

# Verification of DDSYS

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## 1 SDOF

### 1.1 Classic SDOF system

Equation of motion

$$m \ddot{u} + c \dot{u} + ku = -ma_g \quad (1)$$

Parameter definition

$$\omega = \sqrt{\frac{k}{m}} \quad \zeta = \frac{c}{2\sqrt{mk}}$$

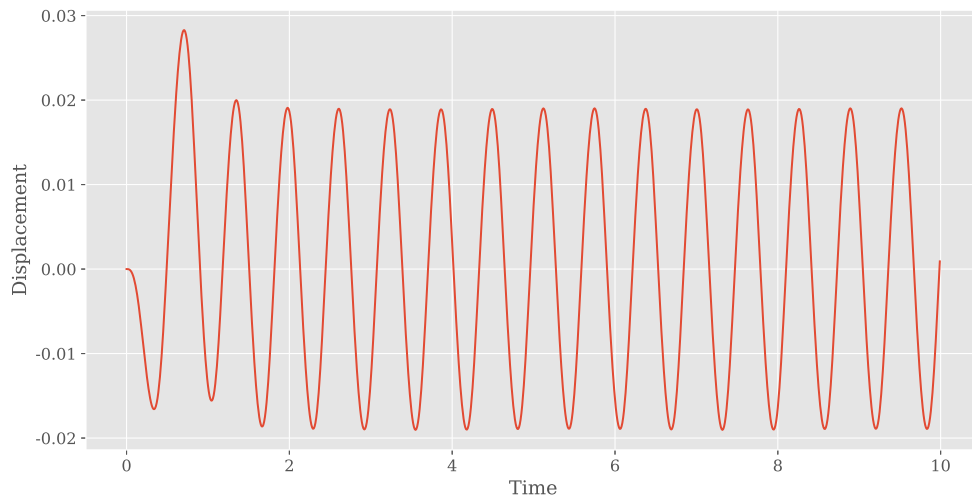
Parameter setting

$$m = 1 \quad k = 100 \quad c = 0.4$$

$$\omega = 10 \quad \zeta = 0.02$$

#### 1.1.1 Case I: resonant excitation

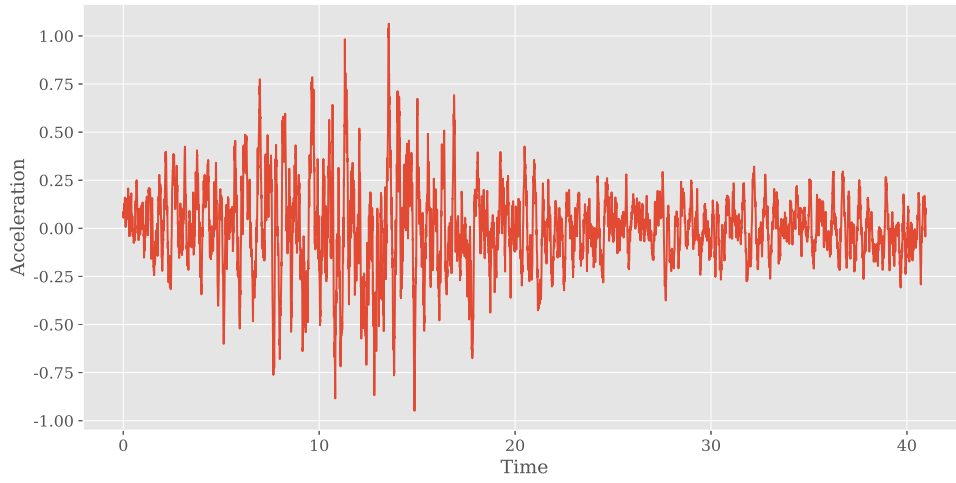
$$a_g = \sin(\omega t) \quad (2)$$



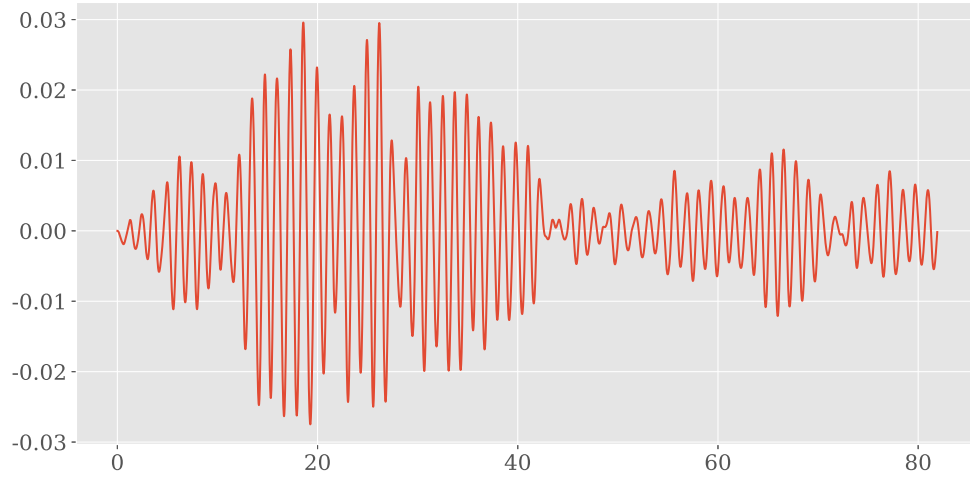
