Practical cases where it makes sense to judge the operational circuit accuracy in this way are, for example, the programmable potentiostat, the automatic titrator, the sawtooth electronic resolver or the automatic resistor-trimming machine.

9.4.1 Non-inverting amplifier rate error

In a fashion similar to the step response, we relate our considerations to a particular operational circuit (Fig. 9.16), the non-inverting amplifier with a closed loop gain

$$G = \frac{G_I}{1 + s/\omega_c},$$

where

$$G_I = \frac{R_2}{R_1} + 1\,, \quad \omega_c = \frac{\omega_t}{G_I},$$

according to Sec. 7.4.1. The input signal is a voltage increasing linearly with time at a rate w_s starting from $t = 0$. If the amplifier has been at rest for a sufficiently long time, it can be considered to be in the steady state. The Laplace transform of the output voltage is

$$v_o(s) = G\frac{w_s}{s^2} = \frac{G_I w_s}{s^2(1 + s/\omega_c)}$$

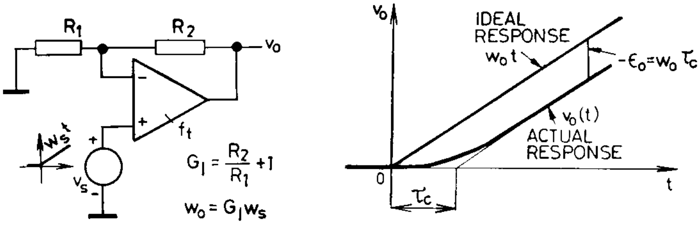

Fig. 9.16 Rate error of a non-inverting amplifier excited by a ramp.

from which the time-domain equivalent is found to be

$$v_o(t) = G_I w_s[t - \tau_c(1 - e^{-t/\tau_c})]\,.$$

The output voltage comprises an ideal component

$$v_{oI} = G_I w_s t = w_o t\,, \tag{9.33}$$