

Read Me

This Geometric Algebra (GA) package was developed in January, 2017 using Mathematica 10 and has been checked out in version 11. It performs GA operations in n -dimensions for any n . The package was designed specifically for geometric (a.k.a. Clifford) algebras but can be configured to perform basic Grassmann algebra operations as well. The command allows the user to enter both numeric and symbolic equations. That is, one can perform specific numerical calculations as well as develop and check general formulas. For example, you can check whether associativity holds for various operations or whether a particular vector identity holds as well for bivectors.

The package uses standard mathematical notation. The user is not required to use special conventions for keying input. For example, in 4-dimensional space-time, a vector basis would be written e_1, e_2, e_3, e_4 and the vector $(1,2,3,4)$ would be written as $e_1 + 2 e_2 + 3 e_3 + 4 e_4$. If spacetime (rather than space) is chosen, the convention is that e_1 is the time axis. A palette is provided that allows the user to choose a quadratic form; that is, whether $e_k^2 = +1$ or -1 (with e_1^2 equal to the opposite if spacetime is chosen). A palette is provided that allows the user to choose either Clifford or Grassmann algebra and, if Clifford, the quadratic form and whether to use space or space-time.

Currently the package performs the following operations (all visible and easily entered from the palette):

- Geometric product (with allowance for multivectors that span multiple grades)
- Wedge product
- Dot product
- Scalar product
- Left contraction
- Right contraction
- Hodge Dual (provides 2 different ones found in current literature)
- Inverse
- Reverse
- Norm
- Gorm
- Several list operations as well as auxiliary operations

The palette simplifies typing of subscripted multivectors by providing a number of expressions at the click of the mouse. If the desired expression is not there it still may be quickly entered by modifying one of the palette items. The palette also allows the user to enter the symbols for the various GA operations with a mouse click.

The author welcomes collaboration. The package has not been beta tested so feedback on errors or quirks would be welcome. In particular, Mathematica 10 introduced a nasty complication called “shadowing” errors and the author has incorporated a process to prevent such errors from popping up. Still, there may be certain actions a user can make to invoke these errors. If so, they can hopefully be remedied by following the instructions in the Documentation.

New users should next read the Installation Guide, then Quick Start, Examples, and Documentation (which is very short because not much is needed.) .