Lecture # 3.4

Preferred Number Series

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A designed product needs standardization.

It means that some of its important specified parameter should be common in nature.

For example, the sizes of the ingots available in the market have standard sizes.

A manufacturer does not produce ingots of sizes of his wish, he follows a definite pattern and

for that matter designer can choose the dimensions from those standard available sizes.

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Motor speed, engine power of a tractor, machine tool speed and feed, all follow a definite pattern or series.

This also helps in interchangeability of products.

It has been observed that if the sizes are put in the form of geometric progression, then

wide ranges are covered with a definite sequence.

These numbers are called preferred numbers having common ratios as,

$$\sqrt[5]{10} \approx 1.58, \sqrt[10]{10} \approx 1.26, \sqrt[20]{10} \approx 1.12, \text{and } \sqrt[40]{10} \approx 1.06,$$

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Depending on the common ratio,

four basic series are formed; these are R5 , R10, R20 and R40 .

These are named as Renard (French balloonist and engineer Charles Renard) series.

Many other derived series are formed by multiplying or dividing the basic series by 10, 100 etc.

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Typical values of the common ratio for four basic Geometric Progression series are given below.

$$R5: \quad \sqrt[5]{10} \quad 1.58: 1.0, 1.6, 2.5, 4.0, ...$$

$$R10: \quad \sqrt[10]{10} \quad 1.26: 1.0, 1.25, 1.6, 2.0, ...$$

$$R20: \quad \sqrt[20]{10} \quad 1.12: 1.0, 1.12, 1.25, 1.4, ...$$

$$R40: \quad \sqrt[40]{10} \quad 1.06: 1.0, 1.06, 1.12, 1.18, ...$$

Few examples

R10 , R20 and R40 : Thickness of sheet metals, wire diameter

R5 , R10 , R20 : Speed, layout in a machine tool

(R10 : 1000,1250,1600, 2000)

R20 or R40 : Machine tool feed

R5 : Capacities of hydraulic cylinder

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Basic series

R5, R10, R20, R40 and R80 are called basic series.

Any series that is formed on the basis of these five basic series is called derived series.

Derived series

There are two methods of forming derived series, namely,

reducing the numbers of a particular basic series

or

increasing the numbers.

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In the first method, a derived series is obtained by taking every second, third, fourth or pth term of a given basic series.

Such a derived series is designated by the symbol of the basic series followed by the number 2, 3, 4 or p and separated by '/' sign.

If the series is limited, the designation also includes the limits inside the bracket.

If the series is unlimited, at least one of the numbers of that series is mentioned inside the bracket.

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Let us consider the meaning of these designations.

(i) Series R 10/3 (1, … ,1000) indicates a derived series comprising of every third term of the R10 series and having the lower limit as 1 and higher limit as 1000.

(ii) Series R 20/4 (…, 8, …) indicates a derived series comprising of every fourth term of the R20 series, unlimited in both sides and having the number 8 inside the series.

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(iii) Series R 20/3 (200, …) indicates a derived series comprising of every third term of the R20 series and having the lower limit as 200 and without any higher limit.

(iv) Series R 20/3 (…200) indicates a derived series comprising of every third term of the R20 series and having the higher limit as 200 and without any lower limit.

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In the second method, the derived series is obtained by increasing the numbers of a particular basic series.

Let us consider an example of a derived series of numbers ranging from 1 to 1000 based on the R5 series.

the numbers belonging to the R5 series from 1 to 10 are as follows: 1, 1.6, 2.5, 4, 6.3, 10

The next numbers are obtained by multiplying the above numbers by 10 are as follows: 16, 25, 40, 63, 100

The same procedure is repeated and the next numbers are obtained by multiplying the above numbers by 10 are 160, 250, 400, 630, 1000

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Therefore, the complete derived series on the basis of R5 series is as follows: 1, 1.6, 2.5, 4, 6.3, 10, 16, 25, 40, 63, 100, 160, 150, 400, 630, 1000

The advantage of derived series is that one can obtain geometric series for any range of numbers, that is, with any value of the first and the last numbers.

Also, one can have any intermediate numbers between these two limits.

References

ABDULLA SHARIF, Design of Machine Elements, Dhanpat Rai Publications (P) Ltd, New Delhi, 1995.

V. B. Bhandari, Design of Machine Elements, Third Ed., The McGraw-Hills Companies, New Delhi

R. S. KHURMI and J.K.GUPTA, A Text Book of Machine Design, S.Chand and company ltd., New Delhi, 2000.

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