Lecture # 3.3

Surface Roughness

Surface Roughness

Surface roughness or surface finish is of great importance in the parts to be assembled.

The surfaces of various parts are produced by various machining operations such as turning, milling, shaping, planing, grinding and so on.

Each one of them gives a different surface finish and when compared they show a marked variations.

The variation is judged by the degree of smoothness.

The surface produced by superfinishing is the smoothest while that produced by planing is the roughest.

Surface Roughness

In order to express the surface roughness numerically, the following two methods are used:

1. Centre line average method (CLA method)

2. Root mean square method (RMS method)

In both the methods the surface roughness is measured as the average deviation from a nominal surface.

The centre line average method is defmed as the average value of the ordinates between the surfaces and the mean line, measured on both sides of it.

According to Indian Standards, the surface roughness is measured in terms of CLA value and is denoted by Ra.

Surface Roughness

Mathematically, CLA value or Ra (microns).

$$cla = \frac{y_1 + y_2 + y_3 + ... y_n}{n}$$

where y_1, y_2, etc. are the ordinates measured on both sides of the mean line and

n are the number of ordinates.

Surface Roughness

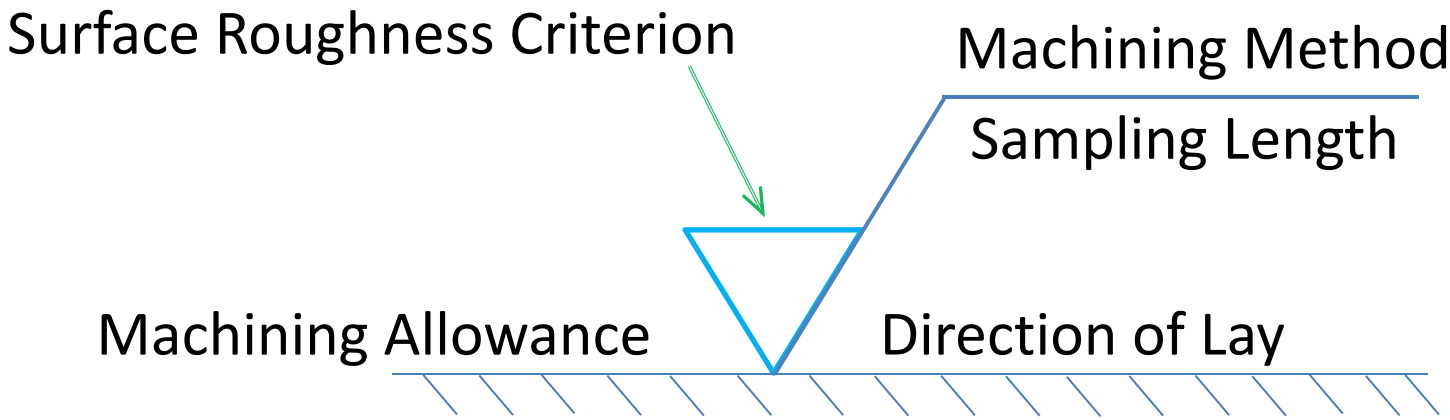
The root mean square method is defined as the square root of the arithmetic mean of the square of the ordinates.

Mathematically, RMS value (in microns)

$$rms = \sqrt{\frac{y_1^2 + y_2^2 + y_3^2 + \ldots\ldots y_n^2}{n}}$$

Surface Roughness

According to Indian Standards the surface roughness is represented as shown in Fig. The



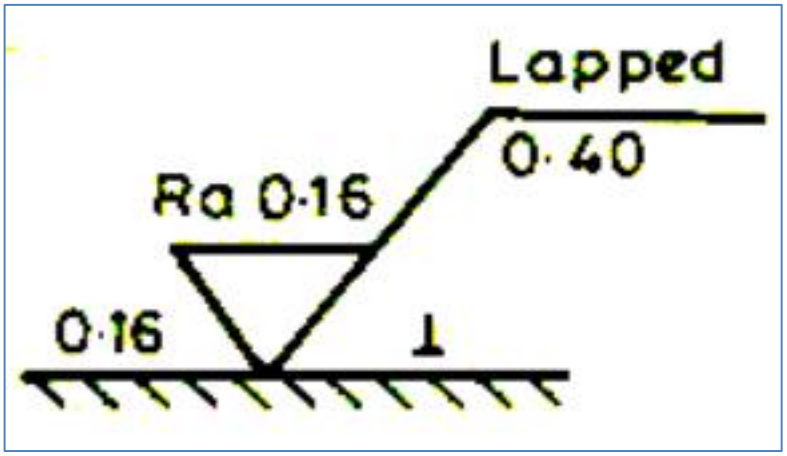
Surface Roughness

The direction of lay is represented by the following symbols:

=	Lay parallel to the line representing the surface to which the symbol is applied.
⊥	Lay perpendicular to the line representing the surface to which the symbolis applied.
x	Lay angular in both directions to line representing the surface to which symbol is applied.
M	Lay multi-directional.
C	Lay approximately circular relative to the centre of the surface to which the symbol is applied.
R	Lay approximately radiail relative to the centre of the surface to which the symbol is applied.

Surface Roughness

As an example, Fig. represents symbolically the surface roughness.



This means, the value of Ra is 0.16

with cut of length 0.40 and

the direction of lay being perpendicular and

the method of machining is lapping.

Surface Roughness

According to Indian Standards the various degree of roughness is represented by the following symbols.

Symbols	*Surface Roughness (Ra) in microns*
▽	8 to 25
▽▽	1.6 to 8
▽▽▽	0.025 to 1.6
▽▽▽▽	less than 0.025

Surface Roughness

Sl. No.	Manufacturing processes	Surface roughness in microns		
1.	Lapping	0.012	to	0.016
2.	Honing	0.025	to	0.40
3.	Cylindrical grinding	0.063	to	5
4.	Surface grinding	0.063	to	5
5.	Broaching	0.04	to	3.2
6.	Reaming	0.32	to	25
7.	Turning	0.32	to	25
8.	Hot rolling	2.5	to	50
9.	Extrusion	0.16	to	5
10.	Boring	0.4	to	6.3
11.	Milling	0.32	to	25
12.	Planing and shaping	1.6	to	25
13.	Drilling	1.6	to	20
14.	Sand casting	5	to	50
15.	Die casting	0.8	to	3.2
16.	Forging	1.6	to	2.5

References

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