

What Is Runout, And Why Should I Worry About It?

Robert E. Smith

Runout is a troublemaker! Good shop practice for the manufacture or inspection of gears requires the control of runout.

Runout is a characteristic of gear quality that results in an effective center distance variation. As long as the runout doesn't cause loss of backlash, it won't hurt the function of the gear, which is to transmit smooth motion under load from one shaft to another. However, runout does result in accumulated pitch variation, and this causes non-uniform motion, which does affect the function of the gears. Runout is a radial phenomenon, while accumulated pitch variation is a tangential characteristic that causes transmission error. Gears function tangentially. It is also possible to have a gear with accumulated pitch

variation, but little or no runout.

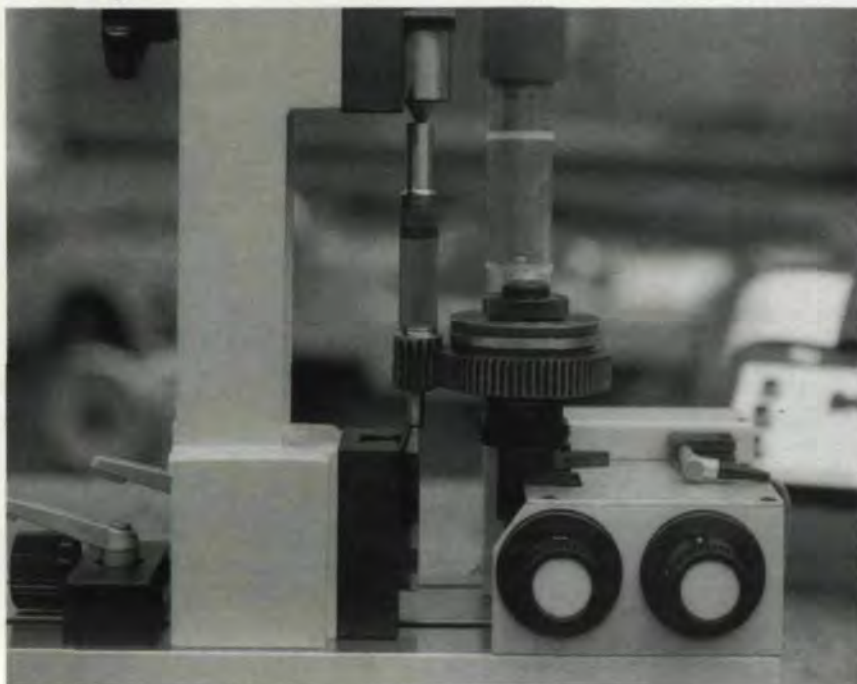
In fact, runout affects every other characteristic of gear quality, such as involute or tooth form, index or pitch variation, lead or tooth alignment variation, and noise and vibration. It is quite common for one to have problems trying to meet specifications for index or pitch variation when the cause is actually runout. The various measures of gear quality are not independent parameters. They are all influenced by runout.

Much time can be wasted trying to fix the wrong source of the problem in a machine tool. For example, if a perfect gear were to be produced on a machine, but put into an inspection machine with runout in the arbor or centers, it would have apparent involute and index er-



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"Shop Floor" is *your* column. When you have questions you can't answer or need information you can't seem to find, let our panel of experts help. Your questions will be directed to gear consultants Robert E. Smith, Bill Janninck, and Don McVittie, who bring to our pages over 120 years of combined experience in gearing. Address your questions to them, care of Shop Floor, *Gear Technology*, P.O. Box 1426, Elk Grove Village, IL 60009, or call our editorial staff at (708) 437-6604.



Courtesy of Hommel America.

Robert E. Smith

is the principal in R. E. Smith & Co., Inc., gear consultants. He has over 40 years' experience in the gear industry, working in gear methods, manufacture, and research applications. His specialties include manufacture, metrology, noise control, and transmission error testing. He is presently Chairman of the AGMA Handbook Measuring Methods and Practices Subcommittee and the Calibration Committee. If you have other questions for Mr. Smith, circle Reader Service No. 45.

