiner Design Using Circuit Models', *IEEE Transactions on Microwave Theory and Techniques*, vol. 62, no. 11, November, 2014, pp. 2650 – 2658.
35. (2014) R. Lehmensiek and D.I.L. de Villiers, 'On reflector feeds with unidirectional axially symmetric radiation patterns, their cross-polarization performance and efficiencies'. *IEEE Antennas and Propagation Magazine*, vol. 56, February, 2014, pp. 39 - 61.
36. (2014) R. Lehmensiek and D.I.L. de Villiers, 'Constant Radiation Characteristics for Log-Periodic Dipole Array Antennas', *IEEE Transactions on Antennas and Propagation*, vol. 62, no. 5, May, 2014, pp. 2866 – 2869.
37. (2014) D.J. Ludick, R. Maaskant, D.B. Davidson, U. Jakobus, R. Mittra and D.I.L. de Villiers, "Efficient Analysis of Large Aperiodic Antenna Arrays Using the Domain Green's Function Method", *IEEE Transactions on Antennas and Propagation*, vol. 62, no. 4, April, 2014, pp. 1579 – 1588.

38. (2013) A. Ibbotson, D.I.L. de Villiers and K.D. Palmer, 'A Defocused Rotman Lens with Reduced Conjugate Port Coupling', *IEEE Microwave and Wireless Components Letters*, vol. 23, no. 8, August 2013, pp. 394 – 396.
39. (2013) D.I.L. de Villiers and R. Lehmensiek, 'Modeling of the Radiation Pattern of a Pair of Thin Circular-Arc Dipoles Over an Infinite Ground Plane', *IEEE Transactions on Antennas and Propagation*, vol. 61, no. 8, August 2013, pp. 4375 - 4378.
40. (2013) A. Young, R. Maaskant, M.V. Ivashina, D.I.L. de Villiers and D.B. Davidson, 'Accurate Beam Prediction Through Characteristic Basis Function Patterns for the MeerKAT/SKA Radio Telescope Antenna', *IEEE Transactions on Antennas and Propagation*, vol. 61, no. 5, May, 2013, pp. 2466 – 2473.
41. (2013) D.I.L. de Villiers, 'Prediction of Aperture Efficiency Ripple in Clear Aperture Offset Gregorian Antennas', *IEEE Transactions on Antennas and Propagation*, vol. 61, no. 5, May, 2013, pp. 2457 – 2465.
42. (2011) D.I.L. de Villiers, 'Offset Dual Reflector Antenna System Efficiency Predictions Including Sub-Reflector Diffraction', *IEEE Antennas and Wireless Propagation Letters*, vol. 10, 2011, pp. 947 - 950.
43. (2011) D.I.L. de Villiers, 'Aperture Efficiency Predictions in Symmetrical Paraboloidal Reflector Antennas with Non Planar Log-Periodic Type Feeds', *IEEE Antennas and Wireless Propagation Letters*, vol. 10, 2011, p 476 - 479.
44. (2009) D.I.L. de Villiers, P. Meyer and K.D. Palmer, 'Broadband Offset Quad-Ridged Waveguide Orthomode Transducer', *Electronics Letters*, vol. 45, no. 1, January, 2009, pp 60 – 62.
45. (2009) D.I.L. de Villiers and P. Meyer, 'The Numerical Calculation of Analytic Solutions for Higher-Order Modes in Conical Lines', *International Journal of RF and Microwave Computer-Aided Engineering*, vol. 19, no. 1, January, 2009, pp. 99-109.
46. (2008) D.I.L. de Villiers, P.W. van der Walt and P. Meyer, 'Design of Conical Transmission Line Power Combiners Using Tapered Line Matching Sections', *IEEE Transactions on Microwave Theory and Techniques*, vol. 56, no. 6, June, 2008, pp. 1478-1484.
47. (2007) D.I.L. de Villiers, P.W. van der Walt and P. Meyer, 'Design of a 10-Way Conical Transmission Line Power Combiner', *IEEE Transactions on Microwave Theory and Techniques*, vol. 55, no. 2, February, 2007, pp. 302-308.

INTERNATIONAL CONFERENCE PROCEEDINGS

Most important conferences in the fields of Antennas and Microwave Engineering:
IEEE International Microwave Symposium (IMS)
IEEE AP-S International Symposium on Antennas and Propagation
European Conference on Antennas and Propagation (EuCAP)
European Microwave Conference
International Conference on Electromagnetics in Advanced Applications (ICEAA)
International Symposium on Antennas and Propagation

1. (2023) M. Venter and D.I.L. de Villiers, "Beam modeling of reflector antennas across elevation", *URSI General Assembly*, Sapporo, Japan, August 2023, *submitted.*
2. (2023) T. Stek, D.I.L. de Villiers, E. Meyer and D.S. Prinsloo, "Towards Accelerating the Feed Design of a Series of Different Reflector Antennas", *IEEE AP-S International Symposium on Antennas and Propagation*, Portland, OR, USA, July 2023, *submitted*.
3. (2023) D.I.L. de Villiers and R. Lehmensiek, "Performance estimates of the 18-meter ngVLA reflector system with main reflector rim extension", *IEEE AP-S International Symposium on Antennas and Propagation*, Portland, OR, USA, July 2023, *submitted*.
4. (2023) Z. du Toit, F.T.T. Mokhupuki and D.I.L. de Villiers, "Tri-ridged waveguide orthomode transducer", *International Microwave and Antennas Symposium*, Cairo, Egypt, February 2023, accepted.

