Curriculum Vitae

DANIEL JACOBUS LUDICK

Electrical & Electronic Engineer (PhD)

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Overview

Danie matriculated in 2003 from Jan van Riebeeck High school in Cape Town. He received distinctions in Afrikaans, English (both first language), Science, Computer Science, Geography and Mathematics (all high-grade). He graduated in 2007 from Stellenbosch University with a B.Eng. (Cum Laude) in Electrical and Electronic Engineering with additional Computer Science subjects. In 2009 he completed his MScEng (Cum Laude) and thereafter obtained his PhD (part-time) from the same institution in December 2014. During the course of his undergraduate studies, he received distinctions in 43 out of 44 undergraduate modules, including his final year project entitled Focal Plane antennas for the Square Kilometer Array. For this, he was nominated as one of four finalists in the 2007 M-Net Jak van der Merwe Competition for Innovation.

For his MScEng, Danie focused on the development of a Focal Plane Array feed-structure for parabolic dish reflector antennas for the Square Kilometer Array (SKA) and the Karoo Array Telescope (KAT). Thereafter, he pursued his PhD (part-time) while working at Altair Development S.A. (Pty) Ltd (previously EM Software & Systems – S.A. (Pty) Ltd.) in Stellenbosch, South Africa, as a senior software developer for the commercial computational electromagnetic (CEM) software package, FEKO.

His PhD research was focused on the development of efficient numerical analysis techniques for the analysis of finite antenna arrays. During this period, Danie developed a domain decomposition based technique called the Domain Green's Function Method (DGFM) that is now included in FEKO.

During his post-graduate studies, he formed part of the research group of Stellenbosch University (CEMAGG) under the leadership of Prof. D.B. Davidson. His research interests include electromagnetic modeling, high performance computing (HPC), parallel programming, antenna design and energy efficiency, and characteristic mode analysis. In 2011 Danie co-founded a creative web development firm called Webfront Creative Design that now forms part of RMS Engineering (Pty) Ltd. who provides a variety of consulting engineering, software and application development services to a wide audience. From 2015 to 2017 he was employed as a post-doctoral researcher at Stellenbosch University focusing on the use of High Performance Computing for Radio Astronomy purposes. As of July 2017 he holds a

lectureship position at the Department of Electrical & Electronic Engineering, at the same institution. He also forms part of the computational and electromagnetics group (CEMAGG) at Stellenbosch University.

Danie is married to Sunel Ludick and together with their two children, they reside in Somerset West, South Africa. He is also a keen mountain biker, trail-runner and golfer.

Education

- **PhD — Computational Electromagnetics**

  Stellenbosch University, Stellenbosch, South Africa

  2011 — 2014 (part-time)

  Thesis title: *Efficient Numerical Analysis of Focal Plane Antennas for the SKA and the MeerKAT*
  Advisors: Prof. D.B. Davidson and Dr. Ulrich Jakobus (from Altair Engineering Inc.)

- **MScEng (*cum laude*) — Computational Electromagnetics**

  Stellenbosch University, Stellenbosch, South Africa

  2008 — 2009

  Thesis title: *Efficient Numerical Analysis of Focal Plane Antennas for the SKA and the MeerKAT*
  Advisor: Prof. D.B. Davidson

- **BEng (*cum laude*) — Electrical and Electronic Engineering**

  Stellenbosch University, Stellenbosch, South Africa

  2004 — 2007

  Final year project title: *Focal Plane Antennas for the SKA and the MeerKAT*
  Advisor: Prof. D.B. Davidson

Skills

Programming skills

Experienced in various programming languages, including C, Java, Python, Matlab/Octave and FORTRAN. Special interest and experience with parallel programming for HPC infrastructures, using both distributed and shared memory programming models, such as MPI and OpenMP.

Computer and Project Management skills

Experienced in using both Windows and Linux/Unix operating systems including productivity software such as Word, Excel, PowerPoint, etc. Having worked in a commercial environment for nearly 6 years, Danie is also familiar with version control methods and issue tracking platforms.

Research, Communication and Team work skills

Danie has presented his post-graduate research at various local and international conferences. A full list of the publications he authored is presented on the following page. He worked closely in a team of engineers, each contributing to the success of the CEM software package FEKO.

