$\cos(A-B) = \cos A \cos B + \sin A \sin B$, hence we see that:

$$A_n(t) = A_n \cos\varphi_n \cos(n\omega_1 t) + A_n \sin\varphi_n \sin(n\omega_1 t) = A_n \cos(n\omega_1 t - \varphi_n)$$

We also see that: $A_n = \sqrt{A_n^2 \cos^2\varphi_n + A_n^2 \sin^2\varphi_n} = \sqrt{a_n^2 + b_n^2}$ and that: $\varphi_n = \tan^{-1}(b_n/a_n)$.

Hence, we can equivalently write the Fourier series expression:

$$\boxed{A_{tot}(t) = a_o + \sum_{n=1}^{\infty} a_n \cos(n\omega_1 t) + \sum_{n=1}^{\infty} b_n \sin(n\omega_1 t)}$$

as:

$$\boxed{A_{tot}(t) = a_o + \sum_{n=1}^{\infty} A_n \cos(n\omega_1 t + \varphi_n)}$$

with: $A_n = \sqrt{a_n^2 + b_n^2}$ and: $\varphi_n = \tan^{-1}(b_n/a_n)$.

Fourier analysis applies to any/all kinds of complex periodic waveforms – electrical signals, optical waveforms, *etc*. - ***<u>any</u>*** periodic waveform (temporal, spatial, *etc*.). Please see/read Physics 406 Series of Lecture Notes on Fourier Analysis I-IV for much more details/info…