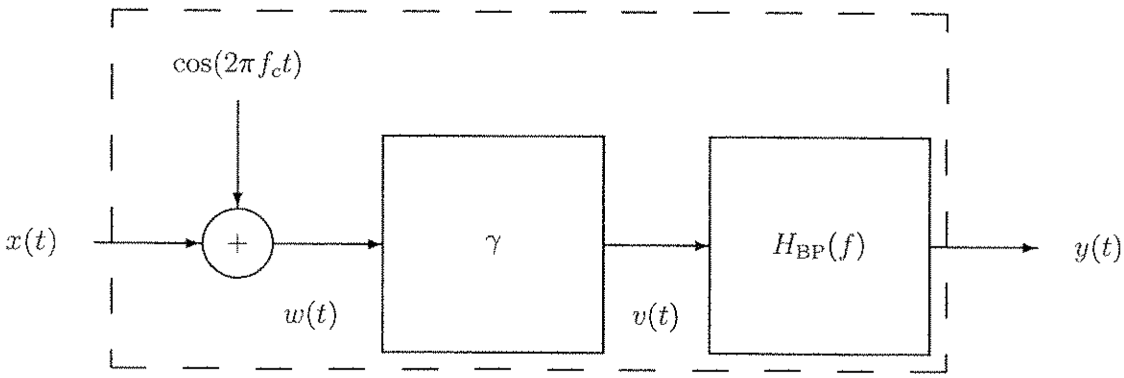
Continue with the system



$$w(t) = x(t) + \cos(2\pi f_c t)$$

$$v(t) = \gamma(w(t)) \quad , \quad \gamma(w) = a_0 + a_1 w + a_2 w^2$$

$H_{\mathrm{BP}}(f)$ as before

$$X(f) = \int_{-\infty}^{\infty} x(t) e^{-j2\pi f t}\, dt = 0 \text{ for } \begin{cases} |f| \geq W \\ f = 0 \end{cases}$$

(bandlimited to $(-W, W)$ and no DC)

- Find a simple expression for $y(t)$.

Solution

$$\begin{aligned} v(t) &= a_0 + a_1\left(x(t) + \cos(2\pi f_c t)\right) \\ &\quad + a_2\left(x(t) + \cos(2\pi f_c t)\right)^2 \\ &= \underbrace{a_0 + a_1 x(t) + a_2 x(t)^2}_{\textit{baseband}} \\ &\quad + \underbrace{a_1 \cos(2\pi f_c t) + 2a_2 x(t)\cos(2\pi f_c t)}_{\textit{passband}} \\ &\quad + a_2 \cos(2\pi f_c t)^2 \end{aligned}$$

Since $\cos(2\pi f_c t)^2 = (1 + \cos(4\pi f_c t))/2$, this is

$$\begin{aligned} v(t) &= \underbrace{a_0 + a_2/2 + a_1 x(t) + a_2 x(t)^2}_{\textit{baseband}} \\ &\quad + \underbrace{a_1 \cos(2\pi f_c t) + 2a_2 x(t)\cos(2\pi f_c t)}_{\textit{passband}} \\ &\quad + \underbrace{(a_2/2)\cos(4\pi f_c t))}_{\textit{highband}} \end{aligned}$$