Reference page for the Exploration of Geometric Algebra for Microwave Network Classification, Simplification, and self-study

Miguel Gomez
University of Utah Computer Engineering

Abstract—Index Terms—Bivector, Clifford Algebra, Geometric Algebra, Mobius Transformation, Multivector, Rotor, Spinor

I. Introduction

I am adding in all my references here for the assignment. [1] [2] [3] [4] [5] [6] [7] [8] [9] [10]

II. REFLECTION

A. My Process

My journey has had me working on papers and compiling sources for some time now. I do not like using Mendeley as they broke the integration with Google Chromium based browsers and have yet to do anything to fix it. I used it before and it was useful, but I have taken to keeping the PDFs of the papers that I put together, and I always get the bibtex entry from the source itself. I add them all to a custom bibliography that contains everything which is backed up on Github as well as my home PC and Laptop. That way I am never too far away from my sources and have an easy method of sharing them with others.

Additionally, I have been using Emacs as my main text editor for some time since it is very easy to have custom code that runs when I am working in a particular language. One of which is the LATEX language for markup. It is easy to put together papers with the exact formatting that I want, or in the case of the main place where I am looking to publish, IEEE has the IEEETran document style that is provided for their journals.

B. Things I liked this week

I had not used the Open Knowledge Map before but I really liked the way things are set up there. Knowing that I could easily take the topic that I am working on and create a map like this by just using a single search term is a powerful tool. It was very rewarding and validating to see many of the same resources that I have come across show up in the list of papers and topic bubbles when looking at Geometric Algebra. I will likely continue to use these in the future. I particularly liked the fact that the bubbles contained papers that likely had a smaller Euclidean distance in the N-dimensional space where this data is compiled.

REFERENCES

- [1] F. G. Montoya, A. Alcayde, F. M. Arrabal-Campos, and R. Baños, "How to overcome the limitations of p-q theory: Geometric algebra power theory to the rescue," in 2020 IEEE PES Innovative Smart Grid Technologies Europe (ISGT-Europe), 2020, pp. 339–343.
- [2] F. G. Montoya, F. M. Arrabal-Campos, A. Alcayde, X. Prado-Orbán, and J. Mira, "Geometric power and poynting vector: a physical derivation for harmonic power flow using geometric algebra," in 2022 20th International Conference on Harmonics Quality of Power (ICHQP), 2022, pp. 1–6.
- [3] Z. Zhang, P. Cai, M. Shen", G. Huang, and S. Wang, "Geometric algebra adaptive filter based on multi-dimensional complex-valued random fourier features," in 2022 IEEE 32nd International Workshop on Machine Learning for Signal Processing (MLSP), 2022, pp. 1–6.
- [4] Y. Li, Y. Wang, R. Wang, Y. Wang, K. Wang, X. Wang, W. Cao, and W. Xiang, "Ga-cnn: Convolutional neural network based on geometric algebra for hyperspectral image classification," <u>IEEE Transactions on</u> Geoscience and Remote Sensing, vol. 60, pp. 1–14, 2022.
- [5] S. Franchini, A. Gentile, F. Sorbello, G. Vassallo, and S. Vitabile, "Conformalalu: A conformal geometric algebra coprocessor for medical image processing," <u>IEEE Transactions on Computers</u>, vol. 64, no. 4, pp. 955–970, 2015.
- [6] A. H. Eid and F. G. Montoya, "A systematic and comprehensive geometric framework for multiphase power systems analysis and computing in time domain," IEEE Access, vol. 10, pp. 132725–132741, 2022.
- [7] E. Bayro-Corrochano, "A survey on quaternion algebra and geometric algebra applications in engineering and computer science 1995–2020," IEEE Access, vol. 9, pp. 104326–104355, 2021.
- [8] M. J. Neve, "Reinterpreting the smith chart using conformal geometric algebra," IEEE Access, vol. 11, pp. 138 827–138 838, 2023.
- [9] A. Arsenovic, "Applications of conformal geometric algebra to transmission line theory," <u>IEEE Access</u>, vol. 5, pp. 19920–19941, 2017.
- [10] A. Arsenovic, J. Hillairet, J. Anderson, H. Forstén, V. Rieß, M. Eller, N. Sauber, R. Weikle, W. Barnhart, and F. Forstmayr, "scikit-rf: An open source python package for microwave network creation, analysis, and calibration [speaker's corner]," <u>IEEE Microwave Magazine</u>, vol. 23, no. 1, pp. 98–105, 2022.