Form Talysurf® PGI **NOVUS** and **Metrology 4.0** software

Rapid roller bearing measurements

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Roller bearings

There are a wide variety of roller bearings available which serve a diverse range of applications. Tapered, cylindrical and needle roller bearings are just a few of the types available. Roller bearing elements require good surface finish and form and precise dimensions to provide low noise and high load capacity in the roller bearing assembly.

In this Application Note we consider the challenges faced in measuring roller bearings. We show how using Form Talysurf® PGI NOVUS and Metrology 4.0 software provides a unique, rapid and precise solution for measurement of all four sides of the roller bearing, removing reliance on external fixture datums.

Figure 1 - Roller bearing assembly.

Challenges

1. Fast inspection time for higher throughput of parts

A fast measurement cycle time is crucial for roller bearing manufacturers. For example, a high throughput of up to 200 parts might be required to be measured each day. In some cases, such as in aerospace applications, 100% inspection is necessary.

A suitable measurement platform should have the capability for a fully automatic measurement procedure that minimises the need for operator interaction and complicated fixturing.

2. X-offset of crown from end faces, drops from crown and comparison to the design (DXF)

The position of the crown from the end faces is crucial to the performance of the bearing. For this to be determined the position of the end faces needs to be known. Conventional techniques require references - such as balls or cylinders of known diameter - to be located at either end of the roller bearing. These are used to identify the end faces so that the X-offset of the crown can be determined.

This approach adds complexity to set up and adds time to the measurement procedure. Time is also taken in ensuring that the external references and roller bearing are well-aligned.

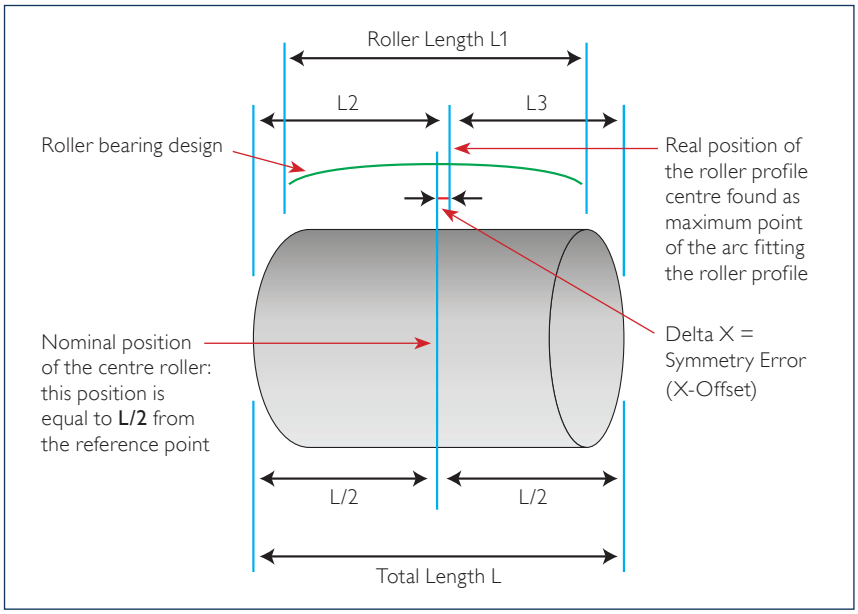


Figure 2 - Showing how X-offset is calculated.

3. Correct alignment to bearing axis

Inspection of roller bearings for dimensions, crown position and localised drops are conventionally performed using a profilometer. With this method, a large error can be introduced into the measurement by misalignment of the part. Roller bearings can be difficult to position accurately in fixtures that are not well-matched to the roller design. This can lead to misalignment which causes 'cross-tracking' during the measurement. This 'cross-tracking' could introduce a roller radius error and the contour drops would also change dramatically. Using this method, false parallelism errors may occur, causing the operator to change the tool alignment based on results that are compromised.

A suitable system should provide automatic alignment to remove any operator uncertainty in setup. Poor alignment is the main source of measurement errors.

Solutions provided by Form Talysurf® PGI NOVUS and Metrology 4.0

1. Fast inspection time for higher throughput of parts

Using the PGI NOVUS dual bias gauge with the roller bearing sitting at an angle of 45°, all four faces of the roller bearing can be referenced in one routine without the need for external reference balls being used to predict where the end faces are located. This innovative approach drastically reduces setup time for the measurement process and improves measurement accuracy.

An added reduction in measurement time comes from the intelligent PCS coordinate system. First, a reference measurement is completed on top of the bearing. Using the design of the bearing, precise datum points are plotted that relative to the design of the component (see figure C). Smart move is then utilised to move the stylus tip quickly and accurately around the component. This unique way of stylus positioning significantly simplifies the measurement procedure (Please see Application Note A157 for further information).

Figure 3 - Roller bearing angled at 45° allowing all 4 sides of the component to be measured in one setup and without external reference fixtures.

