

## 1.4 Bearing Loads

The first step in sizing a suitable ball bearing for a given application is the determination of the loads which it has to support. In this section, we list some of the most frequently occurring mechanical configurations and the bearing loads imposed by them.

### (a) Radial Shaft Load Between Bearings

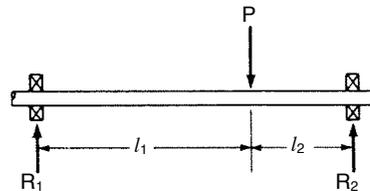
$P$  = radial load

$R_1, R_2$  = bearing loads

$l_1, l_2$  = distances from radial load to bearings

$$R_1 = \frac{l_2 P}{l_1 + l_2} \quad (1)$$

$$R_2 = \frac{l_1 P}{l_1 + l_2} \quad (2)$$



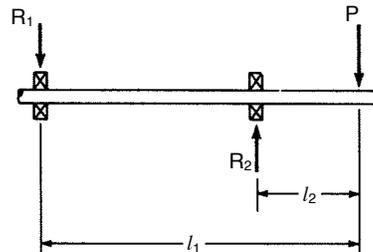
**Fig. 1-6 Radial Load Between Bearings**

### (b) Overhung Radial Load

Notation same as in paragraph (a).

$$R_1 = \frac{l_2 P}{l_1 - l_2} \quad (3)$$

$$R_2 = \frac{l_1 P}{l_1 - l_2} \quad (4)$$



**Fig. 1-7 Overhung Radial Load**

For cases other than those shown above, the rules of static distribution of loads on a beam should be considered. The shaft which is supported by bearings is nothing else but a beam subjected to forces which result in radial loading of bearings.

## 1.5 Determination of Bearing Size

### (a) Basic Definitions

In the course of many years of experience with ball bearings and extensive testing, it has been found that the prediction of the load capacity of a ball bearing is a statistical event related to the fatigue life of the bearing. This makes the sizing of ball bearings more difficult than that of many other machine elements.

A basic phenomenon in ball bearings is that ball bearing life has been found to be inversely proportional to the cube of the bearing load. This means that when the load is doubled, the life expectancy of the bearing is reduced by a factor of eight. This phenomenon has been studied extensively and has led to the adoption of an industry-wide national standard for rating ball bearings pioneered by the American Bearing Manufacturers Association (formerly Anti-Friction Bearing Manufacturers Association, Inc.), 1200 19th Street, N.W., Suite 300, Washington, D.C. 20036-2433.

The following represents a summary of the load rating of ball bearings of less than one inch in diameter, according to ANSI-AFBMA Standard 9-1978: "Load Rating and Fatigue Life for Ball Bearings" – reprinted with the permission of the American National Standards Institute, Inc., 11 West 42nd Street, 13th Floor, New York, N.Y. 10036.