5. (2022) W.J. Cerfonteyn, F.T.T. Mokhupuki and D.I.L. de Villiers, “Frequency ripple in antenna noise temperature of small offset Gregorian reflector systems”, *International Conference on Electromagnetics in Advanced Applications (ICEAA)*, Cape Town, South Africa, September 2022, pp. 207 - 211.
6. (2022) T. Stander, D.I.L. de Villiers, A. de Witt, D. Ferrusca Rodriquez, D. Hiriart, S.E. Kurtz, F. Van den Heever and M.V. de la Rosa Becerra, “A retrospective of the SA-Mexico bilateral programme on water vapour radiometry”, *International Conference on Electromagnetics in Advanced Applications (ICEAA)*, Cape Town, South Africa, September 2022, pp. 282 - 286.
7. (2022) S.G.H. Kriel and D.I.L. de Villiers, “A figure of merit for the X-band all-sky survey”, *International Conference on Electromagnetics in Advanced Applications (ICEAA)*, Cape Town, South Africa, September 2022, pp. 267 - 272.
8. (2022) R.-M. Weideman, R. Louw, F. Knaepkens, D.I.L. de Villiers, A. Cuyt and W.-s. Lee “Simulated performance of antenna position estimation through sub-sampled exponential analysis”, *International Conference on Electromagnetics in Advanced Applications (ICEAA)*, Cape Town, South Africa, September 2022, pp. 128 - 132.
9. (2022) R. Lehmensiek and D.I.L. de Villiers, “First Order Design of a Quadruple-Ridged Flared Horn for the ngVLA Band 1”, *European Conference on Antennas and Propagation (EuCAP)*, Madrid, Spain, March, 2022, pp. 1- 4.
10. (2022) M. Venter and D.I.L. de Villiers, “Towards A New Figure of Merit for Reflector Antenna Based Imaging”, *IEEE AP-S International Symposium on Antennas and Propagation*, Singapore, December, 2021, pp. 49 - 50.
11. (2021) R. Louw, F. Knaepkens, A. Cuyt, W.-s. Lee, S. Wijnholds, D.I.L. de Villiers and R.-M. Weideman, “Antenna Position Estimation Through Sub-Sampled Exponential Analysis of Harmonically Related Input Signals”, *URSI General Assembly*, Rome, Italy, August 2021, pp. 1-4.
12. (2021) R.-M. Weideman, R. Louw and D.I.L. de Villiers, “Practical performance of the VEXPA estimation method in sparse regular arrays”, *URSI General Assembly*, Rome, Italy, August 2021, pp. 1 - 4.
13. (2021) S.E. Kurtz, T. Stander, D.I.L. de Villiers, W. Cerfonteyn, A. de Witt, D. Ferrusca Rodríguez, D. Hiriart, D.H. Hughes, C. Jacobs, L. Loinard, F. Van den Heever, M. Velázquez de la Rosa Becerra, "Progress toward improved water vapour radiometry: an overview of the South Africa-Mexico bilateral programme," *Proc. SPIE 11445, Ground-based and Airborne Telescopes VIII*, 114451B, December 2020.
14. (2021) T. Stander, R. Deane, D.I.L. de Villiers, A. de Witt, D. Ferrusca Rodríguez, D. Hiriart, S.E. Kurtz, F. Van den Heever, M. Velázquez de la Rosa Becerra, "The potential for a K-band receiver on the Large Millimeter Telescope," *Proc. SPIE 11453, Millimeter, Submillimeter, and Far-Infrared Detectors and Instrumentation for Astronomy X*, 1145340, December 2020.
15. (2020) D.I.L. de Villiers, R. Lehmensiek and F. Mokhupuki, “Investigations of Quadruple-Ridge Flared Horn Performance for ngVLA Band 2”, *European Conference on Antennas and Propagation (EuCAP)*, Copenhagen, Denmark, March, 2020, pp. 1 - 4.
16. (2019) E. Hunter, T. Stander and D.I.L. de Villiers, “mm-Wave Circular Patch Arrays with Radial Feed Networks”, *Asia-Pacific Microwave Conference*, Singapore, December, 2019, pp. 1322 - 1324.
17. (2019) K.Z. Adami, et al, “The Mid-Frequency Aperture Array”, *International Conference on Electromagnetics in Advanced Applications (ICEAA)*, Grenada, Spain, September, 2019, pp. 1149-1154.
18. (2019) J.C. Koech, P.G. Wiid and D.I.L. de Villiers, “Hyperband Antenna Design for RFI Testing”, *International Conference on Electromagnetics in Advanced Applications (ICEAA)*, Grenada, Spain, September, 2019, pp. 280-285.
19. (2019) D.I.L. de Villiers, K. Asad, O. Smirnov, R. Lehmensiek, M. de Villiers and J. Jonas, “Primary Beams of the MeerKAT Radio Telescope: Measurements and Simulations”,

IEEE AP-S International Symposium on Antennas and Propagation, Atlanta, GA, USA, July, 2019, pp. 393-394.

20. (2019) B. Klopper, J.G. bij de Vaate, D. Davidson and D.I.L. de Villiers, "Sparse-Regular Array Design for SKA Mid Frequency Aperture Array", *IEEE AP-S International Symposium on Antennas and Propagation*, Atlanta, GA, USA, July, 2019, pp. 397-398.
21. (2019) M. Johnston, C. van Niekerk and D.I.L. de Villiers, "Coaxial Marchand Balun - Design and Fabrication", *IEEE AP-S International Symposium on Antennas and Propagation*, Atlanta, GA, USA, July, 2019, pp. 739-740.
22. (2019) M. Johnston, C. van Niekerk and D.I.L. de Villiers, "Ultra-wideband Planar Marchand Balun Design for the Pyramidal Sinuous Antenna", *IEEE AP-S International Symposium on Antennas and Propagation*, Atlanta, GA, USA, July, 2019, pp. 735-736.
23. (2019) H.J. du Toit, D.I.L. de Villiers and R.D. Beyers, "A Simple Low Loss Partially Filled 16-way Radial Power Combiner", *IEEE MTT-S International Microwave Symposium (IMS)*, Boston, MA, USA, June 2019, pp. 440-443.
24. (2019) R. Lehmensiek and D.I.L. de Villiers, "Wideband Feed Performance Limits on Shaped and Unshaped Offset Gregorian Reflector Antennas", *European Conference on Antennas and Propagation (EuCAP)*, Krakow, Poland, Mar., 2019, pp. 1-4.
25. (2019) F.T.T. Mokhupuki and D.I.L. de Villiers, "Surrogate Based Optimization of Wideband Reflector Feed Antennas", *European Conference on Antennas and Propagation (EuCAP)*, Krakow, Poland, Mar., 2019, pp. 1-5.
26. (2019) B. Klopper and D.I.L. de Villiers, "Efficient Performance Modelling of Broadband Sparse-Regular Aperture Array Antenna Elements", *European Conference on Antennas and Propagation (EuCAP)*, Krakow, Poland, Mar., 2019, pp. 1-5.
27. (2019) R. Lehmensiek and D.I.L. de Villiers, "On the performance of the SKA mid-frequency array's reflector system and its feeds", *URSI Asia Pacific Radio Science Conference*, New Delhi, India, Mar., 2019, pp. 1-3.
28. (2019) S.G.H. Kriel and D.I.L. de Villiers, "Probe Positioning Error Sensitivity Analysis for Planar Near-field Antenna Measurements", *URSI Asia Pacific Radio Science Conference*, New Delhi, India, Mar., 2019, pp. 1-4.
29. (2018) B. Klopper and D.I.L. de Villiers, "Efficient Antenna Scan Response Models for Large Phased Arrays", *Asia Pacific Microwave Conference (APMC)*, Kyoto, Japan, Nov., 2018, pp. 1 – 3.
30. (2018) T. Stander, W. Cerfonteyn, R. Deane, D.I.L. de Villiers, et al., 'Initial progress toward planar integrated, low-cost water vapour radiometers', *Sensors, MEMS and Electro-Optical Systems (SMEOS)*, Skukuza, South Africa, October, 2018, accepted.
31. (2018) D.B. Davidson, A. Sutinjo, R. Wayth, D. Ung, D.I.L. de Villiers, J. Gilmore, J.G. Bij de Vaate, R. Baelemans, and B. Smolders, "Recent Progress on the Design of Aperture Arrays for Radio Astronomy", *Radio and Antenna Days of the Indian Ocean (RADIO)*, Mauritius, Oct. 2018, pp. 1-2.
32. (2018) D.I.L. de Villiers, "Wideband Reflector Antenna Beam Pattern Frequency Variation Modeling through the Characteristic Basis Function Pattern Method", *International Conference on Electromagnetics in Advanced Applications (ICEAA)*, Cartagena de Indias, Columbia, September, 2018, pp. 220 – 223.
33. (2018) D.I.L. de Villiers, F.T.T. Mokhupuki and B. Klopper, "Low-Cost Frequency Variation Models of Quad-Ridge Flared Horn Reflector Feed Antennas", *IEEE MTT-S International Conference on Numerical Electromagnetic and Multiphysics Modeling and Optimization (NEMO)*, Reykjavik, Iceland, August 2018, pp. 1- 4.
34. (2018) D.I.L. de Villiers and C. Sibanda, "Space Mapping Design of Gap Waveguide Filters", *IEEE AP-S International Symposium on Antennas and Propagation*, Boston, MS, USA, July, 2018, pp. 1105 - 1106.
35. (2018) M.A.X. Ruppert, R.D. Beyers and D.I.L. de Villiers, "Array Element Number Effects on System G/T for Single Plane Scanning Phased Array Feeds", *IEEE AP-S International Symposium on Antennas and Propagation*, Boston, MS, USA, July, 2018, pp. 1419 - 1420.