NEWS ABOUT... HURTH

In an effort to consolidate ownership and diversify global manufacturing activities, Carl Hurth GmbH and Co. (Munich) was recently acquired by Fritz C. A. Hurth, the founder's grandson. The younger Mr. Hurth founded and also operates Hurth Axle S.p.A. in Italy.

The Hurth organization is manufacturing and marketing a broad range of products and equipment for the Gear, Automotive, Aerospace and Off-Highway industries throughout the world. Included are gears and gearboxes; precision finishing machinery for gears in the green or hard stages; deburring and tooth pointing equipment; together with tooling and accessories.

Klingelberg Gear Technology, Inc., the exclusive representation for HURTH in North America, indicated that the consolidation of ownership of Carl Hurth GmbH within the Hurth family will serve to strengthen both organizations. The Hurth line of products is known worldwide for state-of-the-art design of high quality equipment and power transmission components. That tradition will continue under the strong leadership of Fritz C. A. Hurth.

For more information on Hurth products and services, contact: Ernst Loffelmann, Klingelberg Gear Technology, Inc. 15200 Foltz Industrial Parkway, Strongsville, OH 44136. Phone (216) 572-2100 FAX (216) 572-0935

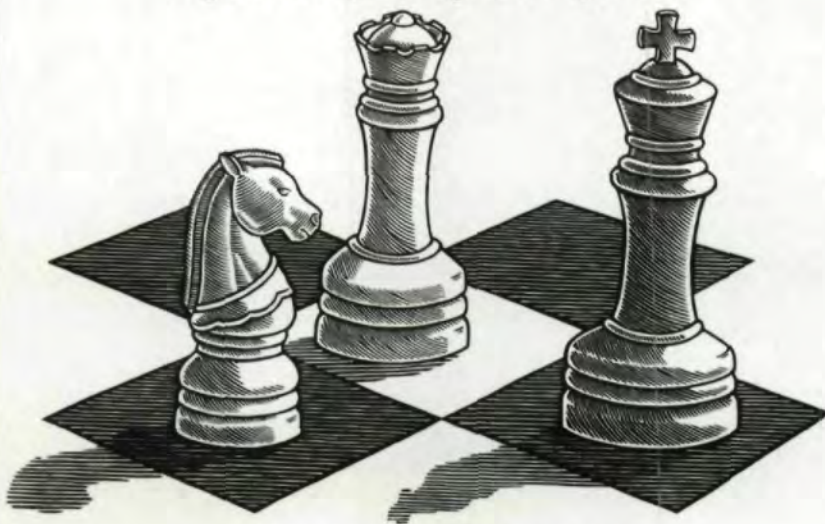


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rors, as well as possible tooth alignment variation.

It is extremely important throughout the manufacturing and measurement process to be careful that the center axis of the pitch cylinder of the teeth is coincident with the center of rotation of the machine or journals. Many inspection machines and some finishing machines use centers for locating the gear. Unfortunately, the gears are never used from centers in the application. They either mount from a bore or from journals and shoulders. Most people believe that because the journals and teeth were finished from centers, that they all run true. "Murphy" says that even though the journals were ground from centers, they will never run true again. Just check them and see!

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Care should be taken with the choice of arbor types used. If a solid, cylindrical arbor goes into a bore, there has to be clearance; therefore, the gear can drop off center, causing runout — maybe only a few ten thousandths of an inch, but this is a lot when trying to meet involute tolerances. If a slow taper arbor is used in a cylindrical bore, the gear will tip, causing wobble and tooth alignment variation. The only way to use these types of arbors with confidence is to use pre-qualified axial and radial proof spots or bands that are true with the actual journals. These can be indicated and trued before finishing or measuring.

Some of the recommended arbor types that will take up the clearance in the bore or journals are hydraulic expanding, expanding collet, precision 3-jaw mandrels, and ball sleeve interference fit.

When it comes to the manufacture and measurement of AGMA class Q11 and higher gears, the results depend more upon the practices and care discussed above than on the condition of the finishing machine.

BE AWARE!!