Again, we can determine the Fourier coefficients, a_0, a_n and b_n from the inner products:

$$
\begin{aligned}
a_0 &= \frac{1}{\pi}\left\langle f(\theta),1\right\rangle = \frac{1}{\pi}\int_{\theta=\theta_1}^{\theta=\theta_2} f(\theta)d\theta = \frac{1}{\pi}\int_{\theta=0}^{\theta=2\pi} f(\theta)d\theta \\
&= \frac{1}{\pi}\left[\int_{\theta=0}^{\theta=2\pi\alpha} f(\theta)d\theta + \int_{\theta=2\pi\alpha}^{\theta=2\pi(1-\alpha)} f(\theta)d\theta + \int_{\theta=2\pi(1-\alpha)}^{\theta=2\pi} f(\theta)d\theta\right] \\
&= \frac{1}{\pi}\left[\int_{\theta=0}^{\theta=2\pi\alpha} (\tfrac{1}{2\pi\alpha})\theta d\theta + \int_{\theta=2\pi\alpha}^{\theta=2\pi(1-\alpha)} \left((\tfrac{-1}{\pi(1-2\alpha)})\theta + \tfrac{1}{1-2\alpha}\right)d\theta + \int_{\theta=2\pi(1=\alpha)}^{\theta=2\pi} \left((\tfrac{1}{2\pi\alpha})\theta - \tfrac{1}{\alpha}\right)d\theta\right]
\end{aligned}
$$

Since this *bipolar* sawtooth waveform has no d.c. offset, we know that $a_0 = 0$.

The Fourier coefficients, a_n and b_n are:

$$
\begin{aligned}
a_n &= \frac{1}{\pi}\left\langle f(\theta),\cos(\theta_n)\right\rangle = \frac{1}{\pi}\int_{\theta=\theta_1}^{\theta=\theta_2} f(\theta)\cos(\theta_n)d\theta = \frac{1}{\pi}\int_{\theta=0}^{\theta=2\pi} f(\theta)\cos(n\theta)d\theta \\
&= \frac{1}{\pi}\left[\int_{\theta=0}^{\theta=2\pi\alpha} f(\theta)\cos(n\theta)d\theta + \int_{\theta=2\pi\alpha}^{\theta=2\pi(1-\alpha)} f(\theta)\cos(n\theta)d\theta + \int_{\theta=2\pi(1-\alpha)}^{\theta=2\pi} f(\theta)\cos(n\theta)d\theta\right] \\
&= \frac{1}{\pi}\left[\int_{\theta=0}^{\theta=2\pi\alpha} (\tfrac{1}{2\pi\alpha})\theta\cos(n\theta)d\theta + \int_{\theta=2\pi\alpha}^{\theta=2\pi(1-\alpha)} \left((\tfrac{-1}{\pi(1-2\alpha)})\theta + \tfrac{1}{1-2\alpha}\right)\cos(n\theta)d\theta + \int_{\theta=2\pi(1=\alpha)}^{\theta=2\pi} \left((\tfrac{1}{2\pi\alpha})\theta - \tfrac{1}{\alpha}\right)\cos(n\theta)d\theta\right]
\end{aligned}
$$

and:

$$
\begin{aligned}
b_n &= \frac{1}{\pi}\left\langle f(\theta),\sin(\theta_n)\right\rangle = \frac{1}{\pi}\int_{\theta=\theta_1}^{\theta=\theta_2} f(\theta)\sin(\theta_n)d\theta = \frac{1}{\pi}\int_{\theta=0}^{\theta=2\pi} f(\theta)\sin(n\theta)d\theta \\
&= \frac{1}{\pi}\left[\int_{\theta=0}^{\theta=2\pi\alpha} f(\theta)\sin(n\theta)d\theta + \int_{\theta=2\pi\alpha}^{\theta=2\pi(1-\alpha)} f(\theta)\sin(n\theta)d\theta + \int_{\theta=2\pi(1-\alpha)}^{\theta=2\pi} f(\theta)\sin(n\theta)d\theta\right] \\
&= \frac{1}{\pi}\left[\int_{\theta=0}^{\theta=2\pi\alpha} (\tfrac{1}{2\pi\alpha})\theta\sin(n\theta)d\theta + \int_{\theta=2\pi\alpha}^{\theta=2\pi(1-\alpha)} \left((\tfrac{-1}{\pi(1-2\alpha)})\theta + \tfrac{1}{1-2\alpha}\right)\sin(n\theta)d\theta + \int_{\theta=2\pi(1=\alpha)}^{\theta=2\pi} \left((\tfrac{1}{2\pi\alpha})\theta - \tfrac{1}{\alpha}\right)\sin(n\theta)d\theta\right]
\end{aligned}
$$

Again, we will need to use the *indefinite* integrals:

$$\int\cos(n\theta)d\theta = +\frac{\sin(n\theta)}{n} \qquad\qquad \int\sin(n\theta)d\theta = -\frac{\cos(n\theta)}{n}$$

$$\int\theta\cos(n\theta)d\theta = \frac{\cos(n\theta)}{n^2} + \frac{\theta\sin(n\theta)}{n} \qquad\qquad \int\theta\sin(n\theta)d\theta = \frac{\sin(n\theta)}{n^2} - \frac{\theta\cos(n\theta)}{n}$$

And again using the fact(s) that:

$$\sin(2n\pi(1-\alpha_p)) = -\sin(2n\pi\alpha_p)$$

and that:

$$\cos(2n\pi(1-\alpha_p)) = +\cos(2n\pi\alpha_p)$$