therefore

$$m = \frac{w\alpha^2 L^2}{6}\left(\frac{1.5\beta - \beta^2}{1 + (4\mu\beta\alpha^2/K)}\right) \tag{7.23}$$

For minimum collapse load or maximum value of moment $d(m/w)/d\beta=0$, from which

$$\beta = \frac{K}{4\mu\alpha^2}\left[\left(\frac{6\mu\alpha^2}{K} + 1\right)^{1/2} - 1\right] \tag{7.24}$$

The value of β can be substituted in equations to obtain the relationship between the failure moment and the load.

For a particular panel, the fracture pattern that gives the lowest collapse load should be taken as failure load. The values of m and β for various fracture-line patterns for panels of different boundary conditions are given in Table 7.3, and the reader can derive them from first principles as explained above.

7.5.4 How to obtain the bending-moment coefficient of BS 5628 or EC6 from the fracture-line analysis

Although the fracture-line method has been suggested for accurate analysis, the designer may prefer to use the BS 5628 coefficients. Hence this section briefly outlines the method to obtain the coefficients from the fracture line. In BS 5628 the bending-moment coefficients are given for horizontal bending (M_x), whereas the analysis presented in this chapter considers the vertical bending (M_y).

Similarly, the orthotropy ratio in case of BS 5628 is taken as the ratio

$$\frac{\text{strength normal to bed joint}}{\text{strength parallel to bed joint}}$$

Hence the orthotropy is less than 1, whereas in the present analysis the orthotropy is the reciprocal of this ratio.

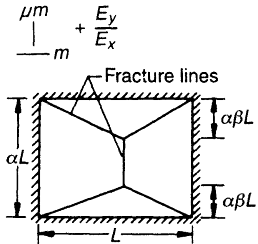
The BS 5628 coefficients can be obtained by putting K=1 in equations (7.24) and (7.23) and also in the equation of Table 7.3, and by multiplying the vertical moment (M_y) by the orthotropy defined as in the fracture-line analysis. The provisions of EC 6 for lateral load design for resistance to wind loads are the same as BS 5628, and hence need no separate explanation.

Example

Consider the case of a panel similar to Fig. 7.9. We have

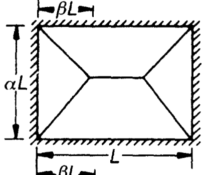
$$\frac{\text{strength parallel to bed joint}}{\text{strength normal to bed joint}} = 3.33; \quad \alpha = h/L = 0.75$$

Table 7.3 Ultimate moment for panels of different boundary conditions.



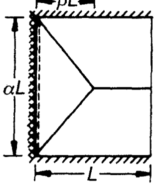
$$m=\frac{w\alpha^2L^2}{6}\left(\frac{1.5\beta-\beta^2}{1+2\mu\alpha^2\beta/K}\right)$$

$$\beta=\frac{K}{2\mu\alpha^2}\left[\left(\frac{3\mu\alpha^2}{K}+1\right)^{1/2}-1\right]$$



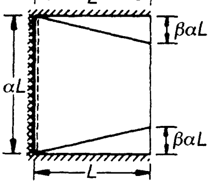
$$m=\frac{w\alpha^2L^2}{6}\left(\frac{1.5\beta-\beta^2}{2\beta+\mu\alpha^2/K}\right)$$

$$\beta=\frac{\mu\alpha^2}{2K}\left[\left(\frac{3K}{\mu\alpha^2}+1\right)^{1/2}-1\right]$$



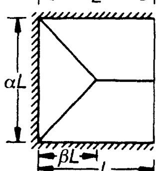
$$m=\frac{w\alpha^2L^2}{12}\left(\frac{3\beta-\beta^2}{2\beta+\mu\alpha^2/K}\right)$$

$$\beta=\frac{\mu\alpha^2}{2K}\left[\left(\frac{6K}{\mu\alpha^2}+1\right)^{1/2}-1\right]$$



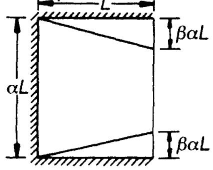
$$m=\frac{w\alpha^2L^2}{12}\left(\frac{3\beta-2\beta^2}{1+\mu\beta^2\alpha^2/K+0.5\,\mu\alpha^2\beta/K}\right)$$

$$\beta=\frac{K}{2\mu\alpha^2}\left[\left(\frac{3\mu\alpha^2}{K}+1\right)^{1/2}-1\right]$$



$$m=\frac{w\alpha^2L^2}{6}\left(\frac{3\beta-\beta^2}{4\beta+\mu\alpha^2/K}\right)$$

$$\beta=\frac{\mu\alpha^2}{4K}\left[\left(\frac{12K}{\mu\alpha^2}+1\right)^{1/2}-1\right]$$



$$m=\frac{w\alpha^2L^2}{12}\left(\frac{3\beta-2\beta^2}{1+\mu\beta^2\alpha^2/K}\right)$$

$$\beta=\frac{K}{1.5\mu\alpha^2}\left[\left(\frac{2.25\mu\alpha^2}{K}+1\right)^{1/2}-1\right]$$

Notation

(hatched line)	is the simple support
(heavy hatched line)	is the continuous support
———	is the positive fracture line
--------	is the negative fracture line
ı	is the ultimate moment/unit length along the bed joint
m	is the ultimate moment/unit length normal to bed joint
$K = E_x/E_y$	is the ratio of modulus of elasticity in two directions
L	is the length
α	is the height/length ratio (h/L)
w	is the failure pressure
β	is a factor