

## Hint to Homework #2 : Mathematica

### Householder Transformation, QR Decomposition, and QR Algorithm

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Since some of you are using MATHEMATICA, I must give an idea how to use While & Block command to form a QR algorithm for diagonalization of the mass matrix :

#### QR Decomposition of Mg by the Householder transformation

```
In[146]:=
R=N[Mg]
Q=IdentityMatrix[neq];
Block[{i,j},
  Do[RT=Transpose[R];
    mi=RT[[i]];
    If[i>1,Do[mi[[j]]=0,{j,1,i-1}]];
    norm=Sqrt[mi.mi];
    vi=mi;
    vi[[i]]=vi[[i]]-norm;
    P=IdentityMatrix[neq]-2*Outer[Times,vi,vi]/(vi.vi);
    R=P.R;
    Q=Q.P,{i,1,neq-1}]]
R
Q
```

#### QR Algorithm of Diagonalization of a matrix A

```
In[151]:=
error=1;
toler=0.001;
iter=0;
While[error>toler,
```

```

R=A;
Q=IdentityMatrix[neq];
Block[{i,j},
  Do[RT=Transpose[R];
    mi=RT[[i]];
    If[i>1,Do[mi[[j]]=0,{j,1,i-1}]];
    norm=Sqrt[mi.mi];
    vi=mi;
    vi[[i]]=vi[[i]]-norm;
    P=IdentityMatrix[neq]-2*Outer[Times,vi,vi]/(vi.vi);
    R=P.R;
    Q=Q.P,{i,1,neq-1}]];
An=R.Q;
  error=Sqrt[Flatten[An-A].Flatten[An-
A]]/Sqrt[Flatten[An].Flatten[An]];
  iter=iter+1;
  Print["iteration = ",iter,"  relative error = ",error];
  A=An]

```

A