

Chirp (Sine Sweep) function

ORIGIN := 1

L San Andres (c) 2019

Physical parameters and natural frequency

$$K := 150 \cdot 10^6 \cdot \frac{\text{N}}{\text{m}} = 8.565 \times 10^5 \cdot \frac{\text{lbf}}{\text{in}}$$

stiffness and mass

$$\zeta := 0.05 \quad \text{damping ratio}$$

$$M := 300 \cdot \text{kg} = 661.387 \cdot \text{lb}$$

$$f_n := \frac{\omega_n}{2 \cdot \pi} = 112.54 \cdot \text{Hz}$$

natural frequency and

natural period of motion

$$T_n := \frac{1}{f_n} = 8.886 \times 10^{-3} \text{ s}$$

$$\omega_n := \left(\frac{K}{M} \right)^{.5} = 707.107 \text{ s}^{-1}$$

$$C := \zeta \cdot 2 \cdot (K \cdot M)^{.5} = 121.131 \cdot \text{lbf} \cdot \frac{\text{s}}{\text{in}}$$

Damping coefficient

$$F_I := 100 \cdot \text{N}$$

$$\Delta T_{\text{sweep}} := \frac{T_{\text{max}}}{4}$$

Time for sweep

$$T_{\text{max}} := \frac{(N_P - 1)}{\Delta \text{rate}} = 0.409 \text{ s}$$

$$f_{\text{start}} := 50 \cdot \text{Hz} \quad f_{\text{end}} := 150 \cdot \text{Hz}$$

