

**NAME**

qmr - quasi minimal residual method with preconditioning

**CALLING SEQUENCE**

```
[x,err,iter,flag,res] = qmr(A,b,x0,M1,M1p,M2,M2p,maxi,tol)
```

**PARAMETERS**

**A** : matrix of size n-by-n or function returning  $A*x$

**b** : right hand side vector

**x0** : initial guess vector (default: zeros(n,1))

**M1** : left preconditioner: matrix or function returning  $M1*x$  (In the first case, default: eye(n,n))

**M1p** : must only be provided when **M1** is a function. In this case **M1p** is the function which returns  $M1'*x$

**M2** : right preconditioner: matrix or function returning  $M2*x$  (In the first case, default: eye(n,n))

**M2p** : must only be provided when **M2** is a function. In this case **M2p** is the function which returns  $M2'*x$

**maxi** : maximum number of iterations (default: n)

**tol** : error tolerance (default: 1000\*%eps)

**x** : solution vector

**err** : final residual norm

**iter** : number of iterations performed

**flag** : 0 = **qmr** converged to the desired tolerance within **maxi** iterations  
1 = no convergence given **maxi**

**res** : residual vector

**DESCRIPTION**

Solves the linear system  $Ax=b$  using the Quasi Minimal Residual Method with preconditioning.

**EXAMPLE**

```
A=makefish(4); b=rand(16,1);x0=zeros(16,1);
[x,err,iter,flag,res] = qmr(A,b,x0)
M1=eye(16,16); M2=M1; max_it=16; tol=1000*%eps;
[x,err,iter,flag,res] = qmr(A,b,x0,M1,M2,max_it,tol)

deff("y=precond_g(x)","y=(M1+eye(size(M1,1),size(M1,2)))*x");
deff("y=precondp_g(x)","y=(M1+eye(size(M1,1),size(M1,2)))'*x");

deff("y=precond_d(x)","y=(M2+6*eye(size(M2,1),size(M2,2)))*x");
deff("y=precondp_d(x)","y=(M2+eye(size(M2,1),size(M2,2)))'*x");

deff("y=matvec(x)","y=(A+eye(size(A,1),size(A,1)))*x");

[x,err,iter,flag,res] = qmr(A,b,x0,precond_g,precondp_g,M2,max_it,tol)
[x,err,iter,flag,res] = qmr(matvec,b,x0,precond_g,precondp_g,precond_d,precondp_d)
```

**AUTHOR**

Adaptation by Aladin Group of the corresponding code of netlib/mltemplatesdev (Univ. of Tennessee and Oak Ridge National Laboratory) - 20 March 2001.

**SEE ALSO**

bicg, bicgstab, cgs, gmres