36. (2017) D.I.L. de Villiers and R. Maaskant, "Element Pattern Prediction in Mutually-Coupled Arrays Through Isolated Antenna Characterization", *International Symposium on Antennas and Propagation*, Phuket, Thailand, Oct., 2017, pp.1-2.
37. (2017) A. Cuyt, R. Louw, C. Segers and D.I.L. de Villiers, "Towards Blended Rational Interpolation of Multi-Fidelity Antenna Data", *International Conference on Electromagnetics in Advanced Applications (ICEAA)*, Verona, Italy, Sep., 2017, pp. 1045 - 1048.
38. (2017) B. Klopper and D.I.L. de Villiers, "Surrogate-based Antenna Element Optimisation for Regularly Spaced Aperture Arrays", *International Conference on Electromagnetics in Advanced Applications (ICEAA)*, Verona, Italy, Sep., 2017, pp. 933 - 936.
39. (2017) D.I.L. de Villiers, "A Comparison of Full Pattern and Feature Based Modeling of Antenna Radiation Patterns", *International Conference on Electromagnetics in Advanced Applications (ICEAA)*, Verona, Italy, Sep., 2017, pp. 916 - 919.
40. (2017) R. Lehmensiek and D.I.L. de Villiers, "Aperture Efficiency Performance Limits of the SKA Reflector System", *IEEE AP-S International Symposium on Antennas and Propagation*, San Diego, CA, USA, July, 2017, pp. 989 - 990.
41. (2017) D.I.L. de Villiers, I. Couckuyt and T. Dhaene, "Multi-Objective Optimization of Reflector Antennas using Kriging and Probability of Improvement", *IEEE AP-S International Symposium on Antennas and Propagation*, San Diego, CA, USA, July, 2017, pp. 985 - 986.
42. (2017) D.I.L. de Villiers, "Initial Study of a Pyramidal Sinuous Antenna as a Feed for the SKA Reflector System in Band-1", *IEEE AP-S International Symposium on Antennas and Propagation*, San Diego, CA, USA, July, 2017, pp. 555 - 556.
43. (2017) N. Steenkamp, D.I.L. de Villiers and N. Mutonkole, 'Wideband Pyramidal Sinuous Antenna for Reflector Antenna Applications', *European Conference on Antennas and Propagation (EuCAP)*, Paris, France, March, 2017, pp. 2291 - 2295.
44. (2017) N. Mutonkole and D.I.L. de Villiers, 'Adaptive Frequency Sampling for Radiation Patterns and S-parameters of Antennas', *European Conference on Antennas and Propagation (EuCAP)*, Paris, France, March, 2017, pp. 3195 - 3199.
45. (2016) R. Lehmensiek, and D.I.L. de Villiers, 'Approximate Noise Temperature Calculations of Offset Gregorian Reflector Systems', *International Symposium on Antennas and Propagation (ISAP)*, Okinawa, Japan, pp. 804-805, October, 2016.
46. (2016) D.I.L. de Villiers, R. Lehmensiek, and M.V. Ivashina, 'Low Frequency Diffraction Effects when Shaping the Offset Gregorian Reflector System of the SKA', *International Symposium on Antennas and Propagation (ISAP)*, Okinawa, Japan, pp. 802-803, October, 2016.
47. (2016) B. Klopper and D.I.L. de Villiers, "Space Mapping Optimization of Aperture-coupled Patch Antennas using Circuit Models", *IEEE AP-S International Symposium on Antennas and Propagation*, Fajardo, Puerto Rico, pp. 289-290, June, 2016.
48. (2016) D.I.L. de Villiers, 'Recent Advances in Surrogate Modelling of Reflector Antenna Systems', *European Congress on Computational Methods in Applied Sciences and Engineering (ECCOMAS)*, Crete Island, Greece, pp. 1-11, June, 2016.
49. (2016) J.P. Jacobs and D.I.L. de Villiers, 'Surrogate Modeling of Antenna Radiation Properties by Gaussian Processes', *European Congress on Computational Methods in Applied Sciences and Engineering (ECCOMAS)*, Crete Island, Greece, pp. 1-8, June, 2016.
50. (2016) R.D. Beyers and D.I.L. de Villiers, 'Design of Power Combiners using Surrogate Based Optimization', *European Congress on Computational Methods in Applied Sciences and Engineering (ECCOMAS)*, Crete Island, Greece, pp. 1-12, June, 2016.
51. (2016) R.D. Beyers and D.I.L. de Villiers, "A General Conical to Coaxial Line Transition", *IEEE International Microwave Symposium (IMS)*, San Francisco, CA, USA, pp. 1-4, May, 2016.
52. (2016) D.I.L. de Villiers, 'Accurate Parametric Modeling of Gain and Sidelobe Levels in Blocked Aperture Reflector Systems Using Implicit Space Mapping', *European*

Conference on Antennas and Propagation (EuCAP), Davos, Switzerland, pp. 1-4, April, 2016.

