What is an IV Curve Good For?

A graph of the current flowing through an electrical device as a function of the voltage across it is called a **Characteristic Curve** or sometimes an IV curve. In this short note we will show an example IV curve and illustrate how one might use it as an aid in building an electronic circuit.

Figure 1 contains a made up characteristic curve for a diode, where the data points are shown as small triangles and a smooth curve connects the data points. We will describe how to use this graph to find the operating point of this diode connected in series with a known resistor. When a bias voltage, V_B is applied to a load resistor, R_L connected in series with a device, D, the current which flows is

$$I = \frac{V}{R} = \frac{V_B - V_D}{R_L} = \frac{V_B}{R_L} - \frac{V_D}{R_L}. \tag{1}$$

Notice that this is linear in the voltage across the (unspecified) device, V_D with slope $-1/R_L$ and zero-intercept V_B/R_L. This line is called a *load line*. There is a load line plotted in Figure 1 for $V_B = 0.8$ volts and $R_L = 80\Omega$ and a second load line for $V_B = 0.7$ volts.

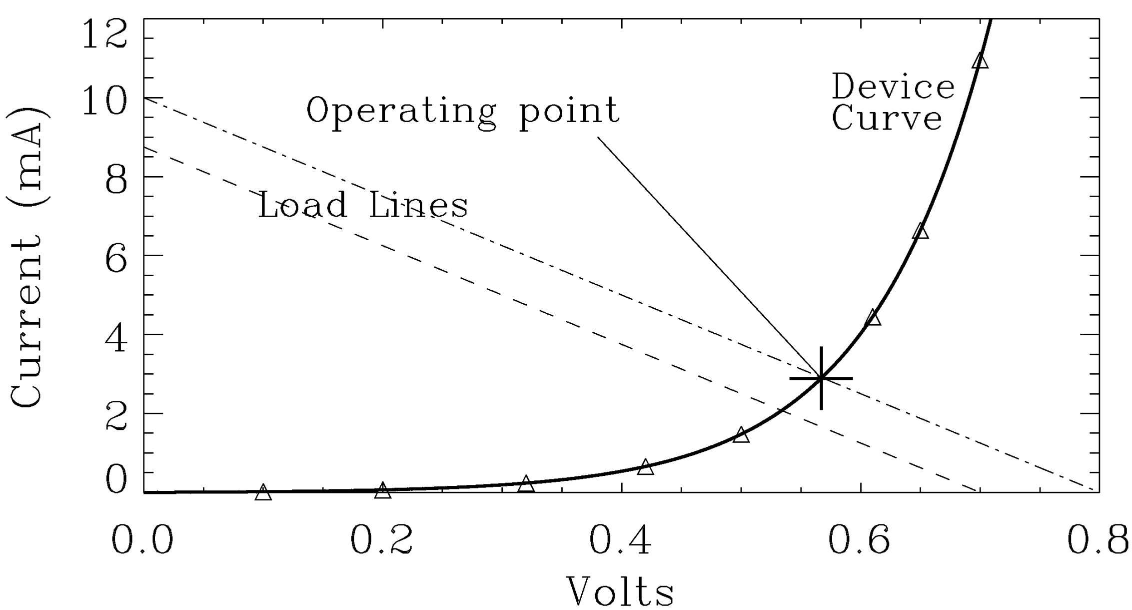

Figure 1: The characteristic curve for a diode is shown as (simulated) data points with a smooth curve passing through them. The dot-dashed line is a load-line for 0.8 volts applied across the device and an 80Ω resistor connected in series. The dashed line is a similar load line for 0.7 volts.

When two devices are connected in series, the same current flows through them both. Therefore finding the operating point amounts to choosing a device voltage, V_D, such that

$$I_{Device}(V_D) = I_{Load}(V_D).$$

This equation is automatically solved at the intersection of the device characteristic curve and the load line, as is illustrated in Figure 1.