Resistor stabilizes gain of monolithic d-a converter

When a digital-to-analog converter having an R-2R ladder network must provide voltage multiplication of greater than 1, the gain is usually obtained by connecting a resistive-divider type of attenuator between an op amp at the converter's output and the converter's feedback resistor. But as Paul Brokaw of Analog Devices Inc. has found, there are several drawbacks to this approach. It makes the overall gain sensitive to the feedback resistance, and it causes gain drift because the divider's temperature coefficient does not match the monolithic device's. **Usually, too, gain must be adjusted over a wide range in standard applications** because the absolute value of the ladder resistors in the d-a converter vary significantly, although the R-2R ratios are very accurate.

But Brokaw, who is manager of Advanced Product Planning for the Norwood, Mass., firm's Semiconductor division, says that fortunately all the problems can be eliminated—you simply add a single compensating resistor in series with the analog reference source driving the converter. The resistor must have the value $R_1R_2/(R_1+R_2)$, where R_1 is the part of the divider closest to the op amp, and its tempco should match the divider's. **Under these conditions, the converter's feedback resistor will not affect the gain,** which thus becomes $(R_1+R_2)/R_2$, assuming the series resistance of the network is not substantially larger than the nominal value of the d-a's feedback resistance.