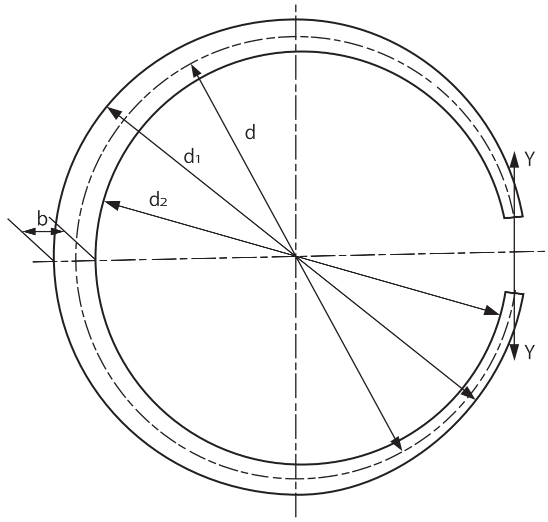
(2) Calculation of Stress

This section calculates the maximum stress where a retaining ring is fit.

Basic Ring

When the retaining ring (Basic External Ring) that is circumscribed by two eccentric circles is to be spread in the Y directions as shown in the figure:

- M : Bending moment
- E : Longitudinal elastic modulus (206000N/ mm^2)
- I : Second moment of area
- r : Average curvature radius (mm)
- ρ : Average curvature radius after change (mm)
- ξ : Rate of change
- d : Average diameter (mm)
- d_1 : Diameter of outer periphery (mm)
- d_2 : Diameter of inner periphery (mm)
- Z : Section modulus
- t : Plate thickness (mm)
- b : Maximum rim width (mm)



If the average curvature radius in the free condition is changed to ρ by spreading the ring in the Y directions as shown in the figure, this relationship is given by the following equation.

$$\frac{1}{r} - \frac{1}{\rho} = \frac{M}{EI}$$

Here, if I is the maximum second moment of area in the section having the maximum width and t is the plate thickness, the value I can be expressed as tb3/12.
In the above equation, assume that ρ =r (1 + ξ) (ξ : Rate of change from r to ρ).
From the equation of the maximum stress, σmax = M/Z, M is given to be σmaxZ.

From the equation of the section modulus, Z=tb2/6, substituting these relations into the above equation yields:

$$\sigma_{max} = \frac{\xi}{1+\xi} \cdot \frac{Eb}{d}$$

For the Internal Ring, assume that $\frac{1}{\rho} - \frac{1}{r} = \frac{M}{EI}$ and ρ=r (1- ξ). Substituting these relations in the same manner indicates the maximum stress by following formula:

$$\sigma_{max} = \frac{\xi}{1-\xi} \cdot \frac{Eb}{d}$$