$$\frac{1}{\Delta T_{\text{sweep}}} = 9.768 \cdot \text{Hz}$$



window

Sampling rate = MIN = 2 x max frequency

Sampling rate

$$\Delta_{\text{rate}} := 10000 \cdot \frac{1}{s} \text{ samples/s}$$

Number of samples

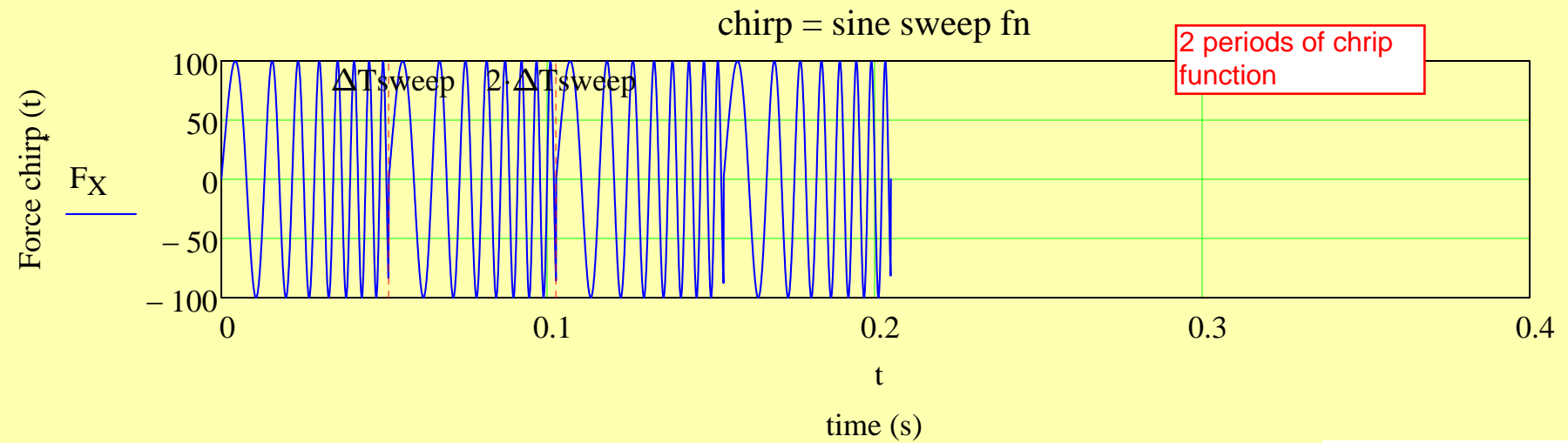
$$N_p := 2^{11} = 2.048 \times 10^3$$

2 periods of chirp
function

1 YES, 0: NO $Y_{\text{window}} := 0$

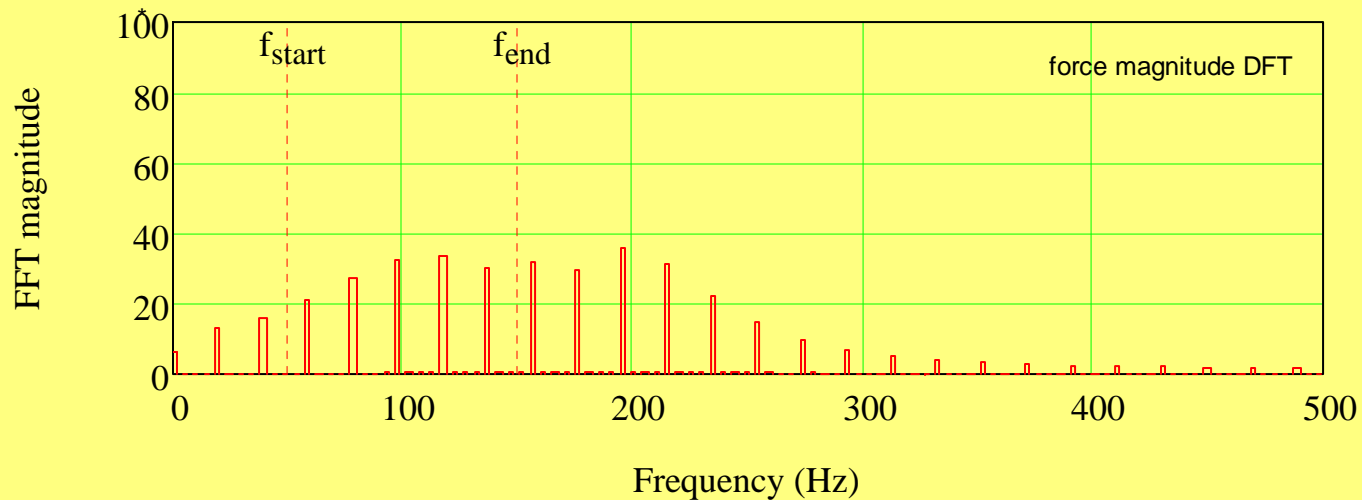
for graphs

$$\text{freq}_{\text{max}} := 500 \cdot \text{Hz} \quad \text{FI}_{\text{max}} := 100 \cdot N$$



$$\frac{\Delta t}{\Delta T_{\text{sweep}}} = 1.954 \times 10^{-3}$$

$$\frac{T_{\text{max}}}{\Delta T_{\text{sweep}}} = 4$$



$$\Delta f = 4.888 \cdot \text{Hz}$$

$$T_{\text{max}} = 0.205 \text{ s}$$

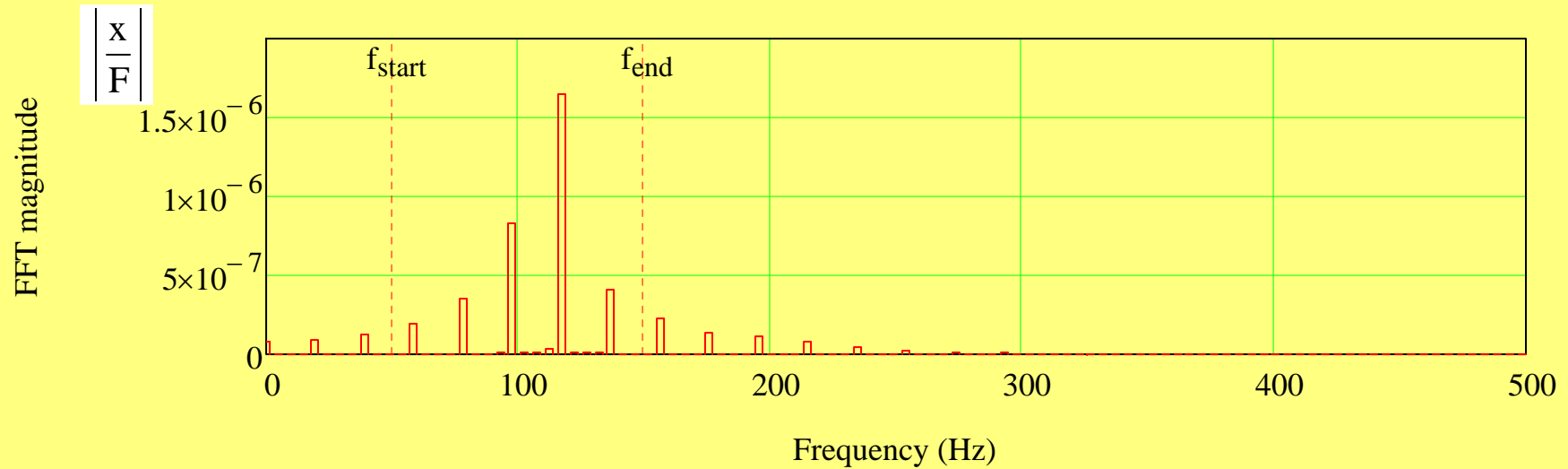
$$\frac{f_{\text{max}}}{\Delta f} = 1.023 \times 10^3$$

$$f_{\text{max}} = 5 \times 10^3 \cdot \text{Hz}$$



Build system response (frequency and time)

