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Structure Preserving Representation of Euclidean Motions through Conformal Geometric Algebra

Abstract: Conformal Geometric Algebra (CGA) is being used to encode Euclidean geometry compactly, resulting in software with fewer exceptions for the usual primitives (points, lines, planes), and extending the Euclidean primitives to spheres, circles, tangents et cetera in a consistent algebraic manner. Its power lies in being a computational framework in which constructions are represented in a structure-preserving manner: moving an element constructed from primitives is identical to moving the primitives and constructing the element (trivial, but our usual linear algebra representations fail in this). I show what the essential steps are to get from standard linear algebra to CGA, with a focus on the representation of transformations (especially Euclidean motions); the primitives then follow.