

BUCKLING STRESS COEFFICIENTS FOR FLAT RECTANGULAR PLATES IN COMPRESSION (EDGES RESTRAINED AGAINST ROTATION – ANTI-SYMMETRIC ROTATION)

1. NOTATION

a	plate length	m	in
b	plate width	m	in
E	modulus of elasticity of plate material	N/m ²	lbf/in ²
f_b	stress at which plate first buckles	N/m ²	lbf/in ²
K	buckling stress coefficient, defined by $f_b = KE(t/b)^2$		
M	elastic restraint against rotation of edges a	$\left(\frac{\text{N m/rad}}{\text{m}} \right)$	$\left(\frac{\text{lbf in/rad}}{\text{in}} \right)$
t	plate thickness	m	in
μ_R	coefficient of restraint against rotation along edges a		
	$\mu_R = M \frac{12(1-\nu^2)b}{Et^3}$		
ν	Poisson's ratio, taken as 0.3		

Both SI and British units are quoted but any coherent system of units may be used.

2. NOTES

Figure 1 shows the coefficient K plotted against a/b for various values of the restraint coefficient μ_R . The number of half waves into which the plate buckles longitudinally is also given.

The plate is loaded at its edges b by a uniformly distributed compressive load. All edges of the plate are assumed to remain straight during loading. The edges b are free to rotate. The edges a parallel to the direction of the applied load are elastically restrained against rotation but are free to move laterally in the plane of the plate. The degree of restraint against rotation is expressed by the coefficient μ_R , which is the ratio of the stiffness of the restraining member to the stiffness of the plate. It is assumed that the plate material is isotropic and that all stresses are within the elastic range.

The data refer to the case of anti-symmetrical buckling of a plate that occurs when the stringers attached to the edges a twist in the same sense. The corresponding case of stringers twisting in opposite senses (symmetrical buckling) is treated in Item No. 72019*. Although the buckling stresses for equal values of μ_R are higher throughout for anti-symmetrical buckling, this type of deflection may occur with torsionally weak stringers, which may exhibit a preference for rotating in the same direction. It is therefore more likely

* Data Item No. 72019 "Buckling of flat isotropic plates under uniaxial and biaxial loading".

to apply for negative values of μ_R , that is, when the stringers exert twisting moments on the plate at buckling.

3. DERIVATION

This section lists selected sources that have assisted in the preparation of this Item.

1. COX, H.L. The buckling of a flat rectangular plate under axial compression and its behaviour after buckling. ARC R & M 2041, 1946.
2. ARGYRIS, J.H. Initial instability stress of flat panels with Z-section stringers (unpublished), 1947.