**Figure 1.** Response of SDOF system under resonant excitation

#### 1.1.2 Case II: seismic excitation

Time-history curve of the ground motion is shown below



**Figure 2.** Ground motion



**Figure 3.** Seismic response

## 1.2 SDOF system with bilinear spring

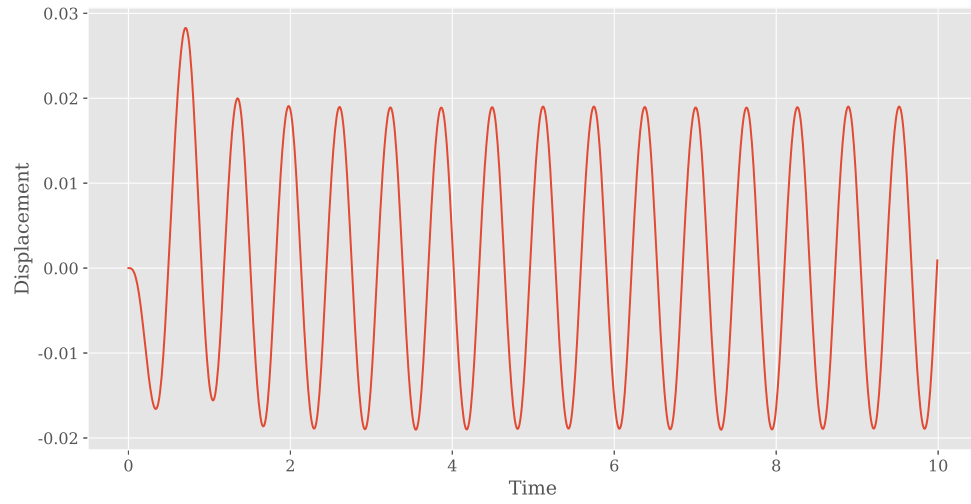
Equation of motion

$$m\ddot{u} + c\dot{u} + f(u) = -ma_g \quad (3)$$

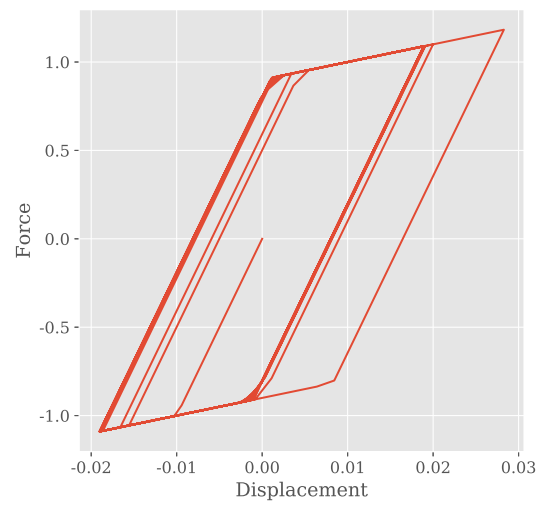
Parameter setting

$$\begin{aligned} m &= 1 & c &= 0.4 \\ k_0 &= 100 & u_y &= 0.01 & \alpha &= 0.1 \end{aligned}$$