Professional Experience

Stellenbosch University

Lecturer

Stellenbosch, S.A – July 2017-present

- Lecturer for Electrotechnique 143 and Computer Programming 143
- Research areas focussed on Antenna Array analysis, Computational Electromagnetics, Machine Learning, High Performance Computing

Stellenbosch University

Post-doctorate Researcher – Computational & Electromagnetics Group (CEMAGG)

Stellenbosch, S.A - 2015-present

- Computational Electromagnetic (CEM) development
- Antenna analysis using HPC

Altair Development S.A (Pty) Ltd (previously EMSS-SA (Pty) Ltd))

Senior Developer – Electromagnetic Solutions - Stellenbosch, S.A - 2014-present

FEKO Kernel Engineer - Stellenbosch, S.A - 2009-2014

- Computational Electromagnetic (CEM) development
- Parallel programming using hybrid OpenMP/MPI
- Testing and Validation of FEKO

TMT (Pty) Ltd *Programmer - Stellenbosch, S.A - Nov 2007 - Feb 2008*

- Development of a software application for a prototype radar-system
- Experience gained in Visual basic programming
- Worked with Axis 207MW IP cameras

Publications

Dissertations

- Ludick, D.J. “Efficient numerical analysis of focal plane antennas for the SKA and the MeerKAT”. *MScEng diss.*, Stellenbosch: University of Stellenbosch, 2010.

- Ludick, D.J. "Efficient numerical analysis of finite antenna arrays using domain decomposition methods." *PhD diss.*, Stellenbosch University, 2014.

Peer-reviewed International Journal Publications

- Ludick, D.J., Maaskant, R., Davidson, D.B., Jakobus, U., Mittra, R. and de Villiers, D.: “Efficient Analysis of Large Aperiodic Antenna Arrays using the Domain Greens Function Method.” *IEEE Transactions on Antennas and Propagation*, vol. 62, no. 4, 2014.

- Jakobus, U., Marchand, R.G., Ludick, D.J., “Aspects of and Insights Into the Rigorous Validation, Verification, and Testing Processes for a Commercial Electromagnetic Field Solver Package”, *IEEE Transactions on Electromagnetic Compatibility*, Vol. 56. Issue 4, pp. 759-770

- Vogel, M., Gampala, G., Ludick, D.J., Jakobus, U., Reddy, C.J.: “Characteristic Mode Analysis: Putting Physics back into Simulation”. *In: IEEE Antennas and Propagation Magazine*. Vol. 57, No. 2, 2015

Peer-reviewed International Conference Publications

- Ludick, D.J. and Davidson, D.B.: “Investigating Efficient Parallelization Techniques for the Characteristic Basis Function Method (CBFM).” In: *Electromagnetics in Advanced Applications, 2009. ICEAA'09. International Conference on*, pp. 400 – 403, 2009.

- Ludick, D.J., Jakobus, U. and Davidson, D.B.: “Efficient analysis of finite antenna arrays using the Domain Green's Function Method.” In: *2012 IEEE Antennas and Propagation Society International Symposium (APSURSI)*, pp. 1-2. 2012.

- Ludick, D.J., Jakobus, U. and Davidson, D.B.: “Numerical analysis of finite antenna arrays using the Domain Green's Function Method.” In: *2012 International Conference on Electromagnetics in Advanced Applications (ICEAA)*, pp. 216-219. Sept 2012.

