space_time_splits.wxm

An application document for Geometric Algebra using wxMaxima

Ref: The Survey, paragraph 4.1.2

Use of G(1,3) to split spacetime!

Initialization

```
(%i35) 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

floating point print (display) precision

```
(%i12) fpprintprec:6$
       ratprint:false$
       ldisplay(fpprintprec,fpprec,ratprint)$
```

(%t14) fpprintprec = 6
(%t15) fpprec = 16
(%t16) ratprint = false

The Survey, para.4.1.2

show the spacetime gammas required for the imitation of G(1,3), where, to avoid the use
of gamma_zero, we have used the fourth axis, e4, for the time axis and the intrinsic
maxima imaginary, %i, for the space axes

```
(%i17) g1:%i*{e1}$
       g2:%i*{e2}$
       g3:%i*{e3}$
       g4:{e4}$
```

the spacetime coordinate vector using the gammas

```
(%i21) x:x1*g1+x2*g2+x3*g3+t*g4;
```

(%o21) %i*{e3}*x3+%i*{e2}*x2+%i*{e1}*x1+{e4}*t

for a small vector, find the spacetime interval, delta x squared

```
(%i22) dx2:x&*x$
       ldisplay(dx2)$
```

(%t23)/R/ $dx2 = -x3^2 - x2^2 - x1^2 + t^2$

The Survey, paragraph 4.1.2, actually suggests a spacetime split using
the geometric product; x&*gamma_zero, thus, using our g's as the gammas,
that is x&*g4; we could call this the split spacetime coordinate, splx

```
(%i24) splx:x&*g4;
```

(%o24)/R/ {e3,e4}*%i*x3+{e2,e4}*%i*x2+{e1,e4}*%i*x1+t

for the imitation of G(1,3), the actual split into time and space is...

```
(%i25) realpart(splx);
       imagpart(splx);
```

(%o25) t
(%o26) {e3,e4}*x3+{e2,e4}*x2+{e1,e4}*x1