

and

$$b = \frac{R_{P0} C_{P0}}{R_{N0} C_{N0}} . \quad (14)$$

In eqn. (14), b represents a relative performance factor for S_H and S_L . If both devices exhibit the same RC product (e.g., are both NMOS), then b equals one. More typically, S_H is a PMOS and S_L is a NMOS, so b is closer to three. Furthermore, it can be shown empirically that f_{opt} fits the power law

$$f_{opt} = kV_{in}^{\beta} , \quad (15)$$

assuming both β and k are functions of b and V_o , and given $V_{in} > 2V_o$. Figure 18 shows how the exponent β varies as a function of b for various V_o .

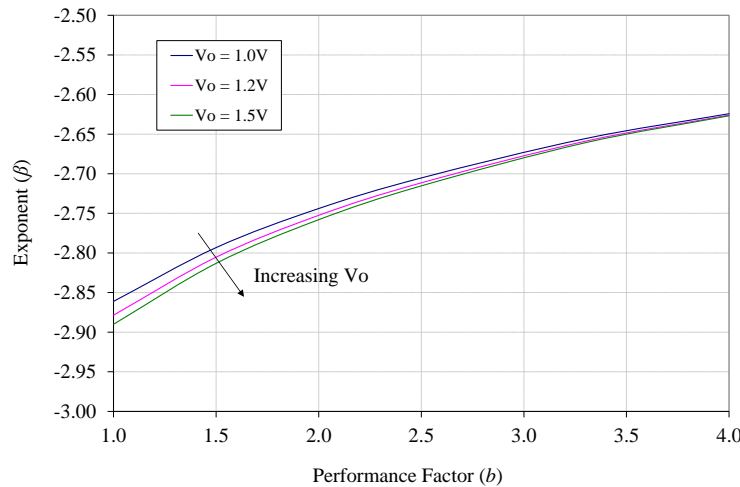


Figure 18 – Exponent β vs. relative performance factor (b)

What can be concluded from eqn. (15) and Figure 18 is that f_{opt} increases very rapidly with decreasing V_{in} . For example, if $b = 3$ and $V_o = 1.0$ V, then $\beta = -2.67$. Therefore, a buck converter with a V_{in} of 1.8 V should be able to switch 15.3 times faster than a buck converter with a V_{in} of 5.0 V with equal power loss in both cases. This leads to less energy storage in the filter elements (L and C) for a given dynamic and static response.