53. (2016) N. Mutonkole and D.I.L. de Villiers, 'An Adaptive Sampling Algorithm for the Efficient Prediction of Antenna Radiation Patterns Over a Wide Frequency Bandwidth', *European Conference on Antennas and Propagation (EuCAP)*, Davos, Switzerland, pp. 1-5, April, 2016.
54. (2016) R. Lehmensiek, D.I.L. de Villiers and I.P. Theron, 'Modeling the Effect of a Large Communication Mast in Front of a Reflector Antenna System', *European Conference on Antennas and Propagation (EuCAP)*, Davos, Switzerland, pp. 1-4, April, 2016.
55. (2015) J.P. Jacobs and D.I.L. de Villiers, "Gaussian Process Modeling of Aperture Efficiency Ripple in Reflector Antennas", Loughborough Antennas and Propagation Conference (LAPC), Loughborough, UK, pp. 1-4, November, 2015.
56. (2015) R.D. Beyers and D.I.L. de Villiers, "Design of Conical Transmission Line Power Combiners Using Space Mapping", *International Conference on Electromagnetics in Advanced Applications (ICEAA)*, Turin, Italy, pp. 1437 - 1440 September, 2015.
57. (2015) D.I.L. de Villiers and S.M. Koziel, "Multi-Objective Optimization of Cassegrain Reflector Feeds Using Space Mapping Surrogate Models", *IEEE-APS Topical Conference on Antennas and Propagation in Wireless Communications (APWC)*, Turin, Italy, pp. 813 – 816, September, 2015.
58. (2015) R. Lehmensiek, and D.I.L. de Villiers, "Accuracy improvement of approximate noise temperature calculations of offset Gregorian reflector systems", *IEEE-APS Topical Conference on Antennas and Propagation in Wireless Communications (APWC)* Turin, Italy, pp. 847 – 850, September, 2015.
59. (2015) D.I.L. de Villiers and M.V. Ivashina, "Diffraction and Pattern Perturbation Effects in Offset Gregorian Reflectors Antennas with Wideband Feeds", *IEEE AP-S International Symposium on Antennas and Propagation,* Vancouver, Canada, pp. 1520 - 1521, July, 2015.
60. (2015) D.I.L. de Villiers and S.M. Koziel, "Fast Multi-Objective Optimization of Shaped Offset Gregorian Reflector Systems", *IEEE AP-S International Symposium on Antennas and Propagation,* Vancouver, Canada, pp. 1342 - 1343, July, 2015.
61. (2015) R. Lehmensiek, I.P. Theron and D.I.L. de Villiers, "Deriving an Optimum Shaped Reflector System for the SKA Single Pixel Feeds", *IEEE AP-S International Symposium on Antennas and Propagation,* Vancouver, Canada, 1370 - 1371, July, 2015.
62. (2015) R.D. Beyers and D.I.L. de Villiers, "A General Isolation Network for *N*-way Power Combiners/Dividers", *IEEE International Microwave Symposium (IMS)*, Phoenix, AZ, USA, pp. 1 - 4, May, 2015.
63. (2015) S.M. Koziel and D.I.L. de Villiers, "Rapid EM-driven Design Optimization of Antennas and Antenna Arrays by Means of Surrogate Modeling", *1st International Conference on Innovative Research and Maritime Applications of Space Technology (IRMAST 2015)*, Gdansk, Poland, In press, April, 2015.
64. (2015) D.I.L. de Villiers, M. Ivashina and R. Maaskant, 'Fast Prediction of Aperture Efficiency and Sidelobe Levels in Shaped Reflector Systems through Model Based Output Space Mapping', *European Conference on Antennas and Propagation (EuCAP)*, Lisbon, Portugal, pp. 1 - 5, April, 2015.
65. (2015) N. Mutonkole and D.I.L. de Villiers, 'Characteristic Basis Function Patterns Method for Reflector Antenna Calibration: An Extension to Multiple Frequencies', *European Conference on Antennas and Propagation (EuCAP)*, Lisbon, Portugal, pp. 1 - 5, April, 2015
66. (2015) R. Lehmensiek, I.P. Theron and D.I.L. de Villiers, "An investigation of offset-fed beams on the proposed SKA dishes with various degrees of shaping", *European Conference on Antennas and Propagation (EuCAP)*, Lisbon, Portugal, pp. 1 - 5, April, 2015.
67. (2014) V. Radonic, V. Crnojevic-Bengin, D. Schoeman and D.I.L. de Villiers, 'Multi-layer Frequency Selective Surfaces with Wideband Response and Their Modelling', *The 22nd*

Telecommunications Forum (TELFOR2014), Belgrade, Serbia, November, 2014, pp. 757 - 760.

