

Sampling output of nonlinear system

The input-output relation of a nonlinear system is

$$y(t) = x^2(t)$$

where $x(t)$ is the input and $y(t)$ is the output.

- The signal $x(t)$ is band limited with a maximum frequency $\Omega_M = 2000\pi$ rad/sec. Determine if $y(t)$ is also band limited, and if so, what is its maximum frequency Ω_{\max} ?
- Suppose that the signal $y(t)$ is low-pass filtered. The magnitude of the low-pass filter is unity and the cut-off frequency is $\Omega_c = 5000\pi$ rad/sec. Determine the value of the sampling period T_s according to the given information.
- Is there a different value for T_s that would satisfy the Nyquist sampling rate condition for both $x(t)$ and $y(t)$ and that is larger than the one obtained above? Explain.