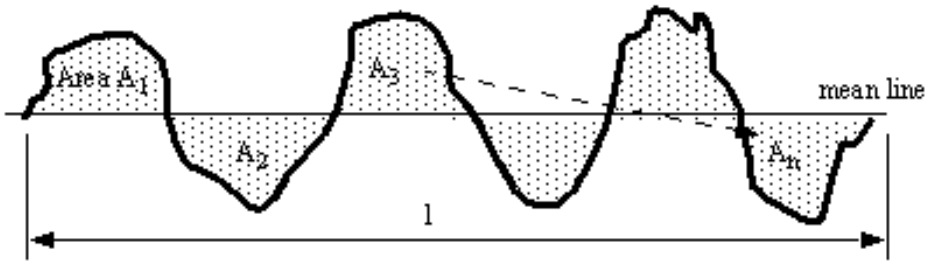
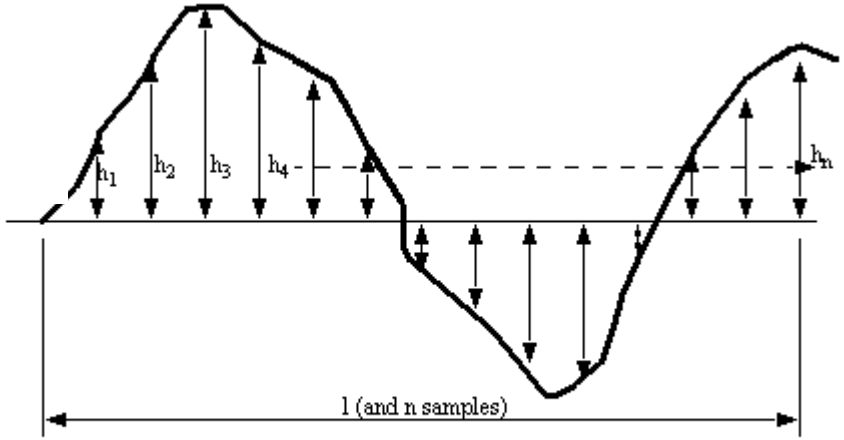
Analysis of Surface Finish

C.L.A. method

The surface roughness is measured as the average deviation from the nominal surface.

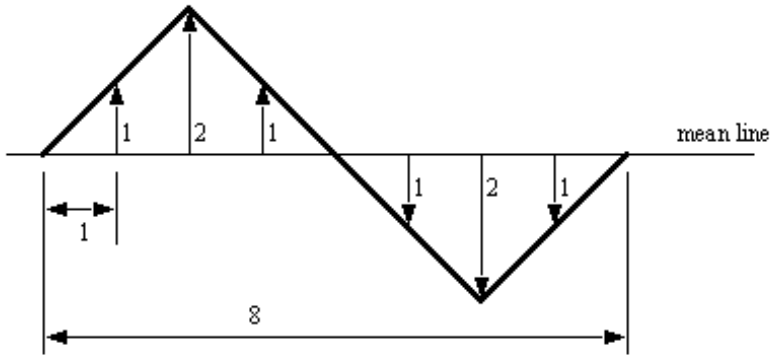


$$CLA = R_a = \frac{\sum A}{l} = \frac{A_1 + A_2 + \ldots + A_n}{l}$$



$$CLA = R_a = \frac{\sum h}{n} = \frac{h_1 + h_2 + \ldots + h_n}{l}$$

Analysis of Surface Finish



We can find the surface roughness using heights,

$$CLA = R_a = \frac{\sum h}{n} = \frac{1+2+1+0+1+2+1+0}{8} = 1$$

We can also find the surface areas using areas,

$$CLA = R_a = \frac{\sum A}{l} = \frac{4+4}{8} = 1$$

Note the results are the same with both methods. These numbers may vary significantly if the height method does not take enough samples for a rougher surface texture.