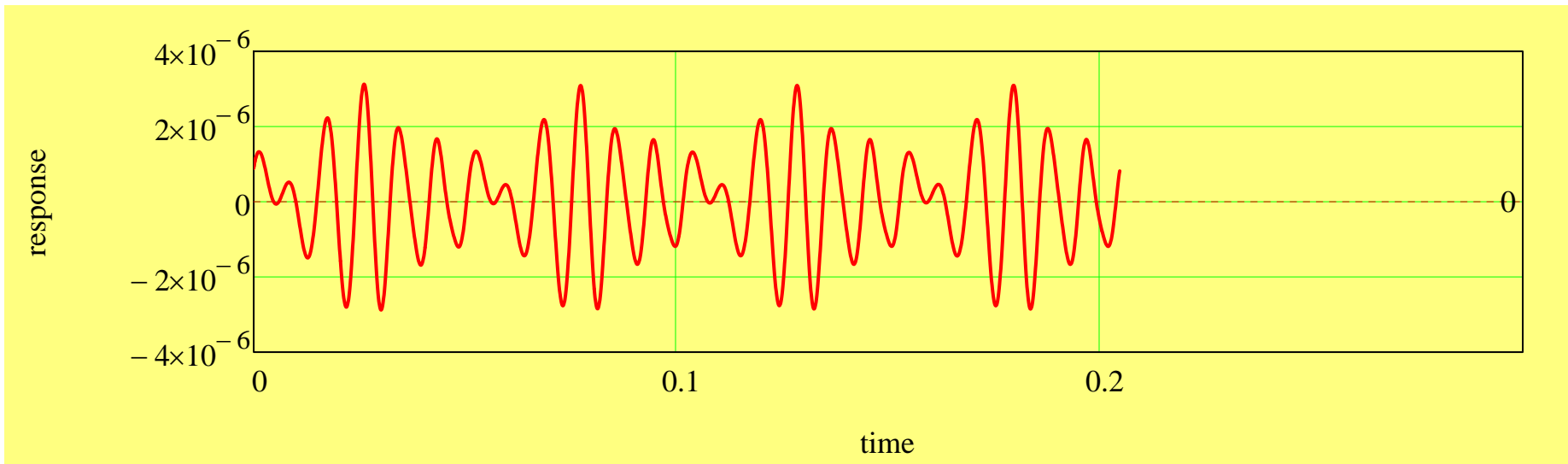
$$A_{\max} := \max(A) = 1.643 \times 10^{-6} \text{ m}$$



