The full basis and Hamiltonian construction

Random initial state

```
for i=1:n
   psi[i]=rand()-0.5
end
norm=1./dot(psi,psi)^0.5
psi.=psi.*norm
```

Perform `niter` Lanczos steps and diagonalize

```
f0=copy(psi)
nn[1]=1.
for m=1:niter
   perform code on previous page
end
```

Diagonalize the matrix of size niter*niter made using the diagonal and subdiagonal elements from aa and nn

Calculation of the states

In order to calculate states (wave functions) we have to perform another Lanczos procedure, since we have not saved all the states $|f_n\rangle$

If we want the m-th lowest state, we transform with the m-th eigenvector obtained in the diagonalization. The eigenvectors are in the matrix `states`; `vec=states(:,m)`

```
f0.=psi
psi.=psi.*vec[1]
hoperation(f0,f1)
f1.=f1.-aa[1].*f0
psi.=psi.+vec[2].*f1./nn[2]
for i:2,niter-1
   hoperation(f1,f2)
   f2.=f2.-aa[i].*f1.-nn[i].*f0
   psi.=psi.+vec[i+1].*f2/nn[i+1]
   f0.=f1
   f1.=f2
end
```

Normalized states $|\phi_n\rangle = N_n{}^{-1/2}|f_n\rangle$

If the ϕ vectors are not too large, they can also all be stored and this procedure is then simpler

We looked at the program "random" on the web site