### 1.2.1 Case I: resonant excitation

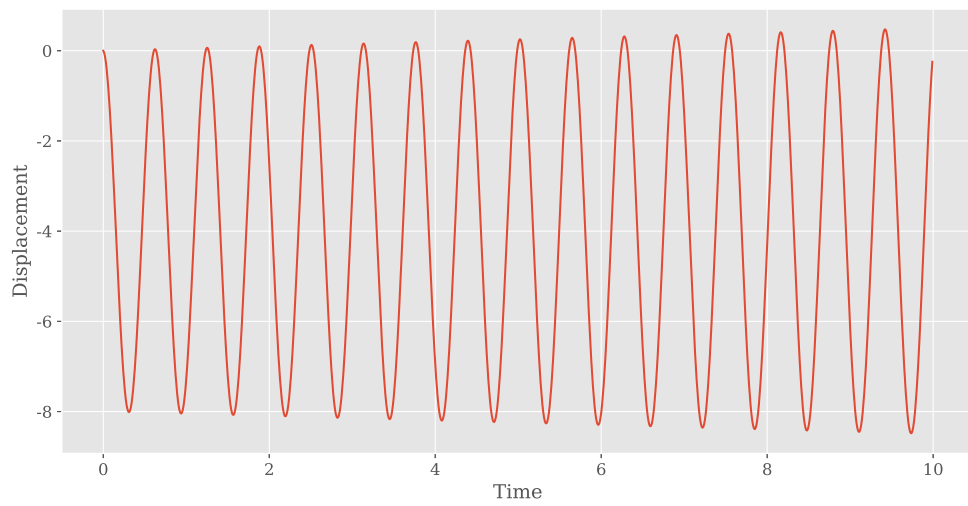


**Figure 4.**

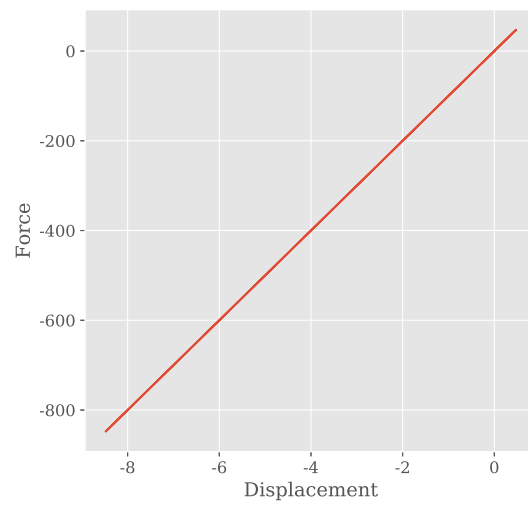


**Figure 5.**

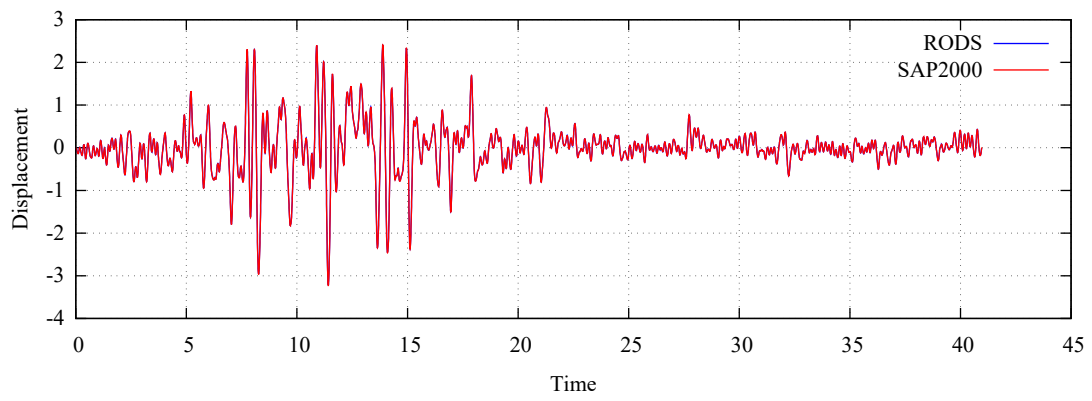
### 1.2.2 Case II: seismic excitation



**Figure 6.**



**Figure 7.**



**Figure 8.**