space_time_para_2.4.3_v2015.wxm



An application document for Geometric Algebra using wxMaxima

Ref: The Survey, para 2.4.3, March 2015 version

investigate the use of the fourth axis, %i*{e4}, as a possible imitation for G(3,1)

## Initialization

```
(%i1)  ext:["wxm"]$
       file_type_maxima:append(ext,file_type_maxima)$
       batchload("initialize_fns")$
```

the pseudoscalar and its inverse
the lowest useable dimension pseudoscalar should be {e1,e2} i.e. Plen = 2
e.g. for four dimensions edit Pseudos:{e1,e2,e3}$ to Pseudos:{e1,e2,e3,e4}$

```
(%i1)  Pseudos:{e1,e2,e3,e4}$
       Pvar:listofvars(Pseudos)$
       Plen:length(Pvar)$
       I:Pseudos$
       ni:(Plen-1)*Plen/2$
       Ii:(-1)^ni*I$
       kill(ni)$
       ldisplay(Pvar)$
```

(%t8) Pvar = [e1,e2,e3,e4]

```
(%i9)  batchload("initialize_lsts")$
```

(%t9) lstblds = [[{e1},{e2},{e3},{e4}],[{e1,e2},{e1,e3},{e1,e4},{e2,e3},{e2,e4},{e3,e4}],[{e1,e2,e3},{e1,e2,e4},{e1,e3,e4},{e2,e3,e4}],[{e1,e2,e3,e4}]]
(%t10) allblds = [{e1},{e2},{e3},{e4},{e1,e2},{e1,e3},{e1,e4},{e2,e3},{e2,e4},{e3,e4},{e1,e2,e3},{e1,e2,e4},{e1,e3,e4},{e2,e3,e4},{e1,e2,e3,e4}]
(%t11) invblds = [{e1},{e2},{e3},{e4},-{e1,e2},-{e1,e3},-{e1,e4},-{e2,e3},-{e2,e4},-{e3,e4},-{e1,e2,e3},-{e1,e2,e4},-{e1,e3,e4},-{e2,e3,e4},{e1,e2,e3,e4}]

end of Initialization

set derivabbrev:false$

```
(%i12)  derivabbrev:false$
```

coded from para.2.4.3, March 2015 version of The Survey...
partial verification of the last identity replacing e0 with %i*{e4}

choose a simple rotation angle and unit vector, vhat for the velocity

```
(%i13)  alpha:%pi/3$
        ahalf:alpha/2;
        vhat:{e2}$
```

(%o14) $\frac{\pi}{6}$

the velocity magnitude as a fraction of the speed of light

```
(%i16)  vel:tanh(alpha)$
        ev(%,numer);
```

(%o17) 0.78071443535927

show the rotation bivector (2015 version gave e0&*vhat)

```
(%i18)  Bv:(%i*{e4})&*vhat;
```

(%o18)/R/ -{e2,e4}*%i

form the rotation (for a positive exponent), with accuracy limited using mvexp(...,13)

```
(%i19)  Bv*ahalf$
        mvexp(%,13)$
        ev(%,numer,expand);
```

(%o21) 1.140238321076428-0.54785347388804*%i*{e2,e4}

verify that the identity requires hyperbolic functions noting the negative bivector

```
(%i22)  cosh(ahalf)+Bv*sinh(ahalf)$
        trigsimp(%)$
        Rv:ev(%,numer,expand);
```

(%o24) 1.140238321076429-0.54785347388804*%i*{e2,e4}

Created with wxMaxima.