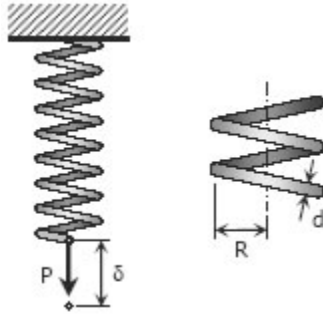


Helical Springs

When close-coiled helical spring, composed of a wire of round rod of diameter d wound into a helix of mean radius R with n number of turns, is subjected to an axial load P produces the following stresses and elongation:



The maximum shearing stress is the sum of the direct shearing stress $\tau_1 = P/A$ and the torsional shearing stress $\tau_2 = Tr/J$, with $T = PR$.

This formula neglects the curvature of the spring. This is used for light spring where the ratio $d/4R$ is small.

For heavy springs and considering the curvature of the spring, a more precise formula is given by: (A.M.Wahl Formula)

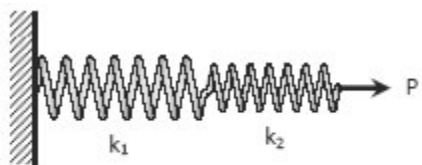
where m is called the spring index and $(4m - 1) / (4m - 4)$ is the Wahl Factor.

The elongation of the bar is

Notice that the deformation δ is directly proportional to the applied load P . The ratio of P to δ is called the spring constant k and is equal to

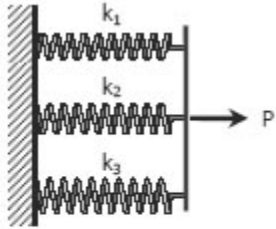
SPRINGS IN SERIES

For two or more springs with spring laid in series, the resulting spring constant k is given by



$$1/k = 1/k_1 + 1/k_2 + \dots$$

SPRINGS IN PARALLEL



$$k = k_1 + k_2 + \dots$$