Load Response to a Source (Chart)

A Supplementary Note to EEL3003, Lecture #4

The following log-log chart indicates how the load voltage v_L, load current i_L, and load power dissipation p_L vary as a function of load resistance R_L for any source having a equivalent resistance of R_{eq} = 10 Ω (either a Thévenin series resistance R_T or Norton parallel resistance R_N) and either a Thévenin equivalent voltage of V_T=10 V, or (equivalently) a Norton equivalent current of I_N=1 A.

Note that as the load resistance becomes large compared to the source equivalent resistance, $R_L >> R_{eq}$, the load voltage approaches the open-circuit or Thévenin equivalent voltage V_T, and as the load voltage becomes small, $R_L << R_{eq}$, the load current approaches the closed-circuit or Norton equivalent current I_N. Also, when $R_L = R_{eq}$, we have $v_L = V_T/2$ (5V) and $i_L = I_N/2$ (0.5A) – this is also the point at which there is maximum power transfer to the load.

For different values of R_{eq} or V_T/I_N, the curves shown here would shift horizontally or vertically relative to the axis labels, but their overall shapes would remain the same. This chart thus serves as a universal illustration of the i/v behavior of a linear (resistive) load when connected to a linear source.