GATE 2021 EC.24

EE23BTECH11203 - Adarsh A*

Question : A 4 kHz sinusoidal message signal having amplitude 4 V is fed to a delta modulator (DM) operating at a sampling rate of 32 kHz. The minimum step size required to avoid slope overload noise in the DM is?

Solution:

Parameter	Value	Description
δ	-	Step size
f_s	32 kHz	Sampling rate
A_{max}	4 V	Maximum amplitude of message signal
f_m	4 kHz	Frequency of message signal

Input Table

To avoid slope overload distortion,

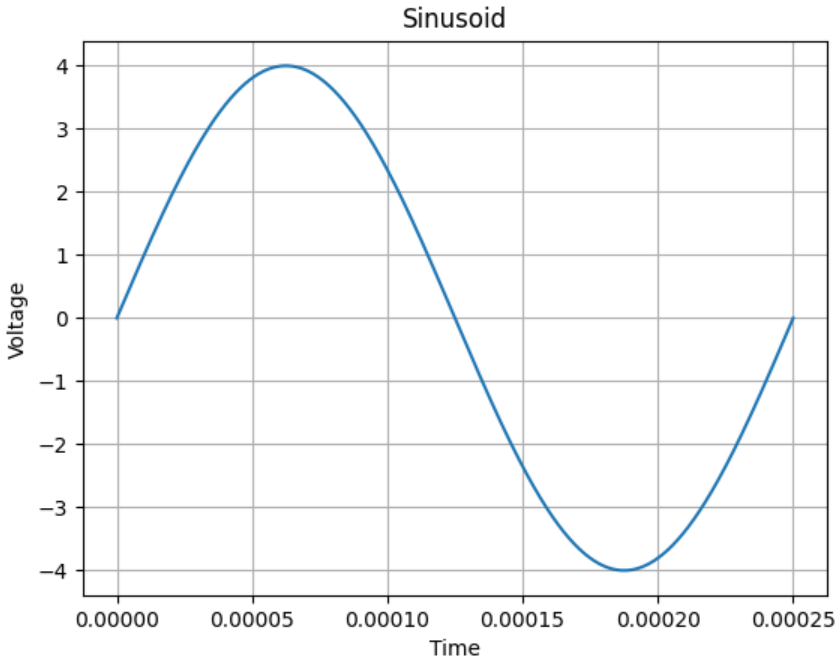
$$\delta f_s \geq 2\pi A_{max} f_m \tag{1}$$

The minimum slope can be obtained when,

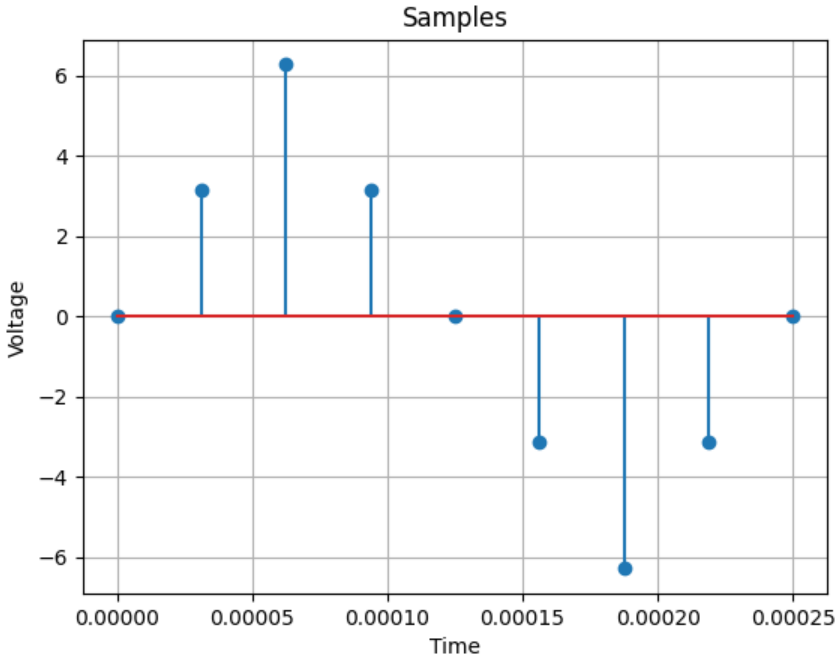
$$\delta_{min} f_s = 2\pi A_{max} f_m \tag{2}$$

$$\delta_{min} (32) = 2\pi (4) (4) \tag{3}$$

$$\delta_{min} = \pi \tag{4}$$



(a) Plot of the sinusoid



(b) Plot of the samples with δ_{min}