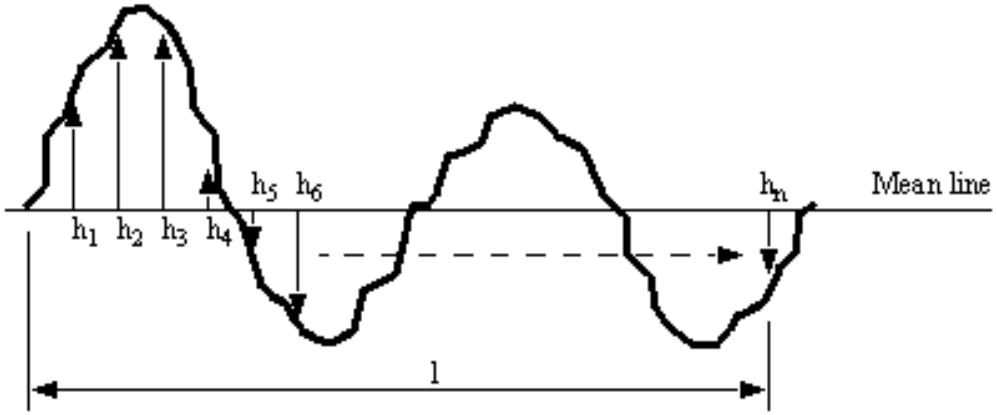
A secondary measure of interest is,

Full Texture Height is 2 - (-2) = 4
Full Texture Height/R_a ratio is 4:1

Analysis of Surface Finish

R.M.S. method

The roughness is measured as the average deviation from the nominal surface. Let, h1,h2, ... are the heights of the ordinates and L is the sampling length



$$RMS = R_q = \sqrt{\frac{h_1^2 + h_2^2 + h_3^2 + \ldots + h_n^2}{n}}$$

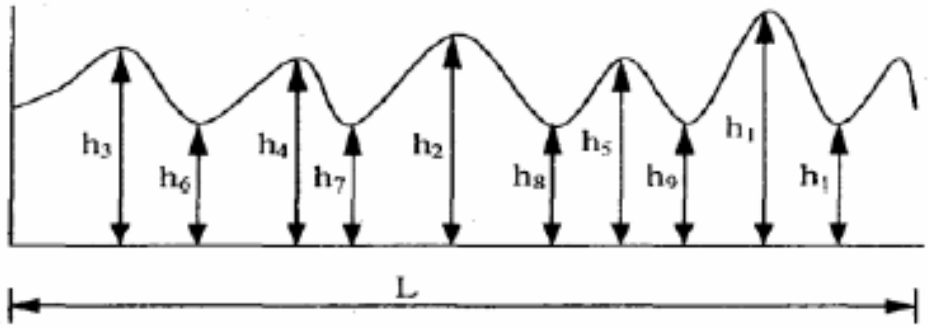
**Note: This value is typically 11% higher than CLA or R_a

Analysis of Surface Finish

Ten point height method

The average difference between five highest peaks and five lowest valleys of surface is taken and irregularities are calculated by

$$S_2 = \frac{1}{5}\left(h_1 + h_2 + h_3 + h_4 + h_5\right) - \left(h_6 + h_7 + h_8 + h_9 + h_{10}\right)$$

