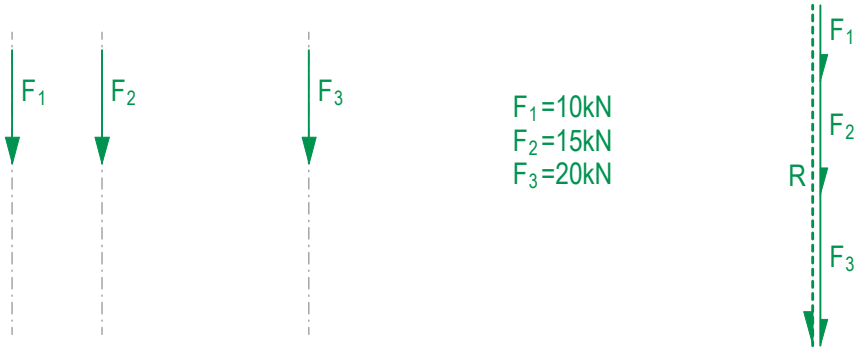
1.3

Compendium Structural Design I & II

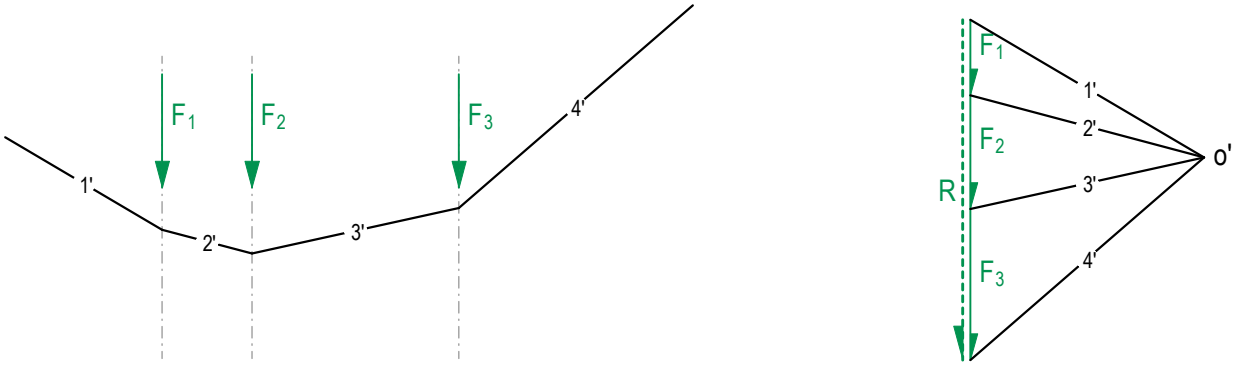
Resultant of several parallel Forces

Three parallel forces are given. The magnitude of the resultant and its position in the form diagram is searched for.

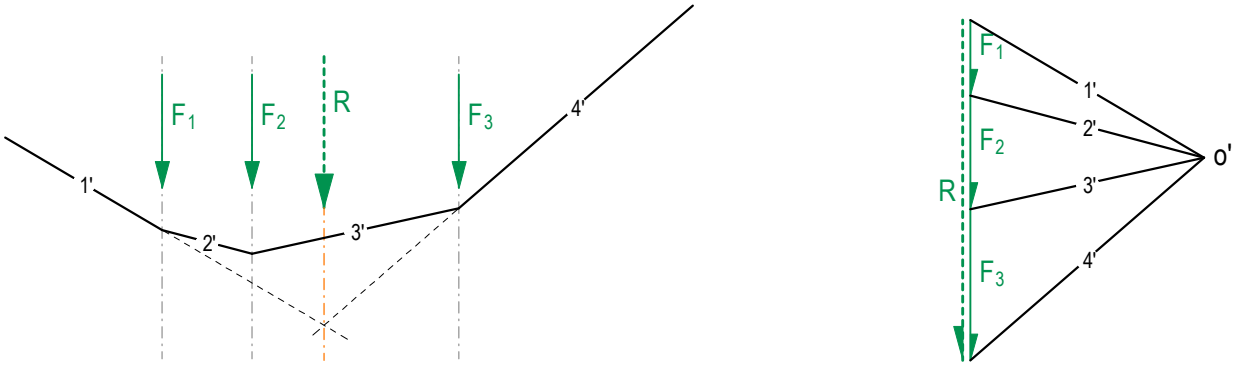
The acting forces are drawn one after the other (clockwise) in the force diagram using the given scale of the force diagram. The connection between the starting point and end point of the load line shows the magnitude and the direction of the resultant R.



The position of the resultant in the form diagram is determined with the aid of a trial funicular. For this purpose a point o‘ is freely selected in the force diagram. Starting from this so-called pole, lines are drawn to the starting and end points of the forces F_1 to F3. These lines 1‘ - 4‘, the so-called rays, are now transferred in parallel into the form diagram. Since the form and force diagram are dual drawings each polygon in the force diagram corresponds to a point in the form diagram – and vice versa. The polygon F_1-1‘-2‘ in the force plan must therefore result in a point of intersection between the line of action of the first force and the first two rays.
The position of 1‘ can be freely selected in the form diagram. At the intersection point of 1‘ and F_1, 2‘ is then applied. Further the elements of the polygon F_2-2‘-3‘ is moved parallel. At the point of intersection of 2‘ with F_2, 3‘ is placed. This is continued until all rays have been transferred to the form diagram.



In order to find the position of the resultant, the first and the last segment of the trial funicular (1‘ & 4‘) are extended until they intersect. The angle of the resultant can now be moved parallel from the force diagram to this intersection point found in the form diagram. The position of the resultant always remains the same, even if a different pole o‘ is selected.



form diagrams 1:100

force diagrams 1cm ≙ 10kN