$$M_j = \frac{\displaystyle\int_{\lambda_1}^{\lambda_2} E_{\mathrm{Ref}}(\lambda) S_{\mathrm{R},j}(\lambda)\,\mathrm{d}\lambda \int_{\lambda_1}^{\lambda_2} E_{\mathrm{S}}(\lambda) S_{\mathrm{T},j}(\lambda)\,\mathrm{d}\lambda}{\displaystyle\int_{\lambda_1}^{\lambda_2} E_{\mathrm{Ref}}(\lambda) S_{\mathrm{T},j}(\lambda)\,\mathrm{d}\lambda \int_{\lambda_1}^{\lambda_2} E_{\mathrm{S}}(\lambda) S_{\mathrm{R},j}(\lambda)\,\mathrm{d}\lambda}. \tag{16.29}$$

This procedure involves adjusting the simulator in equation (16.28), measuring its spectrum, calculating M_j, and readjusting the simulator. If reference cells are used whose relative spectral responsivity efficiency matches each individual junction, then the spectral correction M_j is unity and only equation (16.27) needs to be satisfied. This is possible for the high-efficiency crystalline material systems in which the other junctions can be shorted out without significantly affecting the relative spectral responsivity [108]. The adjustment of the solar simulator to satisfy equation (16.28) can be problematic. Figure 16.6 illustrates the various approaches that researchers have taken in the past. The first approach illustrated in Figure 16.6(a) involves combining an ultraviolet (UV) light source L_1 and infrared (IR) light source L_2 with a dichroic filter assembly [108, 109, 112, 113]. This approach is particularly useful for two- and three-junction devices in which the top-cell energy gap is around 600 to 700 nm and the middle-cell energy gap is also around 600 to 700 nm. This is because of the relatively limited choices in the transition wavelength for standard dichroic filters. Figure 16.6(b) works for any material system because it uses

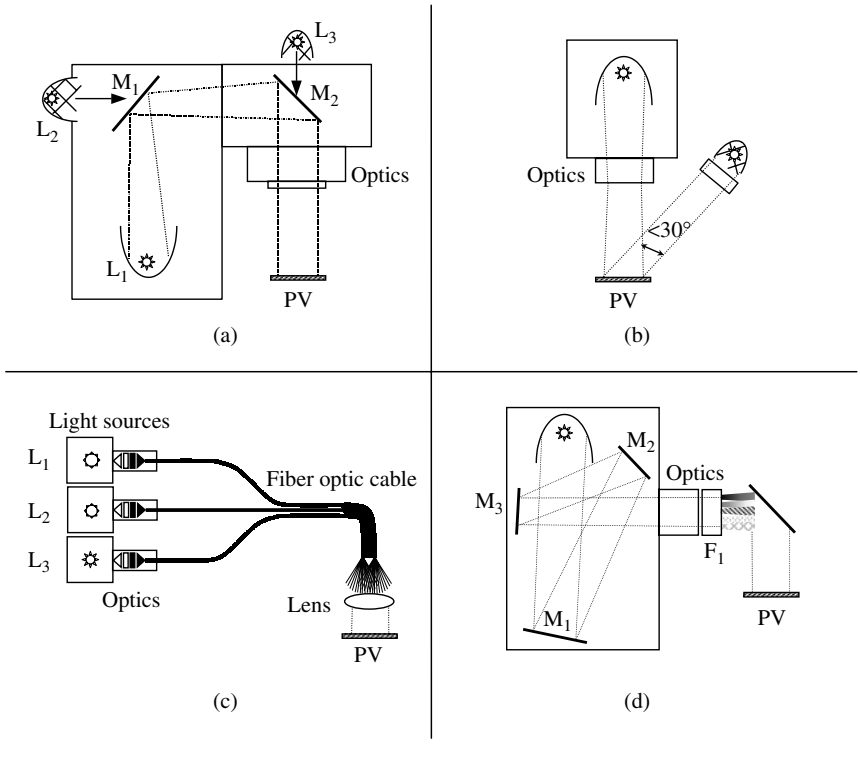

Figure 16.6 Methods of adjusting the spectral content of solar simulators. The light sources are L_1, L_2, and L_3 and the mirrors are M_1, M_2, and M_3