68. (2014) R.D. Beyers and D.I.L. de Villiers, 'Design and Analysis of an Impedance Tapered Conical to Coaxial Transmission Line Transition', *The 44th European Microwave Conference*, Rome, Italy, pp. 307 – 310, October, 2014.
69. (2014) T.S. Beukman, P. Meyer, M.V. Ivashina, R. Maaskant and D.I.L. de Villiers, "Modal Considerations for Synthesizing the Tapering Profile of a Quadruple-Ridged Flared Horn Antenna", *International Conference on Electromagnetics in Advanced Applications (ICEAA)*, Palm Beach, Aruba, pp. 488 - 491 August, 2014.
70. (2014) D.I.L. de Villiers and R. Lehmensiek, "Offset Gregorian Reflector Shaping for Optimum Sensitivity", *International Conference on Electromagnetics in Advanced Applications (ICEAA)*, Palm Beach, Aruba, pp. 585 – 588, August, 2014.
71. (2014) D.I.L. de Villiers and R. Lehmensiek, 'Sub-Reflector Extensions in Shaped Dual Reflector Systems', *IEEE AP-S International Symposium on Antennas and Propagation,* Memphis, TN, USA, pp. 1481-1482, July, 2014.
72. (2014) D.I.L. de Villiers and R. Lehmensiek, 'Sensitivity Performance of Several Mappings in Shaped Offset Gregorian Reflectors', *IEEE AP-S International Symposium on Antennas and Propagation,* Memphis, TN, USA, pp. 1477 – 1478, July, 2014.
73. (2014) R. Lehmensiek and D.I.L. de Villiers, 'Sensitivity Performance of the SKA Offset Gregorian Reflector candidates with Ideal Feeds', *IEEE AP-S International Symposium on Antennas and Propagation,* Memphis, TN, USA, pp. 1479 - 1480 July, 2014.
74. (2014) D.I.L. de Villiers and R. Lehmensiek, 'Dual Reflector Shaping for Realistic Frequency Dependent Feed Patterns with Specific Secondary Field Pattern Targets', *European Conference on Antennas and Propagation (EuCAP)*, Den Haag, Netherlands, pp. 13 – 17, April, 2014.
75. (2013) R.D. Beyers and D.I.L. de Villiers, 'Analysis of Shorted Coaxial Peripheral Feeding Networks for Conical Line Power Combiners', *Asia Pacific Microwave Conference*, Seoul, Korea, pp. 285 – 287 November, 2013.
76. (2013) D.B. Davidson, R. Lehmensiek, D.I.L. de Villiers and A. Young, 'Current capabilities for the full-wave electromagnetic modelling of dishes for SKA', *International Conference on Electromagnetics in Advanced Applications (ICEAA)*, Turin, Italy, pp. 1368 - 1371 September, 2013.
77. (2013) A. Young, D.I.L. de Villiers and D.B. Davidson, 'Sensitivity of Shaped Offset Gregorian Type Reflector Systems to Mechanical Mounting Errors', *International Conference on Electromagnetics in Advanced Applications (ICEAA)*, Turin, Italy, pp. 1446 – 1448, September, 2013.
78. (2013) I.P. Theron, R. Lehmensiek and D.I.L. de Villiers, 'Towards an optics design for the SKA', *Proc. IEEE AFRICON*, Mauritius, September, 2013, pp. 1313 - 1317.
79. (2013) N. Mutonkole and D.I.L. de Villiers, 'A 3:1 Bandwidth Planar, Lossless Cavity Backed Sinuous Antenna for Reflector Feed Applications', *Proc. IEEE AFRICON*, Mauritius, pp. 222 – 226, September, 2013.
80. (2013) K. Schoeman, P. Meyer and D.I.L. de Villiers, 'Exponential TEM Horn with a Convex Triangular Arc', *Proc. IEEE AFRICON*, Mauritius, pp. 257 – 261, September, 2013.
81. (2013) R. Lehmensiek and D.I.L. de Villiers, 'Radiation Performance Evaluation and Improvement of a Pair of Dipoles over a Ground Plane', *IEEE AP-S International Symposium on Antennas and Propagation,* Orlando, FL, USA, pp. 2127 – 2128, July, 2013.
82. (2013) D.I.L. de Villiers and R. Lehmensiek, 'Efficient Simulation of Radiometric Noise in Offset Gregorian Antenna Systems', *European Conference on Antennas and Propagation (EuCAP)*, Gothenburg, Sweden, pp. 3357 – 3359, April, 2013.
83. (2012) D.I.L. de Villiers, 'A simplified peripheral feeding network for conical line power combiners', *Asia Pacific Microwave Conference (APMC)*, Kaohsiung, Taiwan, pp. 986 – 988, December, 2012.

84. (2012) D.I.L. de Villiers and R. Lehmensiek, 'Sub-reflector extension shapes for reduced far-out sidelobes in offset Gregorian antennas', *International Symposium on Antennas, Propagation and Electromagnetic Theory (ISAPE)*, Xi'An, China, pp. 55 – 58, October, 2012.
85. (2012) A. Young, M.A.B. Terada, D.I.L. de Villiers and D.B. Davidson, 'Assessment of the sensitivity of the South African KAT-7 and MeerKAT/SKA radio telescope reflector antennas', *International Conference on Electromagnetics in Advanced Applications (ICEAA)*, Cape Town, South Africa, September, 2012.
86. (2012) D.I.L. de Villiers, 'Higher order modal interactions in conical power combiners', *International Conference on Electromagnetics in Advanced Applications (ICEAA)*, Cape Town, South Africa, September, 2012.
87. (2012) I.P. Theron, R. Lehmensiek and D.I.L. de Villiers, 'The design of the MeerKAT dish optics', *International Conference on Electromagnetics in Advanced Applications (ICEAA)*, Cape Town, South Africa, September, 2012.
88. (2012) D.I.L. de Villiers and R. Lehmensiek, 'Sub-Reflector Extensions for Reduced Noise Temperature in Low-Side Sub-Reflector Offset Gregorian Systems', *European Conference on Antennas and Propagation (EuCAP)*, Prague, Czech Republic, pp. 3438 - 3441, March, 2012.
89. (2012) R. Lehmensiek and D.I.L. de Villiers, 'Wide Flare Angle Axially Corrugated Conical Horn Design for a Classical Offset Dual-Reflector Antenna', *European Conference on Antennas and Propagation (EuCAP)*, Prague, Czech Republic, pp. 3292 - 3294, March, 2012.
90. (2011) D.I.L. de Villiers and R. Lehmensiek, 'Analytical Evaluation of the Efficiency Improvement of Shaped over Classical Offset Dual-Reflector Antennas Including Sub-Reflector Diffraction', *International Conference on Electromagnetics in Advanced Applications (ICEAA)*, Turin, Italy, September, 2011 pp. 191-194.
91. (2011) D.I.L. de Villiers, 'Gain Ripple in Small Offset Gregorian Antennas', *IEEE AP-S International Symposium on Antennas and Propagation,* Spokane, WA, USA, July, 2011, pp. 2172-2175.
92. (2011) D.I.L. de Villiers, 'Analytical Prediction of Feed Efficiency in Offset Gregorian Reflector Antennas with Non Planar Log-Periodic Type Feeds', *Progress in Electromagnetics Research Symposium (PIERS) Proceedings*, Marrakech, Morocco, March, 2011, pp. 573 – 577.
93. (2010) D.I.L. de Villiers, P.W. van der Walt and P. Meyer, 'Design Constraints in Conical Line Power Combiners', *Proc. Mediterranean Microwave Symposium*, Guzelyurt, Cyprus, August, 2010, pp. 148-151.
94. (2009) D.I.L. de Villiers, P. Meyer and K.D. Palmer, 'Design of a Wideband Orthomode Transducer', *Proc. IEEE AFRICON*, Nairobi, Kenya, September, 2009, pp. 1-6.
95. (2007) D.I.L. de Villiers and P. Meyer, 'An Efficient Grid Placing Technique for 2-D Method of Moments Analysis of Coupled Line Structures', *Proc. IEEE AFRICON*, Windhoek, Namibia, September, 2007, pp. 1-6.

