Calculo de las raices propias de una matriz por procesos iterativos.

Util para hallar una sola, por ejemplo la raiz mas grande en valor absoluto. "iteracion directa"

```
> a<-rbind(c(5, -2, 0),c(-2, 3,-1),c(0,-1,1))
> a
     [,1] [,2] [,3]
[1,]    5   -2    0
[2,]   -2    3   -1
[3,]    0   -1    1

> eigen(a)
$values
[1] 6.2899451 2.2942804 0.4157746

$vectors
           [,1]       [,2]      [,3]
[1,]  0.8359921  0.5048961 0.2149353
[2,] -0.5391919  0.6830536 0.4926559
[3,]  0.1019277 -0.5277478 0.8432633

> x<-c(1,0,0)
> xp <- a%*%x
> xp
     [,1]
[1,]    5
[2,]   -2
[3,]    0
> r<-max(xp)
> r
[1] 5

> x<-xp/r
> xp <- a%*%x
> r<-max(xp)
> r
[1] 5.8

> x<-xp/r
> xp <- a%*%x
> r<-max(xp)
> r

[1] 6.103448
```

```
> x<-xp/r
> xp <- a%*%x
> r<-max(xp)
> r
[1] 6.220339

> x<-xp/r
> xp <- a%*%x
> r<-max(xp)
> r
[1] 6.264305

> # Cociente de Rayleigh rho = xt %*% a %*% x / (Xt %*% x)
> rho <- t(x)%*%a%*%x / (t(x)%*% x)
> rho
         [,1]
[1,] 6.289488

# determinacion del valor propio mas pequeño "iteracion inversa"

# inversion de la matriz

> b<-solve(a)
> b
          [,1]      [,2]      [,3]
[1,] 0.3333333 0.3333333 0.3333333
[2,] 0.3333333 0.8333333 0.8333333
[3,] 0.3333333 0.8333333 1.8333333

> x<-c(0,0,1)
> xp <- b%*%x
> r<-max(xp)
> r
[1] 1.833333

> x<-xp/r
> xp <- b%*%x
> r<-max(xp)
> r
[1] 2.272727

> x<-xp/r
> xp <- b%*%x
> r<-max(xp)
> r

[1] 2.38
```

```
> x<-xp/r
> xp <- b%*%x
> r<-max(xp)
> r
[1] 2.40056

> x<-xp/r
> xp <- b%*%x
> r<-max(xp)
> r
[1] 2.404317

> x<-xp/r
> xp <- b%*%x
> r<-max(xp)
> r
[1] 2.404999

> # Cociente de Rayleigh rho = xt %*% a %*% x / (Xt %*% x)
> rho <- t(x)%*%a%*%x / (t(x)%*% x)
> rho
          [,1]
[1,] 0.4157746

> x
          [,1]
[1,] 0.2547925
[2,] 0.5840815
[3,] 1.0000000
```

