

Compute $r^{(0)} = b - Ax^{(0)}$

for $i = 1, 2, \dots$

 solve $Mz^{(i-1)} = r^{(i-1)}$

$\rho_{i-1} = r^{(i-1)T} z^{(i-1)}$

 if $i = 1$

$p^{(1)} = z^{(0)}$

 else

$\beta_{i-1} = \rho_{i-1} / \rho_{i-2}$

$p^{(i)} = z^{(i-1)} + \beta_{i-1} p^{(i-1)}$

 endif

$q^{(i)} = Ap^{(i)}$

$\alpha_i = \rho_{i-1} / p^{(i)T} q^{(i)}$

$x^{(i)} = x^{(i-1)} + \alpha_i p^{(i)}$

$r^{(i)} = r^{(i-1)} - \alpha_i q^{(i)}$

 Check convergence: $\|r^{(i)}\|_2 \leq \epsilon \|b\|_2$

end

```
call psb_geaxpby(one,b,zero,r,desc_a,info)
```

```
rho = zero
```

```
iterate: do it = 1, itmax
```

```
    call psb_spsm(one,L,r,zero,w,desc_a,info)
```

```
    call psb_spsm(one,U,w,zero,z,desc_a,info)
```

```
    rho_old = rho; rho = psb_gedot(r,z,desc_a,info)
```

```
    if (it == 1) then
```

```
        call psb_geaxpby(one,z,zero,p,desc_a,info)
```

```
    else
```

```
        beta = rho/rho_old
```

```
        call psb_geaxpby(one,z,beta,p,desc_a,info)
```

```
    endif
```

```
    call psb_spmv(one,A,p,zero,q,desc_a,info)
```

```
    sigma = psb_gedot(p,q,desc_a,info); alpha = rho/sigma
```

```
    call psb_geaxpby(alpha,p,one,x,desc_a,info)
```

```
    call psb_geaxpby(-alpha,q,one,r,desc_a,info)
```

```
    rn2 = psb_genrm2(r,desc_a,info)
```

```
    bn2 = psb_genrm2(b,desc_a,info)
```

```
    err = rn2/bn2
```

```
    if (err.lt.eps) exit iterate
```

```
enddo iterate
```