conecross.r

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```
#!/usr/bin/r


cone3d <- function(base=c(0,0,0),tip=c(0,0,1),rad=1,n=30,draw.base=TRUE,qmesh=FALSE,
                   trans = par3d("userMatrix"), ...) {
  ax <- tip-base
  if (missing(trans) && !cur3d()) trans <- diag(4)
  ### is there a better way?
  if (ax[1]!=0) {
    p1 <- c(-ax[2]/ax[1],1,0)
    p1 <- p1/sqrt(sum(p1^2))
    if (p1[1]!=0) {
      p2 <- c(-p1[2]/p1[1],1,0)
      p2[3] <- -sum(p2*ax)
      p2 <- p2/sqrt(sum(p2^2))
    } else {
      p2 <- c(0,0,1)
    }
  } else if (ax[2]!=0) {
    p1 <- c(0,-ax[3]/ax[2],1)
    p1 <- p1/sqrt(sum(p1^2))
    if (p1[1]!=0) {
      p2 <- c(0,-p1[3]/p1[2],1)
      p2[3] <- -sum(p2*ax)
      p2 <- p2/sqrt(sum(p2^2))
    } else {
      p2 <- c(1,0,0)
    }
  } else {
    p1 <- c(0,1,0); p2 <- c(1,0,0)
  }
  degvec <- seq(0,2*pi,length=n+1)[-1]
  ecoord2 <- function(theta) {
    base+rad*(cos(theta)*p1+sin(theta)*p2)
  }
  i <- rbind(1:n,c(2:n,1),rep(n+1,n))
  v <- cbind(sapply(degvec,ecoord2),tip)
  if (qmesh)
    ## minor kluge for quads -- draw tip twice
    i <- rbind(i,rep(n+1,n))
  if (draw.base) {
    v <- cbind(v,base)
```

```
    i.x <- rbind(c(2:n,1),1:n,rep(n+2,n))
    if (qmesh)  ## add base twice
      i.x <-  rbind(i.x,rep(n+2,n))
    i <- cbind(i,i.x)
  }
  if (qmesh) v <- rbind(v,rep(1,ncol(v))) ## homogeneous
  if (!qmesh)
    triangles3d(v[1,i],v[2,i],v[3,i],...)
  else
    return(rotate3d(qmesh3d(v,i,material=list(...)), matrix=trans))
}


ellipsoid3d <- function(rx=1,ry=1,rz=1,n=30,ctr=c(0,0,0),
                        qmesh=FALSE,
                        trans = par3d("userMatrix"),...) {
  if (missing(trans) && !cur3d()) trans <- diag(4)
  degvec <- seq(0,pi,length=n)
  ecoord2 <- function(p)
    c(rx*cos(p[1])*sin(p[2]),ry*sin(p[1])*sin(p[2]),rz*cos(p[2]))
  v <- apply(expand.grid(2*degvec,degvec),1,ecoord2)
  if (qmesh) v <- rbind(v,rep(1,ncol(v))) ## homogeneous
  e <- expand.grid(1:(n-1),1:n)
  i1 <- apply(e,1,function(z)z[1]+n*(z[2]-1))
  i2 <- i1+1
  i3 <- (i1+n-1) %% n^2 + 1
  i4 <- (i2+n-1) %% n^2 + 1
  i <- rbind(i1,i2,i4,i3)
  if (!qmesh)
    quads3d(v[1,i],v[2,i],v[3,i],...)
  else return(rotate3d(qmesh3d(v,i,material=list(...)),matrix=trans))
}

############

c(ctr=c(2,2,2),rx=3,ry=2,col="red",alpha=0.4)
```

```
##  ctr1  ctr2  ctr3    rx    ry   col alpha
##   "2"   "2"   "2"   "3"   "2" "red" "0.4"
```

```
c(base=c(-2,-2,-2),rad=0.5,tip=c(-3,0,-4),col="blue",front="lines",back="lines")
```

