VIEWPOINT

Dear Editor:

In Mr. Yefim Kotlyar's article "Reverse Engineering" in the July/August issue, I found an error in the formula used to calculate the ACL = Actual lead from the ASL = Assumed lead.

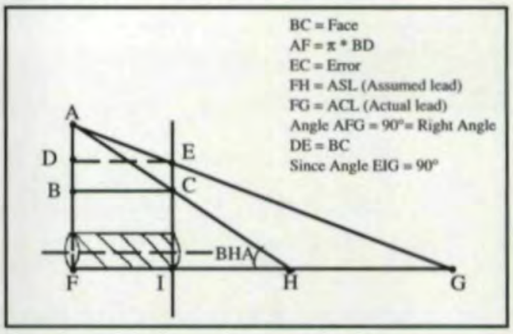
The correct formula should read ACL = ASL*(1 + error/(face*tan(BHA) - error)), instead of ACL = ASL +*(1+ error/ face*tan(BHA)).

The formula is derived as follows:

1) FG = AF*DE/AD = AF*BC/AD

2) AD - AB - BD = AB - EC, since DE/ /BC array AB = BC*tanBHA substituting in the identity (2) gives AD = BC*tan BHA - EC = Face*tanBHA - error.

Therefore, from (1) we derive:



3) FC = AF*BC/(BC*tanBHA - EC) = π*BD*/(Face*tanBHA - error)

4) AF = FH*tanBHA or π*BD = ASL*tanBHA.

Substituting in (3) π*BD we get

FG=ASL*tanBHA*Face/ (Face*tanBHA - error) = ASL*Face*tanBHA/ (Face*tanBHA - error)

This equation can be arranged in the forms:

FG = (ASL*Face*tanBHA - error + error)/(Face*tanBHA - error)

which gives the wanted equation.

5) ACL = ASL*(1 + error/ (Face* tanBHA - error)).

I am sure that Mr. Kotlyar has his formula right, and the error is the result of a typo, therefore, he will pardon my intrusion.

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Mr. Kotlyar replies:

Dr. Basili is right: The correct formula for determining an actual lead should be

$$ACL = ASL*(1 + Error/Face*Tan(BHA) - Error)).$$

The formula used in the article, $ACL = ASL*(1 + Error(Face*Tan(BHA)))$, is an approximation formula which has some degree of inaccuracy. For example, let's assume a gear of 25° helix angle, 1" face width, and with an error detected during lead check of 0.01".

Results calculated by the correct formula are

$$ACL = ASL*(+.01/(1*\tan(25) - .01)) = ASL*1.02191.$$

Results calculated by the approximation formula are:

$$ACL = ASL*(1 + .01/(1*\tan(25))) = ASL*1.02144.$$

As you can see, the inaccuracy for the lead correction multiplier appears only in the fourth digit after the decimal point. If the lead error detected on the inspection machine is .001", then the inaccuracy would be even smaller, appearing only in the sixth digit after the decimal point.

Nevertheless, it is conceivable that the use of Dr. Basili's more precise formula would result in a fewer number of iterations for determining actual lead.

Dear Editor:

May I reinforce what my namesake Robert E. Smith said in your September/October issue about the use of single flank testing?

Single flank testing is essential for worm and bevel gears if noise or vibration is a problem, and also for parallel axis gears if noise is a problem in a critical installation or if accuracy matters, as for printing problems.

In Britain some companies already use 100% checking of S.F. and find that it pays because the rogue gears can be intercepted before they are built into equipment. Statistical checking is not normally used, partly because the objective is to weed out the 5% of poor gears instead of having to tighten tolerances expensively, and partly because S.F. testing is now so fast, it is relatively cheap.

Cycle times for testing can easily be faster than 2/minute, and if many gears are being tested, a special purpose tester can be set up at 20% of the cost of a test which does "everything".

An additional advantage of S.F. testing is that, unlike double flank testing, it can be done at full load quite cheaply, either on a development rig or on a production test rig, and this gives additional information about the effects of torque on load sharing between teeth and on the effects of alignment between teeth on noise levels.

Some British firms have already found that they need a "commercial" S.F. tester as a production control and an additional cheap "high speed" set for use in their development test shop. On a long and complicated gear train, such as that on a large printer, it is a great advantage to be able to measure accuracy between shafts 30 meters apart directly at any speed up to full speed.

Although AGMA has not yet established tolerances for S.F. tests, DIN specs have listed them. In practice, however, specifications are little help, but a couple of sets of gears built into equipment rapidly establishes allowable tolerances on a production line.

The great advantage of S.F. testing is that, for noise control, it is so much faster (cheaper) and easier than using separate pitch, involute, and helix check, that it is by far the most economical way of keeping a check on subcontractors. In time it is the economics which will lead to much greater use.

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