SCRIET(MECHANICAL DEPATMENT),CCSU MEERUT

MACHINE DESIGN(ROLLING CONTACT BEARING LECTURE 3)

Basic Static Load Rating of Rolling Contact Bearings

The basic static load rating is defined as the static radial load which corresponds to a total permanent deformation of the ball and race.

NOTE:-

1. The load carried by a non-rotating bearing is called a static load.
2. No need to remember formulas as they are available in databook.

Static Equivalent Load for Rolling Contact Bearings

The static equivalent load may be defined as the static radial load which, if applied, would cause the same total permanent deformation at the most heavily stressed ball and race contact as that which occurs under the actual conditions of loading.
The static equivalent radial load (W0R) obtained by the following equation, i.e.

S.No.	Type of bearing	Single row bearing		Double row bearing	
		X_0	Y_0	X_0	Y_0
1.	Radial contact groove ball bearings	0.60	0.50	0.60	0.50
2.	Self aligning ball or roller bearings and tapered roller bearing	0.50	0.22 cot θ	1	0.44 cot θ
3.	Angular contact groove bearings :				
	α = 15°	0.50	0.46	1	0.92
	α = 20°	0.50	0.42	1	0.84
	α = 25°	0.50	0.38	1	0.76
	α = 30°	0.50	0.33	1	0.66
	α = 35°	0.50	0.29	1	0.58
	α = 40°	0.50	0.26	1	0.52
	α = 45°	0.50	0.22	1	0.44

$$W0R = X0.WR + Y0.WA$$

where WR = Radial load **(MOSTLY KNOWN)**
WA = Axial or thrust load (**MOSTLY KNOWN)**
X0 = Radial load factor **(FROM DATABOOK)**
Y = Axial or thrust load factor **(FROM DATABOOK).**

Basic Dynamic Load Rating of Rolling Contact Bearings

The basic dynamic load rating is defined as the constant stationary radial load or constant axial load which a group of apparently identical bearings with stationary outer ring can endure for a rating life of one million with only 10 per cent failure.

NOTE:-

1. The load carried by a non-rotating bearing is called a static load.
2. No need to remember formulas as they are available in databook.

Dynamic Equivalent Load for Rolling Contact Bearings

The dynamic equivalent load may be defined as the constant stationary radial load or axial) which, if applied to a bearing with rotating inner ring and stationary outer ring, would give the same life as that which the bearing will attain under the actual conditions of load and rotation.

Type of bearing	Specifications	$\frac{W_A}{W_R} \leq e$		$\frac{W_A}{W_R} > e$		e
		X	Y	X	Y	
Deep groove ball bearing	$\frac{W_A}{C_0}$ = 0.025				2.0	0.22
	= 0.04				1.8	0.24
	= 0.07				1.6	0.27
	= 0.13	1	0	0.56	1.4	0.31
	= 0.25				1.2	0.37
	= 0.50				1.0	0.44
Angular contact ball bearings	Single row		0	0.35	0.57	1.14
	Two rows in tandem		0	0.35	0.57	1.14
	Two rows back to back	1	0.55	0.57	0.93	1.14
	Double row		0.73	0.62	1.17	0.86
Self-aligning bearings	Light series : for bores					
	10 – 20 mm		1.3		2.0	0.50
	25 – 35	1	1.7	6.5	2.6	0.37
	40 – 45		2.0		3.1	0.31
	50 – 65		2.3		3.5	0.28
	70 – 100		2.4		3.8	0.26
	105 – 110		2.3		3.5	0.28
	Medium series : for bores					
	12 mm		1.0	0.65	1.6	0.63
	15 – 20		1.2		1.9	0.52
	25 – 50		1.5		2.3	0.43
	55 – 90		1.6		2.5	0.39
Spherical roller bearings	For bores :					
	25 – 35 mm		2.1		3.1	0.32
	40 – 45	1	2.5	0.67	3.7	0.27
	50 – 100		2.9		4.4	0.23
	100 – 200		2.6		3.9	0.26
Taper roller bearings	For bores :					
	30 – 40 mm				1.60	0.37
	45 – 110	1	0	0.4	1.45	0.44
	120 – 150				1.35	0.41

W = X V WR + Y WA

where

dynamic equivalent radial load (W)

radial load factor (X) for the dynamically loaded bearings (FROM DATABOOK)

axial or thrust load factor (Y) for the dynamically loaded bearings (FROM DATABOOK)

V = A rotation factor,

= 1, for all types of bearings when the inner race is rotating,

= 1, for self-aligning bearings when inner race is stationary,

= 1.2, for all types of bearings except self-aligning, when inner race is stationary.

Dynamic Load Rating for Rolling Contact Bearings under Variable Loads

The approximate rating (or service) life of ball or roller bearings is

$$W = \left[\frac{n_1 (W_1)^3 + n_2 (W_2)^3 + n_3 (W_3)^3 + \ldots}{n_1 + n_2 + n_3 + \ldots} \right]^{1/3}$$

Where W1, W2, W3 etc., be the loads on the bearing for successive n1, n2, n3 etc., number of revolutions and having corresponding life L1,L2 etc. respectively