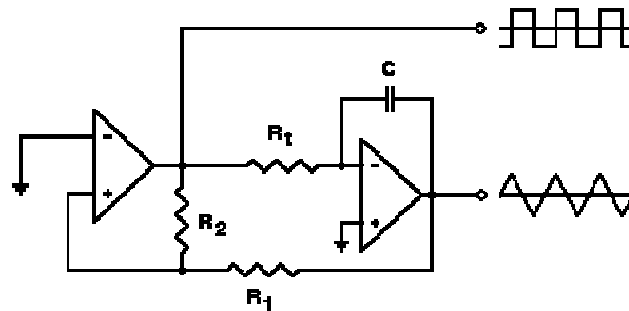


## Triangular wave generators

Triangular wave can be generated by simply connecting integrator to the square wave generator. Can we use an op amp integrator here to obtain a linear triangle wave along with the square wave? we use a separate integrator to generate a ramp voltage from the generated square wave. As a result, we can get both waveforms from a single circuit. The phase relationship shown between the two output waveforms is correct remember that the integrator inverts as well as integrating, so it will produce a negative-going ramp for a positive input voltage, and vice-versa. Because we are now using an op amp integrator to get the triangle wave, we no longer have a logarithmic response anywhere in the circuit. Therefore, the equation for the operating frequency is simplified. The circuit requires a dual op-amp, two capacitors, and at least 5 resistors. The frequency of both waves are same.



**Figure 2.8**

The square wave amplitude is still the limit of voltage transistion, which we are assuming here to be  $\pm 10$  volts. The triangle wave's amplitude is set by the ratio of  $R_1/R_2$ . Note that for this circuit to function, it is necessary that  $R_1$  be less than  $R_2$ . This keeps the triangle amplitude less than the square wave amplitude. It is also necessary for the resistor values to be within a reasonable range for correct operation of the op amps. There is no restriction on the value of  $C$ .