2 periods of chirp
function

(b) Time response

$$\max(X) = 3.125 \times 10^{-6} \text{ m}$$



2 periods of chirp
function

Sampling rate = MIN = 2 x max frequency

Sampling rate

$$\Delta_{\text{rate}} := 10000 \cdot \frac{1}{s} \text{ samples/s}$$

Number of samples

$$N_p := 2^{12} = 4.096 \times 10^3$$

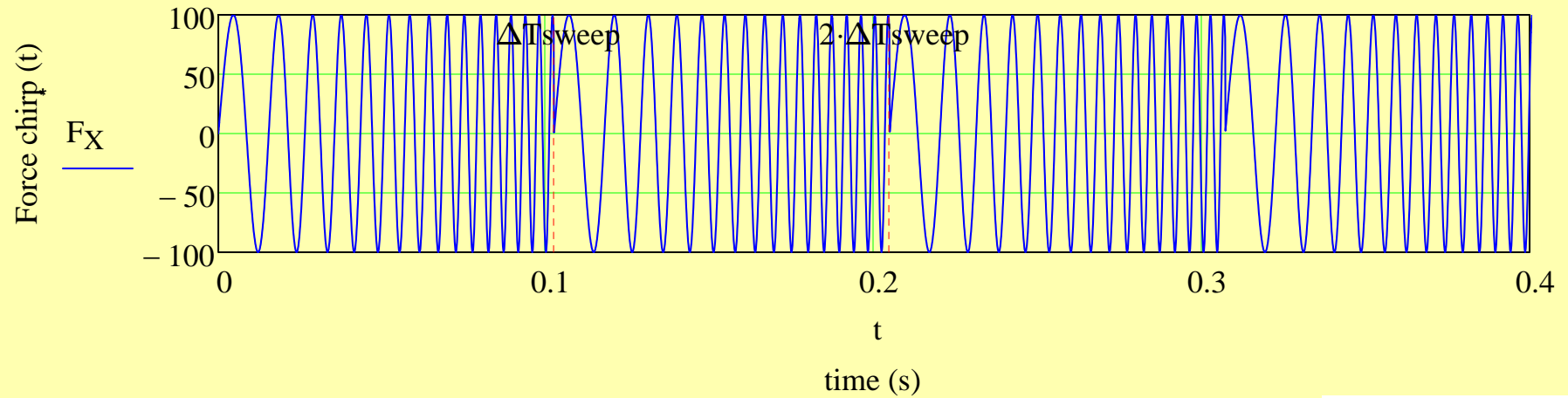
4 periods of chirp
function

1 YES, 0: NO $Y_{\text{window}} := 0$

for graphs

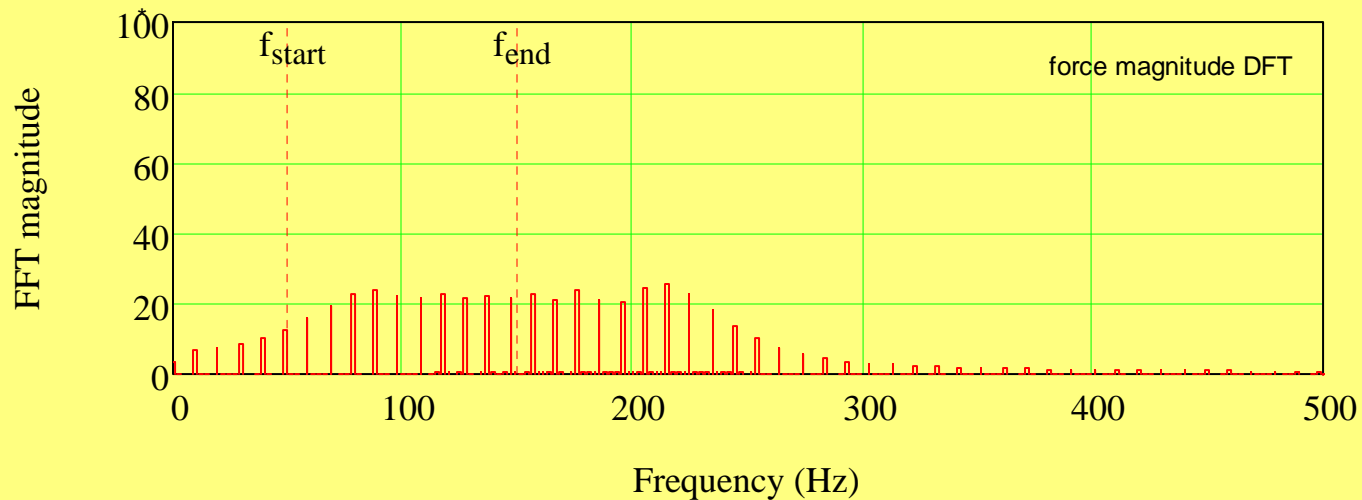
$$\text{freq}_{\text{max}} := 500 \cdot \text{Hz} \quad \text{FI}_{\text{max}} := 100 \cdot N$$

