Nishimura

Solutions

Problem 1

Multiplying the phase of the Fourier transform by -1 amounts to conjugating the spectrum; hence,

$$G(s) = F^*(s) .$$

Therefore

$$g(t) = f^*(-t) .$$

If the input is real-valued, the output is a time-reversed version. The system is non-causal, non-linear, and time variant. If the input is constrained to be real valued, the system behaves linearly.

Problem 2

(a) Yes, one can throw away every other sample and still exceed the Nyquist frequency.

(b) Yes, model the "defective" sampling by $f(t)[1/T\text{comb}(t/T) - \delta(t)]$. The transform of this quantity is the original replicated spectrum shifted vertically based on the value $f(0)$. Therefore, $f(0)$ can be determined by evaluating the spectrum in the gaps between replication islands since the values there should be zero. A time domain approach is possible too.

(c) No, not possible because of aliasing.