Verification

Seismic codes allow ground motion representation by means of artificial accelerograms generated as parts of finite duration Ts of samples of a stationary process, characterized by a PSD consistent with the assigned elastic response spectrum.

In this script the following steps are implemented:

1. The design pseudo-acceleration response spectrum of EC8 is calculated (EC8Sa)
2. The one-sided Power Spectral Density (PSD) and Peak Factor (PF) of EC8Sa are calculated
3. An artificial acceleration time history (ug) is generated based on the above PSD
4. The pseudo-acceleration response spectrum of ug (PSa) is calculated and it is verified that PSa and EC8Sa are close to each other.

Contents

Initial input

Duration of stationary seismic input (sec)

```
Ts=20;
```

Probability of outcrossing of peak value

```
p=0.5;
```

Modal damping ratio

```
zeta=0.05;
```

Cut-off frequency (rad/s)

```
omegaC= 100;
```

Integration step (rad/s)

```
dOmega=0.1;
```

Lowest bound of the existence domain of etaXi (rad/s)

```
omega0=0.36;
```

Normalized design pseudo-acceleration response spectrum of EC8

Circular frequency range

```
omega=(omega0+dOmega/2:dOmega:omegaC)';
```

Eigenperiod range for which the response spectrum will be calculated.

```
Tspectra=2*pi./omega;
```

Selection of spectrum parameters

```
q=3;
GroundType='A';
SeismicZone=1;
ImportanceFactor=1;
```

Calculation

```
[S,Tb,Tc,Td,ag,b]=paramEC8(GroundType,SeismicZone,ImportanceFactor);
EC8Sa = 2*specAccEC8(Tspectra,q,S,Tb,Tc,Td,ag,b);
```

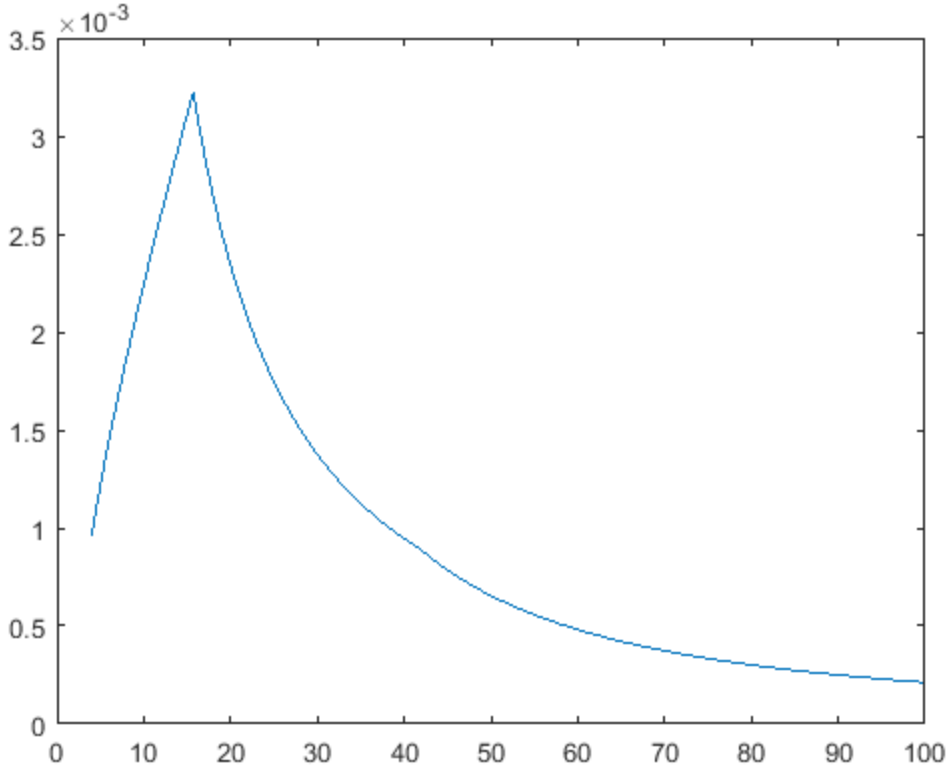
One sided PSD and Peak Factor

Calculation

```
[G,etaX] = StochProcPSD(EC8Sa,omega,Ts,p,zeta,omega0,dOmega);
```

Plot and compare with Figure 1(a) of Cacciola et al. (2004), PFWN, soil type A

```
figure(1)
plot(omega(omega>4),G(omega>4))
```