```
##   base1   base2   base3     rad    tip1    tip2    tip3     col   front    back
##    "-2"    "-2"    "-2"   "0.5"    "-3"     "0"    "-4"  "blue" "lines" "lines"
```

```
c(c(base=c(3,-2,3),col="purple"))
```

```
##    base1    base2    base3      col
##      "3"     "-2"      "3" "purple"
```

```
### now with qmesh()

q1 <- c(qmesh=TRUE,trans=diag(4))  ## the "unit cone";
## height=1,radius=1, base at (0,0,0)
c(q1)
```

```
##   qmesh  trans1  trans2  trans3  trans4  trans5  trans6  trans7  trans8  trans9
##       1       1       0       0       0       0       1       0       0       0
## trans10 trans11 trans12 trans13 trans14 trans15 trans16
##       0       1       0       0       0       0       1
```

```
## various transformations and rotations
c(c(q1,3,0,0),col="green")
```

```
##   qmesh  trans1  trans2  trans3  trans4  trans5  trans6  trans7  trans8  trans9
##     "1"     "1"     "0"     "0"     "0"     "0"     "1"     "0"     "0"     "0"
## trans10 trans11 trans12 trans13 trans14 trans15 trans16
##     "0"     "1"     "0"     "0"     "0"     "0"     "1"     "3"     "0"     "0"
##     col
## "green"
```

```
c(c(c(q1,1,1,2),6,0,0),col="green")
```

```
##   qmesh  trans1  trans2  trans3  trans4  trans5  trans6  trans7  trans8  trans9
##     "1"     "1"     "0"     "0"     "0"     "0"     "1"     "0"     "0"     "0"
## trans10 trans11 trans12 trans13 trans14 trans15 trans16
##     "0"     "1"     "0"     "0"     "0"     "0"     "1"     "1"     "1"     "2"
##                         col
##     "6"     "0"     "0" "green"
```

```
c(c(q1,0,3,0),col="green")
```

```
##   qmesh  trans1  trans2  trans3  trans4  trans5  trans6  trans7  trans8  trans9
##     "1"     "1"     "0"     "0"     "0"     "0"     "1"     "0"     "0"     "0"
## trans10 trans11 trans12 trans13 trans14 trans15 trans16
##     "0"     "1"     "0"     "0"     "0"     "0"     "1"     "0"     "3"     "0"
##     col
## "green"
```

```
c(c(c(q1,2,1,1),0,6,0),col="green")
```

```
##   qmesh  trans1  trans2  trans3  trans4  trans5  trans6  trans7  trans8  trans9
##     "1"     "1"     "0"     "0"     "0"     "0"     "1"     "0"     "0"     "0"
## trans10 trans11 trans12 trans13 trans14 trans15 trans16
##     "0"     "1"     "0"     "0"     "0"     "0"     "1"     "2"     "1"     "1"
##                         col
##     "0"     "6"     "0" "green"
```

```
c(c(q1,0,0,3),col="red")
```

```
##   qmesh  trans1  trans2  trans3  trans4  trans5  trans6  trans7  trans8  trans9
##     "1"     "1"     "0"     "0"     "0"     "0"     "1"     "0"     "0"     "0"
## trans10 trans11 trans12 trans13 trans14 trans15 trans16
##     "0"     "1"     "0"     "0"     "0"     "0"     "1"     "0"     "0"     "3"
##     col
##   "red"
```

```
c(c(c(c(c(q1,1,1,2),pi/4,0,1,0),0,0,6),col="red")
```

```
##               qmesh              trans1              trans2              trans3
##                 "1"                 "1"                 "0"                 "0"
##              trans4              trans5              trans6              trans7
##                 "0"                 "0"                 "1"                 "0"
##              trans8              trans9             trans10             trans11
##                 "0"                 "0"                 "0"                 "1"
##             trans12             trans13             trans14             trans15
##                 "0"                 "0"                 "0"                 "0"
##             trans16
##                 "1"                 "1"                 "1"                 "2"
##
## "0.785398163397448"                 "0"                 "1"                 "0"
##                                                                             col
##                 "0"                 "0"                 "6"               "red"
```

