NRF PhD studentship:

Operator theory and matrix analysis methods in system and control theory

Call for applications

The School of Mathematical and Statistical Sciences at NWU invites applications for a Grant Holder linked PhD bursary at the Potchefstroom Campus under supervision of Professor Sanne ter Horst.

Brief description of the project

The PhD project involves factorization and (linear) representations within certain classes of matrix functions, e.g., Wiener matrix functions, structured rational matrix functions, etc., and related interpolation and inverse problems. The developed methods should be applicable to various problems in system and control theory. See Page 2 for a more elaborate description.

Particulars of the studentship

- An NRF student stipend is offered subject to meeting the NRF funding requirements.
- PhD studentship is tenable for the period January 2019 - December 2021.
- The studentship is only available for full-time on-campus studies.

Requirements

- The successful candidate should have done an MSc in Mathematics or Applied Mathematics on a topic that has a significant functional analysis or matrix analysis component.
- The successful candidate will be required to comply with the University's approved policies, procedures and practices for academic acceptance.
- The studentship is subject to the requirements and guidelines stipulated by the NRF.

Application process

- Applications must include a letter of interest, certified copies of academic transcripts, a CV showing details of the applicant's research competencies/outputs and the names and e-mail addresses of at least two academics that can assess the applicant's academic abilities.
- Applications for and enquiries regarding the studentship should be sent to Prof. Sanne ter Horst (sanne.terhorst@nwu.ac.za), with the reference PhD application 2019, accordingly.
- The Grant holder reserves the right to hold interviews or other means of assessment to select the successful candidate.
- The Grant holder reserves the right to disqualify ineligible, incomplete and/or inappropriate applications.
- The Grant holder reserves the right to change the conditions of award or to make no awards at all.
- Closing date for applications: **March 11, 2019.**

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Description of the project

Factorization techniques and linear descriptions through state space representations of matrix-valued functions are essential tools in the solution to many control problems [ZDG96,BGKR08]. Operator theory and matrix analysis methods play an important role in the development of concrete descriptions of solutions to factorization and state space representation problems for various classes of matrix-valued functions. In this project we are specifically interested in matrix-valued Wiener class functions, which appear as transfer functions of bounded-input bounded-output (BIBO) stable systems. The aim is to develop factorization methods within this class of matrix functions, cf., [GtHK16], and resolve interpolation and inverse problems [EG03,tHKvS17]. Alternative projects within the NRF funded research proposal relate to [BKV14,SP13].

Selected literature

- [BKV14] J.A. Ball and D.S. Kaliuzhnyi-Verbovetskyi, Rational Cayley inner Herglotz-Agler functions: positive-kernel decompositions and transfer-function realizations, Linear Algebra Appl. 456 (2014), 138–156.
- [BGKR08] H. Bart, I. Gohberg, M.A. Kaashoek, and A.C.M. Ran, Factorization of matrix and operator functions: the state space method, Birkhäuser Verlag, Basel, 2008.
- [EG03] R.L. Ellis and I. Gohberg, Orthogonal systems and convolution operators, Operator Theory: Advances and Applications 140, Birkhäuser Verlag, Basel, 2003.
- [GtHK16]G.J. Groenewald, S. ter Horst, and M.A. Kaashoek, The Bezout-corona problem revisited: Wiener space setting, Complex Anal. Oper. Theory 10 (2016), 115-139.
- [tHKvS17] S. ter Horst, M.A. Kaashoek, and F. van Schagen, The discrete twofold Ellis-Gohberg inverse problem, J. Math. Anal. Appl. 452 (2017), 846-870.
- [SP13] P. Shah and P.A. Parrilo,H^2-optimal decentralized control over posets: a state-space solution for state-feedback, IEEE Trans. Automat. Control 58 (2013), 3084–3096.
- [ZDG96] K. Zhou, J.C. Doyle and K. Glover, Robust and Optimal Control, Prentice-Hall, Upper Saddle River, NJ, 1996.

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