Determination of Doctor Angle

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Abstract

For proper doctoring, measurement of doctor angle and its correction is very important. The objective of this work is to develop a simple, lightweight, handy and accurate doctor blade angle measurement system which can be used for a wide range of roll diameters .

INTRODUCTION

For the health of any roll surface, doctoring plays an extremely important role. Many a times, frequent joints are observed, in particular on MG machines due to improper doctoring. Inadequate doctoring allows fines to get deposited on roll surface and this leads to reduced drying and picking. Today, information is available on what should be the correct doctoring angle for a particular application, but low cost angle measurement tools are not very easily available. As a result, most of the small paper mills use hit and trial method for doctor adjustments.

Some of the doctor blade suppliers supply templates ready cut for different angles, say 30, 35 degree for example, but that too can be used only for a particular roll diameter. A template supplied for MG cylinder cannot be used for dryers, or press rolls. That is why, a doctor angle measurement system was designed which is very light, handy and virtually zero priced.

Doctor Angle Measurement

Angle can be expressed in two ways: one is with reference to radial line (BSI) and another is with reference to tangential line (ASTM). The tangential line and radial line are perpendicular to each other, and hence angle with any one can be subtracted from 90 degrees to get in other way. The concept used in development of doctor angle measurement employs generation of a line representing the radial line approximately and then measure the doctor angle directly. If the line generated is having some minute error than the radial line, compensation for the generated error can be made. In this way, our first target is to develop the radial line. If we place a rectangle on a circle in such a way that the two corners of one side of rectangle lie on the circumference of circle, the two other lines in those corners of rectangle would be parallel to each other (being the property of rectangle). Also, these lines will be having some angle from the radial line. The bigger the roll diameter would be, the lesser angle would be there from radial line. This is illustrated in Fig. 1.

As indicated, a rectangle ABCD is put on the circle (XAB) is such a way that the side points A and B touch the circle. At point B, a radial line XY has been shown, which passes through the centre and corner to rectangle, B. It can be shown that the angle-

$$\angle \text{CBY} = \text{Sin}^{-1}\left(\frac{\text{AB}}{\text{XB}}\right)$$

Here, XB is the diameter of the roll, and AB is one side of the templette. Both of these values are known to us. In fact, $\angle$ CBY can be considered as known error between actual radial line, XY, and hypothetical radial line, BC. For practical cases, the side AB can be trimmed in an arc shape or in a notch shape, so that points A and B remain intact, but the templette thus prepared can be put on the roll surface. The final shape of the templette, having notch trimming, would be as shown in Fig. 2.

Now, coming to Fig. 1, suppose, the doctor blade PB touches the roll at point B. Here, the actual doctor angle with reference to radial line (BSI) would be $\angle$ PBY, which can be given as-

Angle $\angle$ PBY = $\angle$ PBC - $\angle$ CBY

Now, we may put another rectangle BPP'B' on

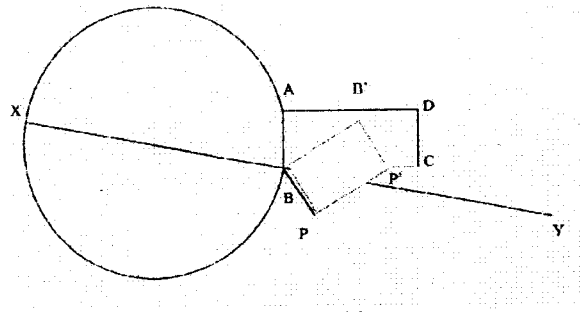

Fig. 1 Radial Line

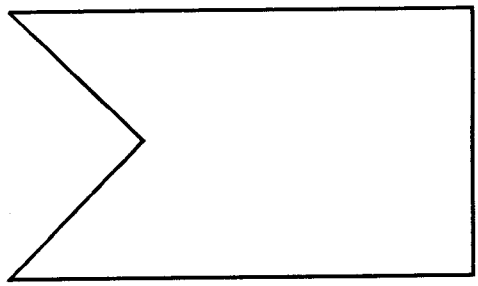

Fig. 2 Modified Rectangle

the doctor in such a way that one side of this second rectangle touches the doctor blade and a corner touches the first rectangle at point B. In this way, the overlap angle would be ∠ B'BC which can be easily measured.

Now, the doctor angle from the radial line can be calculated as

$$\angle PBY = \angle PBC - \angle CBY$$
$$= (90-\angle B'BC) - \sin^{-1}(AB/XB)$$

Here, side AB of the rectangle used as well as roll diameter (XB) is known. As obvious, the bigger the roll diameter, the value will be smaller. Let us have a look on the angle value for different rolls, for a given templette having side AB = 75 mm.

Press Roll (Dia. 750 mm) - ∠CBY = 5.7

Pope Drum (Dia. 1500 mm) - ∠CBY = 2.9

MG Cylinder (Dia. 4250 mm) - ∠CBY = 1.0

In this way, having known the overlap angle of the two templets, dimension AB of the first templette and roll diameter, doctor angle can be measured very easily.

CONCLUSION

For trial purpose, templettes were made using old visiting cards, and doctor blade angle was checked for MG cyclinder, pope drum etc. It was noticed that doctor angle could be measured very easily with an accuracy of 0.5 degree. By this method, a single set of two templettes can be used effectively for roll diameters ranging from a few centimeters to infinite roll diameters, from press rolls to MG cylinders.