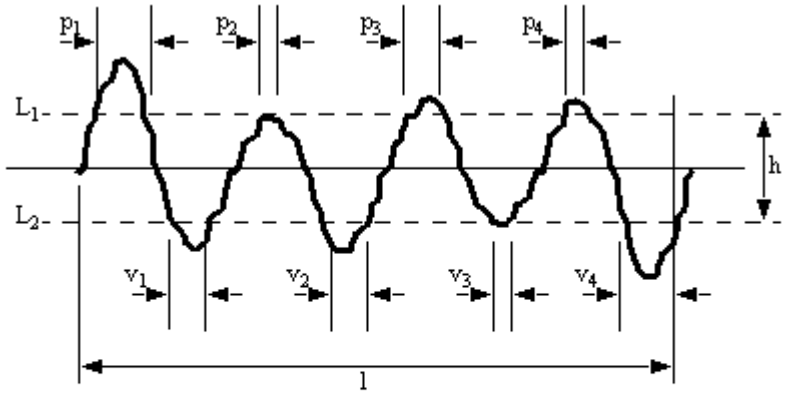


Analysis of Surface Finish

Peak to valley height method

Peak to valley height measures the maximum depth of the surface irregularities over a given sample length and largest value of the depth is accepted for the measurement.

R = Maximum peak to valley height
V=Valley
P = Peak



The two parallel lines L_1 and L_2 are positioned such that they cut off the peaks and valleys, given the mathematical constraints,

$$\sum P = 0.05l \qquad \sum V = 0.10l$$

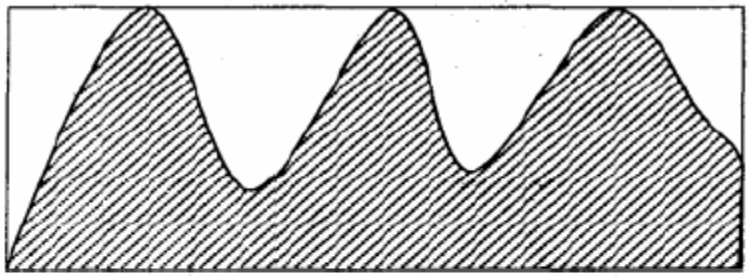
h is the measure of peak to valley height

The disadvantages of R, and is only a single peak or valley which gives the value is not a true picture of the actual profile of the surface

Analysis of Surface Finish

Form factor

It is obtained by measuring the area of material above the arbitrarily chosen base line in the section and the area of the enveloping rectangle.



$$\text{Degree of fullness } (F) = \frac{\textit{Metal Area}}{\textit{Enveloping rectangle Area}}$$

$$\boxed{\text{Degree of emptiness, } (E_1) = 1 - F}$$

Methods of Measuring Surface Finish

The methods used for measuring the surface finish is classified into

1. Inspection by comparison

2. Direct Instrument Measurements

1. Inspection by comparison methods:

In these methods the surface texture is assessed by observation of the surface. The surface to be tested is compared with known value of roughness specimen and finished by similar machining process.

Methods of Measuring Surface Finish

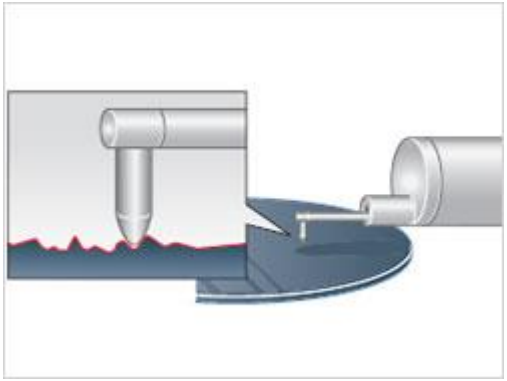
The various methods which are used for comparison are

1. Touch Inspection.
2. Visual Inspection.
3. Microscopic Inspection.
4. Scratch Inspection.
5. Micro Interferometer.
6. Surface photographs.
7. Reflected Light Intensity.
8. Wallace surface Dynamometer.

Methods of Measuring Surface Finish

Touch Inspection:

It is used when surface roughness is very high and in this method the fingertip is moved along the surface at a speed of 25mm/second and the irregularities as up to 0.0125mm can be detected.



Visual Inspection:

In this method the surface is inspected by naked eye and this measurement is limited to rough surfaces.

Microscopic Inspection:

In this method finished surface is placed under the microscopic and compared with the surface under inspection. The light beam also used to check the finished surface by projecting the light about 60° to the work.