

Fig. 5. Details of the class AB bias control loop.

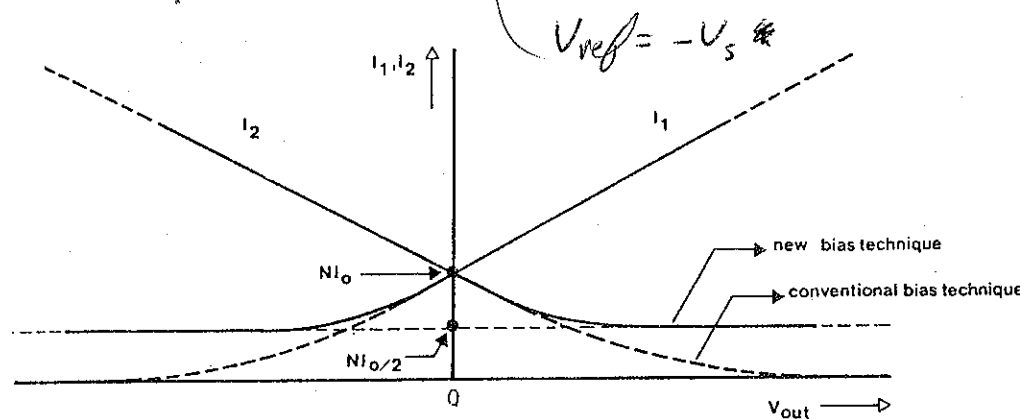


Fig. 6. Class AB behavior of output transistor currents for the new and conventional bias techniques.

Finally, we neglect base current. For the loop comprising Q_7 - Q_{10} we can write

$$I_{s1} \cdot I_{Q9} = I_{s2} \cdot I_{Q8} \quad (2)$$

$$I_{Q8} + I_{Q9} = 2I_0. \quad (3)$$

For the loop consisting of Q_9 - Q_{14} we can write

$$I_{s1} \cdot I_{Q9} = I_0^2. \quad (4)$$

When eliminating I_{Q8} and I_{Q9} from (2)-(4) and substituting

$$I_1 = NI_{s1} \quad (5a)$$

$$I_2 = NI_{s2} \quad (5b)$$

$$\frac{I_1 I_2}{I_1 + I_2} = \frac{N}{2} I_0. \quad (6)$$

We conclude that the new class AB biasing technique involves a harmonic-mean bias control law rather than the geometric-mean control law (1) implemented by conven-

tional class AB output stages. Key to the new technique is the bias network consisting of Q_7 - Q_{14} . This network is a variant of an original translinear circuit implementation of the harmonic-mean function [9].

The quiescent current for the output transistors is found from (6) by equating I_1 and I_2 :

$$I_{\text{quiescent}} = NI_0. \quad (7)$$

The residual output transistor current when the other output transistor is driven very hard is found from (6) by taking I_1 or I_2 very large:

$$I_{\text{residual}} = \frac{N}{2} I_0. \quad (8)$$

This demonstrates that the bias current of the output transistor not carrying the large load current is smoothly stabilized at one-half the quiescent current value. As mentioned before, for conventional output stages the non-driven transistor is cut off during every half-cycle. Fig. 6