

# Conformal Geometric Algebra by Extended Vahlen Matrices

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In this paper, conformal geometric algebra and the Clifford-valued Vahlen matrix representation of Möbius transformations meet, to lay the foundation for a fruitful interaction.

To embed the full conformal model we need to define the matrices that represent the blades in geometric algebra – this gives us an extension of the matrix representation from transformations to geometric primitives such as circles, lines and tangents (and more). This is done by translating the outer product and contraction product constructions of such elements into matrix operations, through the intermediate step of writing them as linear combinations of geometric products. We provide a useful dictionary for this translation. Using the dictionary, we show some examples of how the two representations can interact to study properties of conformal transformations, with some emphasis on Euclidean similarities and motions.