- Ludick, D.J., Van Tonder, J. and Jakobus, U.: “Combining Domain Decomposition solution Techniques with Higher Order Hierarchical Basis Functions”. In: *2013 International Conference on Electromagnetics in Advanced Applications (ICEAA)*, pp. 70-73. 2013.
- Ludick, D.J., Maaskant, R., Davidson, D.B., Jakobus, U. and Mittra, R.: “A Comparison of Domain Decomposition Techniques for Analysing Disjoint Finite Antenna Arrays”. *8th European Conference on Antennas and Propagation (EuCAP)*, pp. 2994-2998, 2014.
- Ludick, D.J., Maaskant, R., Mittra, R., Jakobus, U. and Davidson, D.B.: “Applying the CBFM-Enhanced DGFM to the Analysis of Large Finite Antenna Arrays”. In: *2013 International Conference on Electromagnetics in Advanced Applications (ICEAA)*. 2013.
- Ludick, D.J., Maaskant, R., Davidson, D.B. and Jakobus, U.: “Applying the NGF-Enhanced Domain Green's Function Method to the Analysis of Antenna Arrays and Ground Planes of Finite Sizes”. In: *2014 International Conference on Electromagnetics in Advanced Applications (ICEAA)*. 2014.
- Ludick, D.J., Maaskant, R., Davidson, D.B. and Jakobus, U.: “Accelerating the Domain Green's Function Method through Adaptive Cross Approximation”. *In: 2014 International Conference on Electromagnetics in Advanced Applications (ICEAA)*. 2014.
- Ludick, D.J., Lezar, E., Jakobus, U: “Characteristic Mode Analysis of Arbitrary Electromagnetic Structures using FEKO”. *In: 2012 International Conference on Electromagnetics in Advanced Applications (ICEAA)*. 2012.
- Ludick, D.J, and Smith, A.G. "Understanding the fundamental radiating properties of antennas with characteristic mode analysis." *2013 Proceedings of the International Symposium on Antennas & Propagation (ISAP),* Vol. 2. IEEE, 2013.
- D. J. Ludick, U. Jakobus, and M. Vogel, “A Tracking Algorithm for the Eigenvectors Calculated with Characteristic Mode Analysis," *8th European Conference on Antennas and Propagation (EuCAP)*, pp. 629-632, 2014.
- D. J. Ludick, P. Futter, U. Jakobus, and C. J. Reddy, “Recent extensions to Characteristic Mode Analysis in the commercial electromagnetic Field solver FEKO," *Proceedings for the 2013 Antenna Applications Symposium*, Sept. 2013.
- Ludick, D.J., Van Tonder, J., Jakobus, U: “A Hybrid Tracking Algorithm for Characteristic Mode Analysis”. *In: 2014 International Conference on Electromagnetics in Advanced Applications (ICEAA)*. 2014.
- Ludick, D.J., Davidson, D.B : “Applying Characteristic Mode Analysis to Finite Antenna Array Design”. *In: 2016 International Conference on Electromagnetics in Advanced Applications (ICEAA)*. 2016.

- Ludick, D.J., Venter, M, Davidson, D.B., Venter, G., : “A multiphysics analysis of dish reflector antennas for radio astronomy applications”. *In: 10th European Conference on Antennas and Propagation (EuCAP)*. 2016.
- Ludick, D.J., Botha, M.M., Davidson, D.B., : “Comparison of the iterative Jacobi method and iterative Domain Green’s Function Method for finite antenna array analysis”. *In: 10th European Conference on Antennas and Propagation (EuCAP)*. 2016.
- Ludick, D.J., Botha, M.M., Davidson, D.B., : “Introducing the iterative Domain Green’s Function Method for finite array analysis”. *In: Wireless Information Technology and Systems (ICWITS) and Applied Computational Electromagnetics (ACES)*. 2016.
- Ludick, D.J., Davidson, D.B, Jakobus, U.: “Analysis of finite antenna arrays in the presence of arbitrary electromagnetic structures”. *In: 2015 International Conference on Electromagnetics in Advanced Applications (ICEAA). 2015.*
- Rahola, J., Ludick, D.J, Futter, P..: “Characteristic Modes and Antenna bandwidth”. *In: 2014 Antennas and Propagation Society International Symposium (APSURSI), 2014.*
- Jakobus, U, Bingle, M., Burger, W., Ludick, D., Schoeman, M., van Tonder, J.: “Method of Moments accelerations in FEKO”. *In: 2011 International Conference on Electromagnetics in Advanced Applications (ICEAA), 2011.*
- Schick, M., Jakobus, U., Schoeman, M., Bingle, M., van Tonder, J., Burger, W., and Ludick, D., "Extended solution methods in FEKO to solve actual antenna simulation problems: Accelerated MoM and windscreen antenna modelling." *Proceedings of the 5th European Conference on Antennas and Propagation (EUCAP),*. 2011.
- Gampala, G., Reddy, C. J., Ludick, D.J., and Futter, P., "Systematic design of antennas using the theory of characteristic modes for mobile phone applications." *Antennas and Propagation Society International Symposium (APSURSI),* 2014.

Hobbies

- Outdoor activities such as mountain biking and trail running with my wife and two kids.

References

- Dr. Ulrich Jakobus – Vice President, Electromagnetic Solutions at Altair (e-mail: jakobus@altair.co.za | tel: +27 21 831 1500)

- Prof. David Davidson – SKA Research Chair, Stellenbosch University (e-mail: davidson@sun.ac.za | tel: +27 21 808 4458)

Academic Transcripts

- Available on request