 # Metodo de Jacobi para matrices simetricas, Halla todas las raices y vectores propios.

```
> a<-rbind(c(5, -2, 0),c(-2, 3,-1),c(0,-1,1))
> a
     [,1] [,2] [,3]
[1,]    5   -2    0
[2,]   -2    3   -1
[3,]    0   -1    1

> id <-  diag(x = 1, nrow=3, ncol=3 )
> id
     [,1] [,2] [,3]
[1,]    1    0    0
[2,]    0    1    0
[3,]    0    0    1

# Q <- p1.p2.p3...
# pi son matrices de rotacion plana
# tg 2 theta = 2 aij / (aii – ajj)
# mantener la matriz original

> A<-a

# Convertir a[1,2] = 0
> i <- 1
> j <- 2

> angulo <- 0.5*atan(2*a[i,j]/(a[i,i] - a[j,j]))
> angulo
[1] -0.5535744
> c<-cos(angulo)
> s<-sin(angulo)
> p<-id
> p[i,i]<-c
> p[j,j]<-c
> p[i,j]<--s
> p[j,i]<- s

> p
           [,1]      [,2] [,3]
[1,]  0.8506508 0.5257311    0
[2,] -0.5257311 0.8506508    0
[3,]  0            0              1

> Q <- Q%*%P
> a1<-t(p)%*%a%*%p
> a1
              [,1]          [,2]       [,3]
[1,]  6.236068e+00 -4.206704e-16  0.5257311
[2,] -1.820375e-16  1.763932e+00 -0.8506508
[3,]  5.257311e-01 -8.506508e-01  1.0000000

> a1[i,j]<-0
> a1[j,i]<-0
```

```
> a1
          [,1]       [,2]       [,3]
[1,] 6.2360680  0.0000000  0.5257311
[2,] 0.0000000  1.7639320 -0.8506508
[3,] 0.5257311 -0.8506508  1.0000000

> # elemento 1,3 cero
> i<-1
> j<-3
> a<-a1

> angulo <- 0.5*atan(2*a[i,j]/(a[i,i] - a[j,j]))
> c<-cos(angulo)
> s<-sin(angulo)
> p<-id
> p[i,i]<-c
> p[j,j]<-c
> p[i,j]<--s
> p[j,i]<- s
> p
           [,1] [,2]        [,3]
[1,] 0.99509482    0 -0.09892576
[2,] 0.00000000    1  0.00000000
[3,] 0.09892576    0  0.99509482

> Q <- Q%*%P
> a1<-t(p)%*%a%*%p
> a1
              [,1]        [,2]          [,3]
[1,]  6.288333e+00 -0.08415127 -2.363561e-17
[2,] -8.415127e-02  1.76393202 -8.464782e-01
[3,]  8.578750e-18 -0.84647821  9.477353e-01
> a1[i,j]<-0
> a1[j,i]<-0
> a1
            [,1]        [,2]       [,3]
[1,]  6.28833269 -0.08415127  0.0000000
[2,] -0.08415127  1.76393202 -0.8464782
[3,]  0.00000000 -0.84647821  0.9477353

> # elemento 2,3 cero
> i<-2
> j<-3
> a<-a1
> angulo <- 0.5*atan(2*a[i,j]/(a[i,i] - a[j,j]))
> c<-cos(angulo)
> s<-sin(angulo)
> p<-id
> p[i,i]<-c
> p[j,j]<-c
> p[i,j]<--s
> p[j,i]<- s
> p
     [,1]       [,2]      [,3]
[1,]    1  0.0000000 0.0000000
[2,]    0  0.8468405 0.5318470
[3,]    0 -0.5318470 0.8468405
```

```
> Q <- Q%*%P

> a1<-t(p)%*%a%*%p
> a1
           [,1]          [,2]          [,3]
[1,]  6.2883327 -7.126270e-02 -4.475560e-02
[2,] -0.0712627  2.295552e+00 -2.224783e-16
[3,] -0.0447556 -1.014678e-16  4.161158e-01
> a1[i,j]<-0
> a1[j,i]<-0
> a1
           [,1]       [,2]       [,3]
[1,]  6.2883327 -0.0712627 -0.0447556
[2,] -0.0712627  2.2955515  0.0000000
[3,] -0.0447556  0.0000000  0.4161158

# valores propios (raices caracteristicas)

> diag(a1)
[1] 6.2883327 2.2955515 0.4161158
# Vectores propios Q

> Q
     [,1]       [,2]      [,3]
[1,]    1  0.0000000 0.0000000
[2,]    0  0.8468405 0.5318470
[3,]    0 -0.5318470 0.8468405
```

Mediante R con la funcion eigen()

```
> A<-rbind(c(5, -2, 0),c(-2, 3,-1),c(0,-1,1))
     [,1] [,2] [,3]
[1,]    5   -2    0
[2,]   -2    3   -1
[3,]    0   -1    1

> eigen (A)

$values
[1] 6.2899451 2.2942804 0.4157746

$vectors
           [,1]       [,2]      [,3]
[1,]  0.8359921  0.5048961 0.2149353
[2,] -0.5391919  0.6830536 0.4926559
[3,]  0.1019277 -0.5277478 0.8432633
```

```
a<-rbind(c(4, -1),c(-1, 4))

A<-a
A
id <-  diag(x = 1, nrow=2, ncol=2 )
id
# Convertir a[1,2] = 0

# Q <- p1.p2.p3...
# pi son matrices de rotacion plana
# tg 2 theta = 2 aij / (aii – ajj)
# mantener la matriz original

# Convertir a[1,2] = 0

angulo <- 0.5*atan(2*a[1,2]/(a[1,1] - a[2,2]))
angulo
c<-cos(angulo)
c
s<-sin(angulo)
s
p<-id
p[1,1]<-c
p[2,2]<-c
p[1,2]<--s
p[2,1]<- s
p
a1<-t(p)%*%a%*%p
a1
```

```
> a<-rbind(c(4, -1),c(-1, 4))
>
> A<-a
> A
     [,1] [,2]
[1,]    4   -1
[2,]   -1    4
> id <-  diag(x = 1, nrow=2, ncol=2 )
> id
     [,1] [,2]
[1,]    1    0
[2,]    0    1
> # Convertir a[1,2] = 0
>
> # Q <- p1.p2.p3...
> # pi son matrices de rotacion plana
> # tg 2 theta = 2 aij / (aii - ajj)
> # mantener la matriz original
>
> # Convertir a[1,2] = 0
>
> angulo <- 0.5*atan(2*a[1,2]/(a[1,1] - a[2,2]))
> angulo
[1] -0.7853982

> c<-cos(angulo)
> c
[1] 0.7071068
> s<-sin(angulo)
> s
[1] -0.7071068
> p<-id
> p[1,1]<-c
> p[2,2]<-c
> p[1,2]<--s
> p[2,1]<- s
> p
           [,1]      [,2]
[1,]  0.7071068 0.7071068
[2,] -0.7071068 0.7071068
> a1<-t(p)%*%a%*%p
> a1
              [,1]         [,2]
[1,]  5.000000e+00 5.074066e-17
[2,] -4.803016e-17 3.000000e+00
>
>
```