```
s1 <- c(qmesh=TRUE,trans=diag(4))  ## the "unit sphere";
## radius=1, ctr at (0,0,0)
c(s1)
```

```
##   qmesh  trans1  trans2  trans3  trans4  trans5  trans6  trans7  trans8  trans9
##       1       1       0       0       0       0       1       0       0       0
## trans10 trans11 trans12 trans13 trans14 trans15 trans16
##       0       1       0       0       0       0       1
```

```
## various transformations and rotations
c(c(s1,3,0,0),col="green")
```

```
##   qmesh  trans1  trans2  trans3  trans4  trans5  trans6  trans7  trans8  trans9
##     "1"     "1"     "0"     "0"     "0"     "0"     "1"     "0"     "0"     "0"
## trans10 trans11 trans12 trans13 trans14 trans15 trans16
##     "0"     "1"     "0"     "0"     "0"     "0"     "1"     "3"     "0"     "0"
##     col
## "green"
```

```
c(c(c(s1,1,1,2),6,0,0),col="green")
```

```
##   qmesh  trans1  trans2  trans3  trans4  trans5  trans6  trans7  trans8  trans9
##     "1"     "1"     "0"     "0"     "0"     "0"     "1"     "0"     "0"     "0"
## trans10 trans11 trans12 trans13 trans14 trans15 trans16
##     "0"     "1"     "0"     "0"     "0"     "0"     "1"     "1"     "1"     "2"
##                         col
##     "6"     "0"     "0" "green"
```

```
c(c(s1,0,3,0),col="green")
```

```
##   qmesh  trans1  trans2  trans3  trans4  trans5  trans6  trans7  trans8  trans9
##     "1"     "1"     "0"     "0"     "0"     "0"     "1"     "0"     "0"     "0"
## trans10 trans11 trans12 trans13 trans14 trans15 trans16
##     "0"     "1"     "0"     "0"     "0"     "0"     "1"     "0"     "3"     "0"
##     col
## "green"
```

```
c(c(c(c(s1,2,1,1),0,6,0),col="green")
```

```
##   qmesh  trans1  trans2  trans3  trans4  trans5  trans6  trans7  trans8  trans9
##     "1"     "1"     "0"     "0"     "0"     "0"     "1"     "0"     "0"     "0"
## trans10 trans11 trans12 trans13 trans14 trans15 trans16
##     "0"     "1"     "0"     "0"     "0"     "0"     "1"     "2"     "1"     "1"
##                            col
##     "0"     "6"     "0" "green"
```

```
c(c(s1,0,0,3),col="red")
```

```
##   qmesh  trans1  trans2  trans3  trans4  trans5  trans6  trans7  trans8  trans9
##     "1"     "1"     "0"     "0"     "0"     "0"     "1"     "0"     "0"     "0"
## trans10 trans11 trans12 trans13 trans14 trans15 trans16
##     "0"     "1"     "0"     "0"     "0"     "0"     "1"     "0"     "0"     "3"
##     col
##   "red"
```

```
c(c(c(c(c(s1,1,1,2),pi/4,0,1,0),0,0,6),col="red")
```

```
##               qmesh              trans1              trans2              trans3
##                 "1"                 "1"                 "0"                 "0"
##              trans4              trans5              trans6              trans7
##                 "0"                 "0"                 "1"                 "0"
##              trans8              trans9             trans10             trans11
##                 "0"                 "0"                 "0"                 "1"
##             trans12             trans13             trans14             trans15
##                 "0"                 "0"                 "0"                 "0"
##             trans16
##                 "1"                 "1"                 "1"                 "2"
##
## "0.785398163397448"                 "0"                 "1"                 "0"
##                                                                             col
##                 "0"                 "0"                 "6"               "red"
```