INTERNATIONAL CONFERENCE KEYNOTE PRESENTATIONS

1. (2022) DIL de Villiers, "Design of Modern Radio Telescope Antennas Using Surrogate Modelling", *IEEE MTT-S International Conference on Numerical Electromagnetic and Multiphysics Modeling and Optimization (NEMO)*, Limoges, France, July 2022, non-proceedings.

LOCAL CONFERENCE KEYNOTE PRESENTATIONS

1. (2022) DIL de Villiers, “The optics and feed design of the 18-meter reflector antenna for the ngVLA”, *South African Radio Astronomy Observatory Student Conference*, Johannesburg, December 2022, non-proceedings.

INTERNATIONAL CONFERENCE PRESENTATIONS (NON-PROCEEDINGS)

1. (2022) Z. du Toit, F.T.T. Mokhupuki and D.I.L. de Villiers, “A tri-ridge flared horn reflector antenna feed for radio astronomy”, *International Conference on Electromagnetics in Advanced Applications (ICEAA)*, Cape Town, September 2022.
2. (2022) R. Lehmensiek and D.I.L. de Villiers, “The optics and feed design of the 18-meter reflector antenna for the ngVLA”, *International Conference on Electromagnetics in Advanced Applications (ICEAA)*, Cape Town, September 2022.
3. (2022) R. Lehmensiek and D.I.L. de Villiers, “Faster optimization of quadruple-ridged flared horns using geometric feasibility parameters”, *International Conference on Electromagnetics in Advanced Applications (ICEAA)*, Cape Town, September 2022.
4. (2021) R. Lehmensiek and D.I.L. de Villiers, “A tolerance study of the 18 m offset Gregorian dual reflector antenna for the ngVLA”, *International Conference on Electromagnetics in Advanced Applications (ICEAA)*, Honolulu, HI, August 2021.
5. (2021) F.T.T. Mokhupuki and D.I.L. de Villiers, “Fast Surrogate-Based Optimization of Wideband Quad-Ridge Flared Horn Feeds for SKA and ngVLA”, *International Conference on Electromagnetics in Advanced Applications (ICEAA)*, Honolulu, HI, August 2021.
6. (2021) D.I.L. de Villiers, E. De Lera Acedo, J.M. Cumner, Q.D. Gueuning on behalf of the REACH collaboration, “Antenna Design for the REACH Global 21cm Experiment”, *URSI General Assembly*, Rome, Italy, August 2021.
7. (2021) E. De Lera Acedo and D.I.L. de Villiers on behalf of the REACH collaboration, “Exploring the sky-averaged 21-cm line from the South African Karoo using REACH”, *URSI General Assembly*, Rome, Italy, August 2021.
8. (2021) R. Lehmensiek and D.I.L. de Villiers, “On the design of the 18 m offset Gregorian dual reflector antenna for the ngVLA” *URSI General Assembly*, Rome, Italy, August 2021.
9. (2019) D.I.L. de Villiers, R. Louw, R. Weideman, A. Cuyt, et al., “Practical Performance of Regular Sparse Array Direction of Arrival Estimation in 1-D”, *International Conference on Electromagnetics in Advanced Applications (ICEAA)*, Grenada, Spain, September 2019.
10. (2019) B. Klopper, D.I.L. de Villiers and E. de Lera Acedo, “Antenna Design and Optimisation of the Radio Experiment for the Analysis of Cosmic Hydrogen”, *International Conference on Electromagnetics in Advanced Applications (ICEAA)*, Grenada, Spain, September 2019.
11. (2017) R. Lehmensiek and D.I.L. de Villiers, “On the performance limits of the SKA1-mid reflector system”, 32nd URSI General Assembly, Montreal, Canada, August, 2017.
12. (2013) M. H. Volkmann, C. J. Fourie, D.I.L. de Villiers, D.B. Davidson, W.J. Perold, and T. Ortlepp, “Improving the Square-Kilometre Array with Superconductor Electronics”, *European Conference on Applied Superconductivity (EuCAS)*, Genova, Italy, September, 2013.
13. (2011) M.H. Volkmann, C.J. Fourie, W.J. Perold, D.B. Davidson, H.C. Reader and D.I.L. de Villiers, "Superconducting circuits in the Square Kilometre Array radio telescope", *European Conference on Applied Superconductivity (EuCAS)*, The Hague, The Netherlands, September, 2011.

NATIONAL CONFERENCE PRESENTATIONS

1. (2018) D.I.L. de Villiers, 'The SARChI Chair in Antenna Systems for the SKA at Stellenbosch University' *South African IEEE AP/MTT/EMC Conference*, Stellenbosch, South Africa, August, 2018.
2. (2016) N. Mutonkole, D.I.L. de Villiers, 'Parametric Modelling of Antenna Responses' *South African IEEE AP/MTT/EMC Conference*, Stellenbosch, South Africa, July, 2016.
3. (2014) D.I.L. de Villiers, R.D. Beyers, 'Recent Advances in Conical Transmission Line Power Combiner Design' *South African IEEE AP/MTT/EMC Conference*, Pretoria, South Africa, May, 2014.
4. (2011) D.I.L. de Villiers, R. Lehmensiek, E. Knox-Davies and I.P. Theron, 'Preliminary Reflector Design of the MeerKAT Radio Telescope' *South African IEEE AP/MTT/EMC Conference*, Stellenbosch, South Africa, April, 2011.
5. (2009) D.I.L. de Villiers, 'Ultra Wideband Reflector Antenna Feeds' *South African SKA Postgraduate Bursary Conference*, Stellenbosch, South Africa, December, 2009.
6. (2009) D.I.L. de Villiers, 'Development of a Wideband Ortho-Mode Transducer' *South African IEEE AP/MTT Conference*, Stellenbosch, South Africa, March, 2009.
7. (2008) D.I.L. de Villiers, 'Development of a Wideband Ortho-Mode Transducer' *South African SKA Postgraduate Bursary Conference*, Stellenbosch, South Africa, December, 2008.
8. (2007) D.I.L. de Villiers, P. Meyer and P.W. van der Walt, 'Design of a Ten-Way Conical Transmission Line Power Combiner' *South African IEEE AP/MTT Conference*, Stellenbosch, South Africa, March, 2007.