chirp = sine sweep fn



$$\frac{\Delta t}{\Delta T_{\text{sweep}}} = 9.768 \times 10^{-4}$$

$$\frac{T_{\text{max}}}{\Delta T_{\text{sweep}}} = 4$$



$$\Delta f = 2.443 \cdot \text{Hz}$$

$$T_{\text{max}} = 0.41 \text{ s}$$

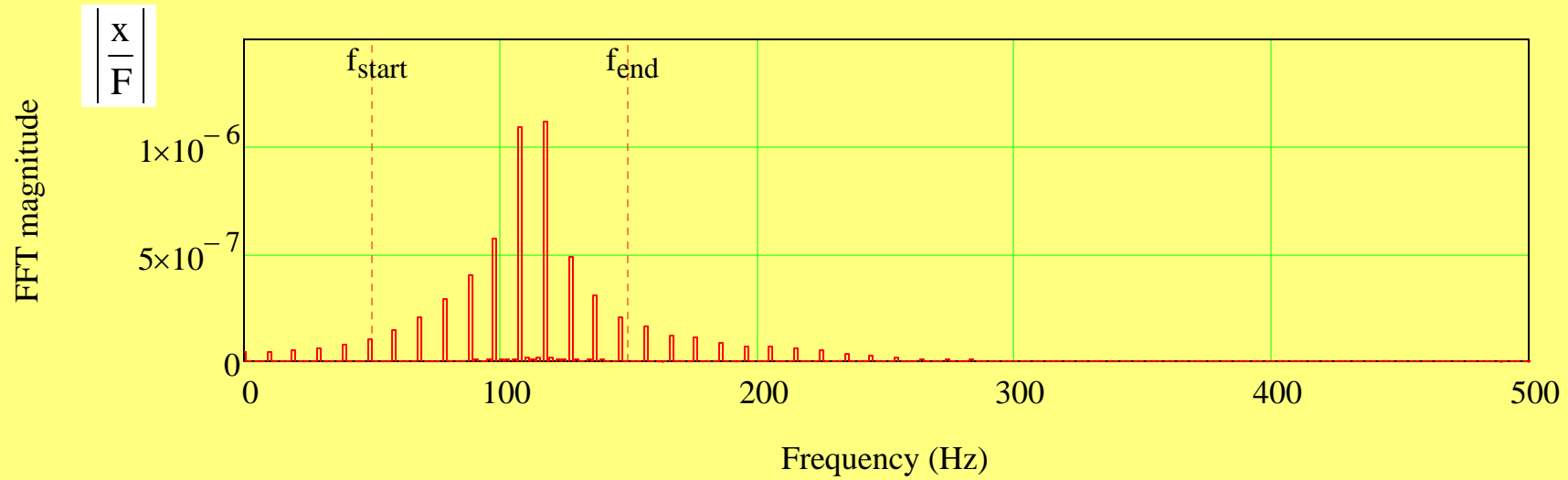
$$\frac{f_{\text{max}}}{\Delta f} = 2.047 \times 10^3$$

$$f_{\text{max}} = 5 \times 10^3 \cdot \text{Hz}$$



Build system response (frequency and time)

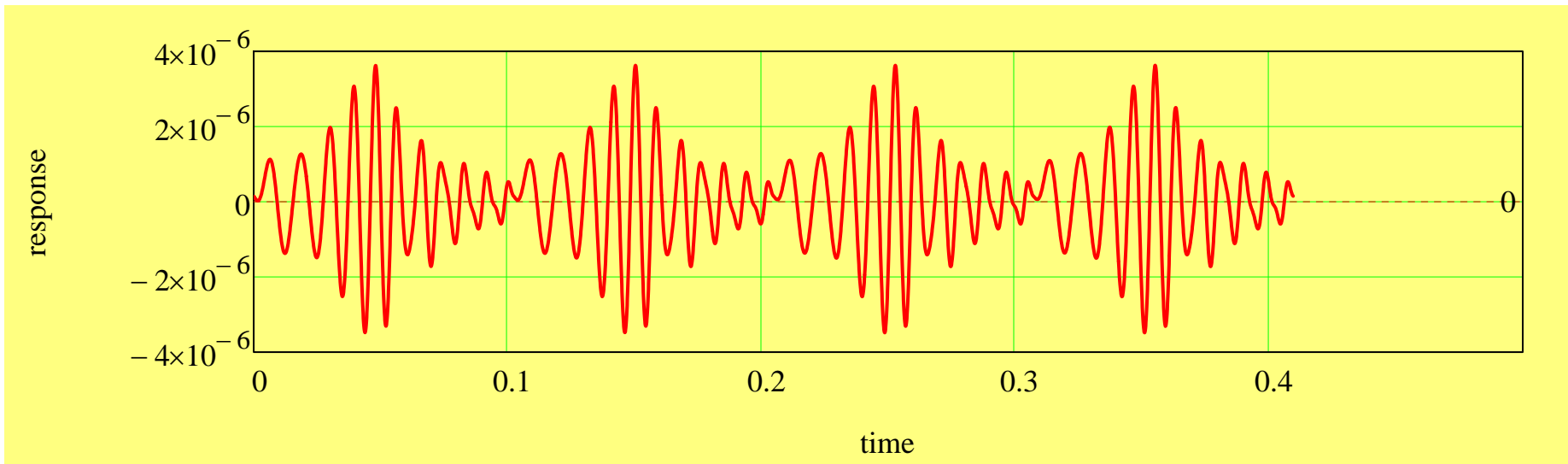
$$A_{\max} := \max(A) = 1.118 \times 10^{-6} \text{ m}$$



4 periods of chirp
function

(b) Time response

$$\max(X) = 3.621 \times 10^{-6} \text{ m}$$



4 periods of chirp
function