Deduction of Conversion Equation

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1 Deduction

Based on the Graphs provided by the Hardware sector of Zenith's Embedded Systems Department, where one of them is presented below:

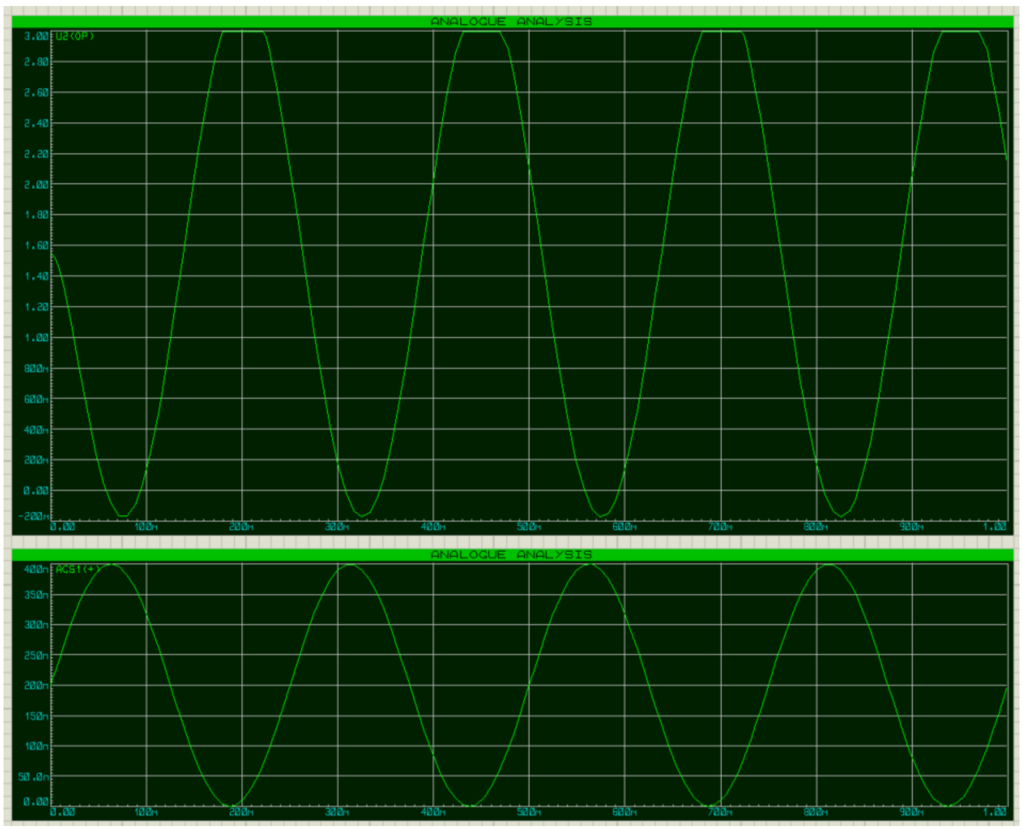

Figure 1: The Top graphic represents the Tension in Volts (y - axis), and the Bottom graphic represents the Current in nano Amperes (y - axis).

An equation was modeled to correlate the Output Tension U_{out} and the Sensor's original Output Current i_{out}, data from graph pairs, as Graphic 1.

Where ϕ is the phase difference between the graphic pairs, b_i and $b_u$are the "offset" values for Current graphic and Tension graphic respectively, and A_i and A_u are the Amplitudes of Current graphic and Tension graphic respectively too.

OBS: Was made an assumption that the wave length is the same for each graphic pair, based that it is defined by the Oscilloscope.

$$\begin{aligned} U_{out} &= A_u \cdot \sin(x) + b_u \\ i_{out} &= A_i \cdot \sin(x + \phi) + b_i \end{aligned} \tag{1}$$

$$i(x) = A_i \cdot (\sin(x) \cdot \cos(\phi) + \cos(x) \cdot \sin(\phi)) + b_i \tag{2}$$

$$f(U_{out}) = i_{out} \tag{3}$$

$$\begin{aligned} \sin(x) &= \frac{U_{out} - b_u}{A_u} \\ \cos(x) &= \sqrt{\frac{{A_u}^2 - (U_{out} - b_u)^2}{{A_u}^2}} \end{aligned} \tag{4}$$

$$i_{out} = A_i \cdot (\frac{U_{out} - b_u}{A_u} \cdot \cos(\phi) + \sqrt{\frac{{A_u}^2 - (U_{out} - b_u)^2}{{A_u}^2}} \cdot \sin(\phi)) + b_i \tag{5}$$

2 Special Case

Special Case where the phase difference ϕ equals to zero:

$$i_{out} = (\frac{A_i}{A_u}) \cdot (U_{out} - b_u) + b_i \tag{6}$$

Notice that the only parameters in this case are the actual converse factor ($\frac{A_i}{A_u}$), the "offset values", (b_i and b_u), that shift both initial functions at Equation 1, and the Output Tension U_{out}.