GUMMEL-POON MODEL OF THE BIPOLAR TRANSISTOR

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$$I_{cc} = -I_s Q_{bo} \frac{\exp(qV_{eb}/kT) - \exp(qV_{cb}/kT)}{Q_b}$$

$$Q_b = A - \sqrt{A^2 - Q_{bo} I_s \{\tau_f [\exp(qV_{eb}/kT) - 1] + \tau_r [\exp(qV_{cb}/kT) - 1]\}}$$

$$A = (Q_{bo} - C_e V_{eb} - C_c V_{cb})/2$$

$$I_{be} = I_1 [\exp(qV_{eb}/kT) - 1] + I_2 [\exp(qV_{eb}/nkT) - 1]$$

$$I_{bc} = I_3 [\exp(qV_{cb}/nkT) - 1]$$

A Compact Bipolar Transistor Model

INCREASING CIRCUIT speeds and demands for optimized technology development and utilization drove the need for accurate device models. The Gummel-Poon high-level injection model was developed to meet those needs. Since its inception, this model served a generation of bipolar circuit designers. This model is still the primary bipolar model used in circuit simulation today.

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