REVIEWER FOR ACADEMIC LITERATURE

JOURNALS

IEEE
- Transactions on Microwave Theory and Techniques (TMTT)
- Transactions on Antennas and Propagation (TAP)
- Antennas and Propagation Magazine (APM)
- Antennas and Wireless Propagation Letters (AWPL)
- Microwave and Wireless Components Letters (MWCL)

IET
- Microwaves, Antennas and Propagation (IETMAP)
- Electronics Letters (EL)

Wiley
- International Journal of Numerical Modelling: Electronic Networks, Devices and Fields
- International Journal of RF and Microwave Computer-Aided Engineering

URSI
- Radio Science Letters

Taylor and Francis
- Journal of Electromagnetic Waves and Applications
- International Journal of Electronics

Emerald
- Engineering Computations

Hindawi
- International Journal of Antennas and Propagation

Bentham Science
- Recent Patents on Electrical Engineering

SAIEE

- Africa Research Journal

CONFERENCES

- **European Microwave Week (EMW)**: 2020 - present
- **IEEE International Symposium on Antennas and Propagation (AP-S)**: 2018 - presnt
- **European Conference on Antennas and Propagation (EuCAP):** 2014 – present
- **International Conference on Electromagnetics for Advanced Applications (ICEAA):** 2017 - present

GRADUATE SUPERVISION

COMPLETED PHD DEGREES

1. (2021-2022) Prof Coenrad Fourie (DEng): 'Inductance in Superconductor Integrated Circuits'
2. (2019-2022) Ridalise Louw (Co-supervisor with Prof Annie Cuyt): 'Sub-Sampled Exponential Analysis Applied to Sparse Planar Antenna Array Configurations'
3. (2017-2020) Fahmi Mokhupuki: 'Efficient Optimisation of Wideband Reflector Feed Antennas'
4. (2016-2019) Jako du Toit (Upgraded from Masters in 2018): 'Partially Filled Radial Power Combiner with Port Isolation'
5. (2018-2019) Jan-Gerald Bij de Vaate: 'Expanding the Field of View: Station Design for the AAMID SKA Radio Telescope'
6. (2016-2018) Brandt Klopper: 'Antenna Elements for Sparse-Regular Aperture Arrays'
7. (2014-2016) Ngoy Mutonkule, 'Modelling of Antenna Responses'
8. (2013-2015) Ryno D. Beyers: 'Circuit Model Design of Conical Transmission Line Power Combiners and Isolation of Reactive Combiners'

COMPLETED MASTERS DEGREES

1. (2020-2022) Yusuf Dhoda (Co-supervisor with Dr Werner Steyn): 'Wide-Band Radio Receiver for Radio Astronomy Applications'
2. (2020-2021) Insight Agbetsiafa (Co-supervisor with Dr Trienko Grobler): 'An RFI Simulation Pipeline to Help Teach Interferometry and Machine Learning'
3. (2020-2021) Stella Schleich: 'Design and implementation of a two-element interferometer'
4. (2020-2021) Jacques Wolmarans: 'Beam ripple modelling in wideband dual-reflector antenna systems'
5. (2020 - 2021) Insight Agbetsiafa (Co-supervisor with Dr. Trienko Grobler): 'An RFI Simulation Pipeline to Help Teach Interferometry and Machine Learning'
6. (2017-2020) Hein Swart (Part time student): 'Wideband Axially Symmetric Power Combiners Based on Short Step Filters'
7. (2019-2020) Rina-Mari Weideman: 'Linear Sparse Regular Array Antenna Demonstrator'
8. (2019-2020) Carla Pieterse: 'Comparison of prime focus and offset Gregorian reflector antennas for 21 cm intensity mapping' (Co-supervisor with Prof. Kavilan Moodley; Student at UKZN)
9. (2018-2019) Scott Kriel: 'Viability of UAV-based Antenna Pattern Measurements'

10. (2018-2019) Zain du Toit (Co-supervisor with Dr. Carlo van Niekerk): 'Wideband, low loss feed integration with a Pyramidal Sinuous Antenna'
11. (2018-2019) Jackline Koech (Co-supervisor with Dr. Gideon Wiid): 'Modified horn-type antennas for SKA RFI Monitoring'
12. (2017-2018) Michael Johnston (Co-supervisor with Dr. Carlo van Niekerk): 'Wideband Balun Design for the Pyramidal Sinuous Antenna'
13. (2017-2018) Shane Moyce: 'Hardware limitations of interference suppressing beamforming'
14. (2017-2018) William J. Cerfonteyn: 'A 22.2 GHz Antenna for Water vapour Radiometry'
15. (2015-2018) David Wolsky (Part time student): 'Automated Space-Mapping Framework for Electromagnetic Device Optimisation'
16. (2016-2017) Clifford Sibanda: 'Design and Optimization of Gap Waveguide Components through Space Mapping'
17. (2016-2017) Ridalise Louw: 'Surrogate Modelling of Performance Metrics of a Wideband Feed for the SKA Reflector Antenna'
18. (2016-2017) Malan A.X. Ruppert: 'A Study on Phased Array Feeds for Paraboloidal Reflector Antennas' – Co-Supervisor with Dr. Ryno Beyers
19. (2015-2017) Nicol Steenkamp: 'Design of a Wideband Sinuous Antenna for Radio Telescope Applications'
20. (2014-2015) Alex A. Vermeulen: 'The design of a dual reflector feed using surrogate modeling techniques'
21. (2014-2015) Brandt Klopper: 'Fast Design and Optimisation of One-Dimensional Microstrip Patch Antenna Arrays'
22. (2013-2014) Lukas M. van Vuuren: 'Design of a Receiver System for Use in Radio Astronomy'
23. (2012-2013) Ngoy Mutonkole: 'Study of a Wideband Sinuous Feed for Reflector Antenna Applications'
24. (2011-2013) Dewald Schoeman: 'Full Scale Low-Cost Ultra Wide Band Antenna for SKA Low Frequency Array'
25. (2011-2012) Alex Ibbotson: 'The Design and Analysis of a Rotman Lens with Reduced Conjugate Port Coupling' – Co-Supervisor with Prof Keith Palmer
26. (2010-2012) Stephanie Alphonse: 'Fast Analysis of a Compound Large Reflector Antenna' – Co-Supervisor with Prof Keith Palmer
27. (2010-2011) Shamim O. Nassar: 'An Investigation of the Equivalence Between Combline and Evanescent-Mode Waveguide Filters & of Aspects Related to Reduction of Manufacturing Costs for Combline Filters' – Co-Supervisor with Prof. Petrie Meyer
28. (2010-2011) David VdM. Prinsloo: 'Characterisation of L-band Differential Low Noise Amplifiers' – Co-Supervisor with Prof. Petrie Meyer
29. (2010-2011) Phillip Terblance: 'Electronically Adjustable Bandpass Filter' – Co-Supervisor with Prof. Petrie Meyer
30. (2009-2010) Karla Schoeman: 'Waveguide Antenna Feed for the Square Kilometre Array' – Co-Supervisor with Prof. Petrie Meyer
31. (2009-2010) Sunelle Otto: 'A study of radio astronomy principles and SKA pathfinder system designs with pulsar science' – Co-Supervisor with Prof. Petrie Meyer