Artificial acceleration time history

Selection of time step

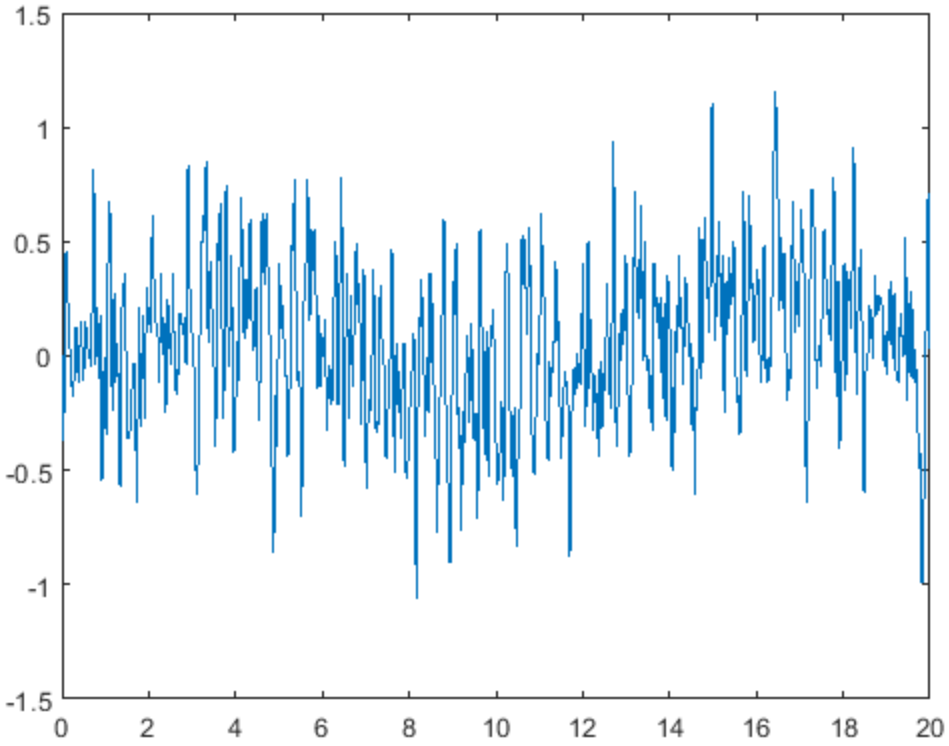
```
dt=0.02;
```

Calculation

```
[ug,t] = AccTHfromPSD(G,dt,Ts,dOmega);
```

Plot

```
figure(2)
plot(t,ug)
```



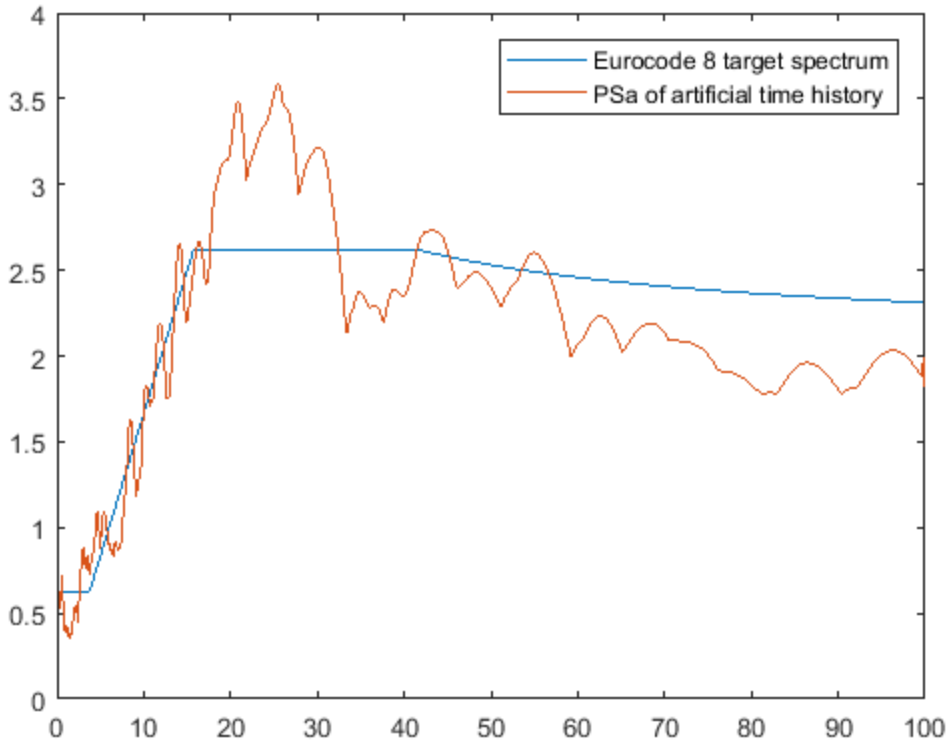
Verification of elastic pseudo-acceleration response spectra

Calculation with OpenSeismoMatlab (Papazafeiropoulos & Plevris, 2018). Open source code OpenSeismoMatlab is available for free download at the following link: https://www.mathworks.com/matlabcentral/fileexchange/67069-openseismomatlab

```
param=OpenSeismoMatlab(dt,ug,'ES',true,[],zeta,Tspectra);
PSa=param.PSa;
```

Plot the two spectra and compare with each other.

```
figure(4)
plot(omega,EC8Sa)
hold on
plot(omega,PSa)
hold off
legend('Eurocode 8 target spectrum','PSa of artificial time history');
```



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