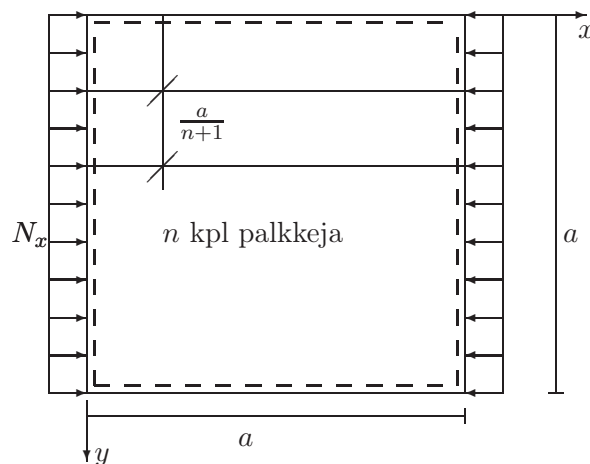


# Stability of structures

## 9. exercise – buckling of plates

1. A square plate is stiffened by equidistant beams of rectangular cross-section in the loading direction. How many stiffeners are required to obtain a buckling load  $N_x$  at least the value  $10\frac{\pi^2 D}{a^2}$ . Thickness of the plate is  $h$ , which is also the width of the beam. The height of the beams is  $\alpha h = 4h$ . The material is isotropic with Poisson's ratio 0.3. Use the energy method and a one-parametric trial function for the deflection  $w(x, y)$ . The plate is simply supported and the torsional stiffness of the beams need not to be taken into account.  $h = a/40$ , where  $a$  is the side-length of the plate.



2. Determine  $\tau_{cr}$  for an infinite plate strip using a trial function

$$w(x, y) = A \sin(\pi y/b) \sin[\pi(x - \alpha y)/s]$$

where  $s$  is the half wavelength of the buckling mode. The plate is simply supported and its bending stiffness is  $D$ . How large is the error in comparison to the analytical solution  $\tau_{cr} = 5.35\pi^2 D/b^2 t$  ( $t$  is the thickness of the plate)?

