IQ Modulator and Practical Considerations

EE 340: Prelab Reading Material for Experiment 4

August 30, 2021

Any arbitrary passband signal $s_p(t)$ with center frequency f_c can be written as

$$s_p(t) = \Re\left\{s(t)e^{j2\pi f_c t}\right\} = s_I(t)\cos(2\pi f_c t) - s_Q(t)\sin(2\pi f_c t),$$

where $s(t) = s_I(t) + js_Q(t)$ is a complex baseband signal consisting of the two independent real baseband signals $s_I(t)$ and $s_Q(t)$. The signal $s(t)$ is also called the complex envelope of $s_p(t)$. Therefore, an IQ modulator is typically used for upconverting a complex baseband signal to a passband IF (intermediate frequency) or RF (radio frequency) signal, as shown in Fig. 1a. In a similar way, an IQ demodulator is used for downconverting as passband RF or IF signal to the complex baseband signal, as shown in Fig. 1b.

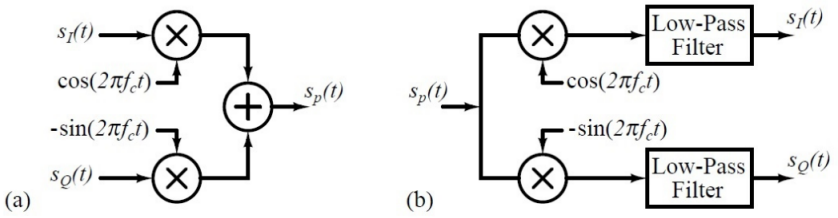

Figure 1: Flowgraph of (a) an IQ modulator, and (b) an IQ demodulator.