$$(C_{dsc} + C_{dscd}V_{ds} + C_{dscb}V_{bseff})\left(\exp(-D_{VT1}\frac{L_{eff}}{2l_t}) + 2\exp(-D_{VT1}\frac{L_{eff}}{l_t})\right)$$

represents the coupling capacitance between the drain or source to the channel. The parameters C_{dsc}, C_{dscd} and C_{dscb} are extracted. The parameter C_{it} in Eq. (2.7.3) is the capacitance due to interface states. From Eq. (2.7.3), it can be seen that subthreshold swing shares the same exponential dependence on channel length as the *DIBL* effect. The parameter *Nfactor* is introduced to compensate for errors in the depletion width capacitance calculation. *Nfactor* is determined experimentally and is usually very close to 1.

2.8 Effective Channel Length and Width

The effective channel length and width used in all model expressions is given below

$$L_{eff} = L_{drawn} - 2dL \tag{2.8.1}$$

$$W_{eff} = W_{drawn} - 2dW \tag{2.8.2a}$$

$$W_{eff}' = W_{drawn} - 2dW' \tag{2.8.2b}$$

The only difference between Eq. (2.8.2a) and (2.8.2b) is that the former includes bias dependencies. The parameters *dW* and *dL* are modeled by the following

(2.8.3)

$$dW = dW' + dW_g V_{gsteff} + dW_b \left(\sqrt{\Phi_s - V_{bseff}} - \sqrt{\Phi_s} \right)$$

$$dW' = W_{int} + \frac{W_l}{L^{W\ln}} + \frac{W_w}{W^{Wwn}} + \frac{W_{wl}}{L^{W\ln} W^{Wwn}}$$

(2.8.4)

$$dL = L_{int} + \frac{L_l}{L^{L\ln}} + \frac{L_w}{W^{Lwn}} + \frac{L_{wl}}{L^{L\ln} W^{Lwn}}$$

These complicated formulations require some explanation. From Eq. (2.8.3), the variable W_{int} models represents the tradition manner from which "delta W" is extracted (from the *int*ercepts of straights lines on a $1/R_{ds}$ vs. W_{drawn} plot). The parameters dW_g and dW_b have been added to account for the contribution of both front gate and back side (substrate) biasing effects. For dL, the parameter L_{int} represents the traditional manner from which "delta L" is extracted (mainly from the *int*ercepts of lines from a R_{ds} vs. L_{drawn} plot).

The remaining terms in both dW and dL are included for the convenience of the user. They are meant to allow the user to model each parameter as a function of W_{drawn}, L_{drawn} and their associated product terms. In addition, the freedom to model these dependencies as other than just simple inverse functions of W and L is also provided for the user. For dW, they are Wln and Wwn. For dL they are Lln and Lwn.

By default all of the above *geometrical* dependencies for both dW and dL are turned off. Again, these equations are provided for the convenience of the user. As such, it is up to the user to adopt the correct extraction strategy to ensure proper use.

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