CURRENT PHD STUDENTS

1. (2021-2023) Carla Pieterse
2. (2021-2023) Rina-Mari Weideman (Co-supervisor with Prof Annie Cuyt)
3. (2020-2023) Mariet Venter

4. (2020-2023) Scott Kriel
5. (2020-2023) Zain du Toit (Co-supervisor with Prof. Robert Lehmensiek)
6. (2019-2023) Malan A. X. Ruppert (Co-supervisor with Prof. Matthys Botha)
7. (2019-2023) William Cerfonteyn

CURRENT MASTERS STUDENTS

1. (2023) Aiden Lötter
2. (2022-2023) Henry Johnston
3. (2022-2023) Raynard Swanepoel (Co-supervisor with Dr. Danie Ludick)
4. (2018-2022) Ben van der Merwe (Part time student)

PROFESSIONAL SERVICE

EXTERNAL EXAMINER

PhD:

- Chalmers University of Technology, Gothenburg, Sweden
- Technical University of Eindhoven, Netherlands
- Antwerp University, Belgium
- Rhodes University, Grahamstown, South Africa

Masters:

- University of Pretoria, Pretoria, South Africa
- University of Cape Town, Cape Town, South Africa

INTERNATIONAL WORKSHOPS AND CONFERENCES

- Organizing committee co-chair of the International Conference on Electromagnetics in Advanced Applications (ICEAA), Cape Town, South Africa, September 2022.
- Technical Programme Committee of the IEEE MTT-S International Conference on Numerical Electromagnetic and Multiphysics Modeling and Optimization (NEMO), Reykjavik, Iceland, August, 2018
- Technical Programme Committee of the European Conference on Antennas and Propagation (EuCAP), 2017 – present
- Main organizer of the European School of Antennas course: Antennas for Radio Telescopes; Stellenbosch University, South Africa, (2016, 2019)
- Invited lecturer at the European School of Antennas course: Reflector and Lens Antennas; Chalmers University of Technology, Gothenburg, Sweden (2011, 2014, 2017, 2022)

LOCAL CONFERENCES

- Organising committee co-chair of the South African AP/MTT/EMC conference in Stellenbosch, South Africa, (2011, 2016, 2018)

PROFESSIONAL SOCIETIES

- Senior Member of URSI (2019 - Present)
- Rated researcher at the South African National Research Foundation: Level C1
- IEEE South African Section Joint AP/MTT/EMC Chapter: Chair (2017 – 2018)
- IEEE South African Section Joint AP/MTT/EMC Chapter: Vice chair for AP (2016,2019-2022)
- Senior member of the IEEE (2015 – Present, #80174571)
- Member of the IEEE (2010 - 2015)
- Member of the IEEE Antennas and Propagation Society (2009 - Present)
- Member of the IEEE Microwave Theory and Techniques Society (2008 - Present)
- Student Member of the IEEE (2005 - 2009)
- Golden Key International Honour Society (2003 - Present)

COLLABORATIONS

INTERNATIONAL

2011 – Present: **Chalmers University of Technology; Gothenburg, Sweden**
Prof. Per-Simon Kildal, Prof. Marianna Ivashina; Prof and Rob Maaskant
Outgoing research visits in 2014, 2016 and 2017
- Antenna design for the SKA
- Fast design of antenna arrays

2014 – 2018: **Ghent University; Ghent, Belgium**
Prof. Tom Dhaene and Dr. Ivo Couckuyt
Joint supervision of PhD student from Stellenbosch through student visit to Ghent in 2015; Collaborative research
- Parametric modelling of antenna impedance characteristics
- Surrogate based optimization of antenna responses using Kriging models

2014 – 2017: **Reykjavik University; Reykjavik, Iceland**
Prof. Slawomir Koziel
Collaborative research
- Surrogate based optimization of antennas

2016 – Present: **Antwerp University; Antwerp, Belgium**
Prof. Annie Cuyt
Joint supervision of Masters' student from Stellenbosch through student visit to Antwerp in 2016-2017
- Rational interpolation modelling of antennas

2012 – 2013: **Novi Sad University; Novi Sad, Serbia**
Prof. Vesna Crnojevic-Bengin
Outgoing research visits in 2012 and 2013
- Design of frequency selective surfaces

LOCAL

2015 – 2017: **University of Pretoria**
Dr. Pieter Jacobs
Collaborative research
- Gaussian process modelling of reflector antennas

2015 – Present: **University of Pretoria**
Prof. Tinus Stander
Joint supervision of Masters students from Stellenbosch and Pretoria Universities

- Radial power combiners and antenna arrays
- Development of a water vapour radiometer

REFERENCES

Prof. Petrie Meyer
Department of Electrical and Electronic Engineering, Stellenbosch University
Private Bag X1, Matieland, 7602
South Africa
Tel: +27 (0)21 808 4322
Email: pmeyer@sun.ac.za

Dr. Isak Theron
Technical Director, EMSS Antennas (Pty) Ltd
Stellenbosch, 7600
South Africa
Tel: +27 (0)21 880 1188
Email : iptheron@emss.co.za