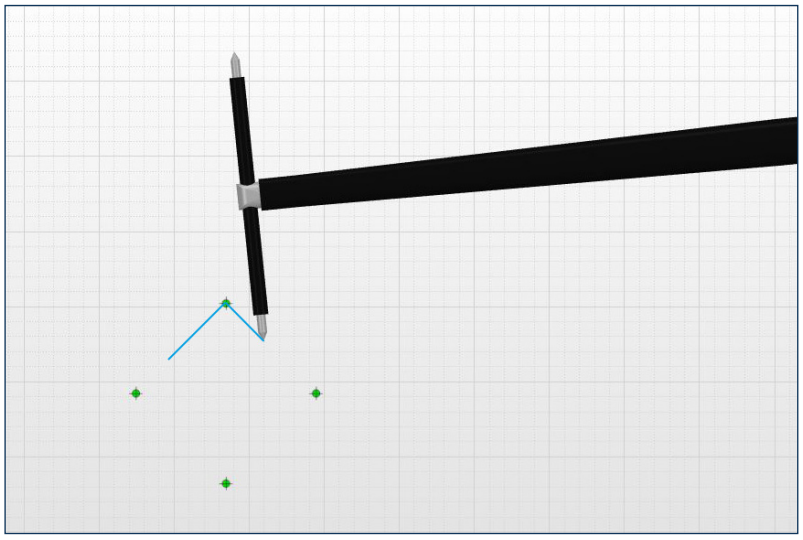


Figure 4 - Datum points are created from the reference measurement that match the design of the bearing.

- Quick
- Automatic
- Measure all 4 sides
- No reference fixture
- Safe, easy measurements

2. X-offset of crown from end faces, drops from crown and DXF fitting

The X-offset of the crown is directly obtained from the measurements of the end faces. The dual bias gauge allows all four sides to be measured which allows the X-offset to be obtained.

Taylor Hobson's dual profile analysis software allows the measured profile to be automatically fitted to the design profile. After fitting, the form error and drops are calculated and displayed automatically.

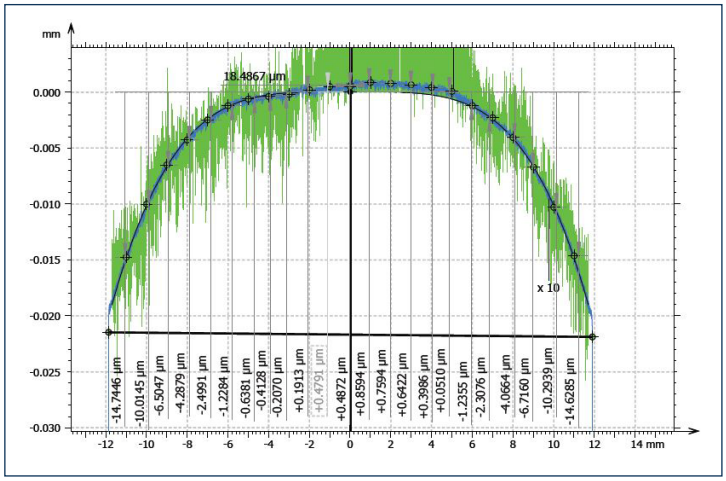


Figure 5 - Crown drops and X-offset analysis in contour software.

3. Correct alignment to bearing axis

Inspection of roller bearings for dimensions, crown position and localised drops are conventionally performed using a profilometer. This method can introduce a large error into the measurement if the roller bearing is misaligned.

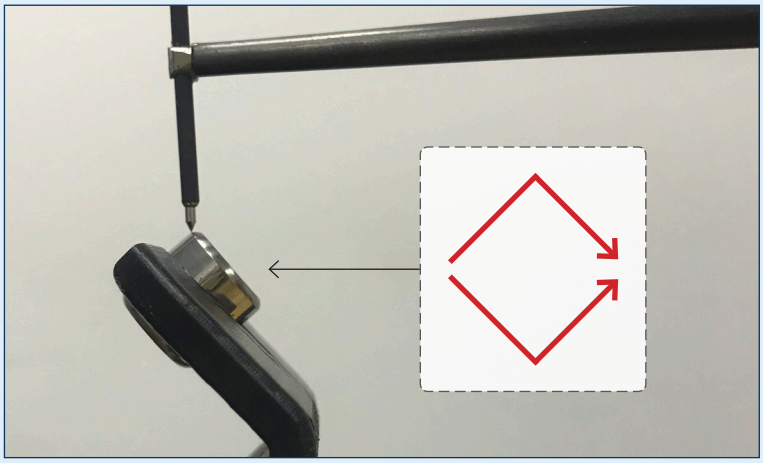
The required instrument should have the ability to automatically align the sample so the true profile can be captured. Ideally the method would remove all operator influence from the process to ensure an accurate and repeatable measurement.

The Form Talysurf® PGI NOVUS with automatic rotary and linear stages aligns the bearing to the measurement axis. The subsequent measurement is then automatically analysed with Metrology 4.0 analysis and contour software. The contour drops, X-offset, surface finish and diameter can be analysed accurately.

- Automatic
- Consistent results
- Accurate X-offset, drops, dimensions…

"All four faces of the roller bearing can be referenced in one routine without the need for external reference balls."

Tomoharu Kumagai
Applications Engineer - Japan



Results

Metrology 4.0 analysis and contour software can accurately analyse the complete roller bearing. Analysis of crown X-offset, roller drops, form residual from DXF, surface finish, diameter and much more can be displayed automatically inside of a measurement program. The layout of the analysis is completely user-specific.

Summary

Form Talysurf® PGI NOVUS and Metrology 4.0 software provide the ultimate solution for roller bearing measurement. The unique way of orientating the bearing, to allow measurements on all four sides, gives an accurate and quick solution for bearing manufactures. This method greatly improves throughput of parts, helping to keep up with the high demand for high volume production.

The NOVUS dual bias gauge gives accurate analysis of crucial parameters and dimensions all of which are key to the performance of the bearing. Automatic alignment eliminates operator error, providing confidence in the measurement setup and accuracy of results.

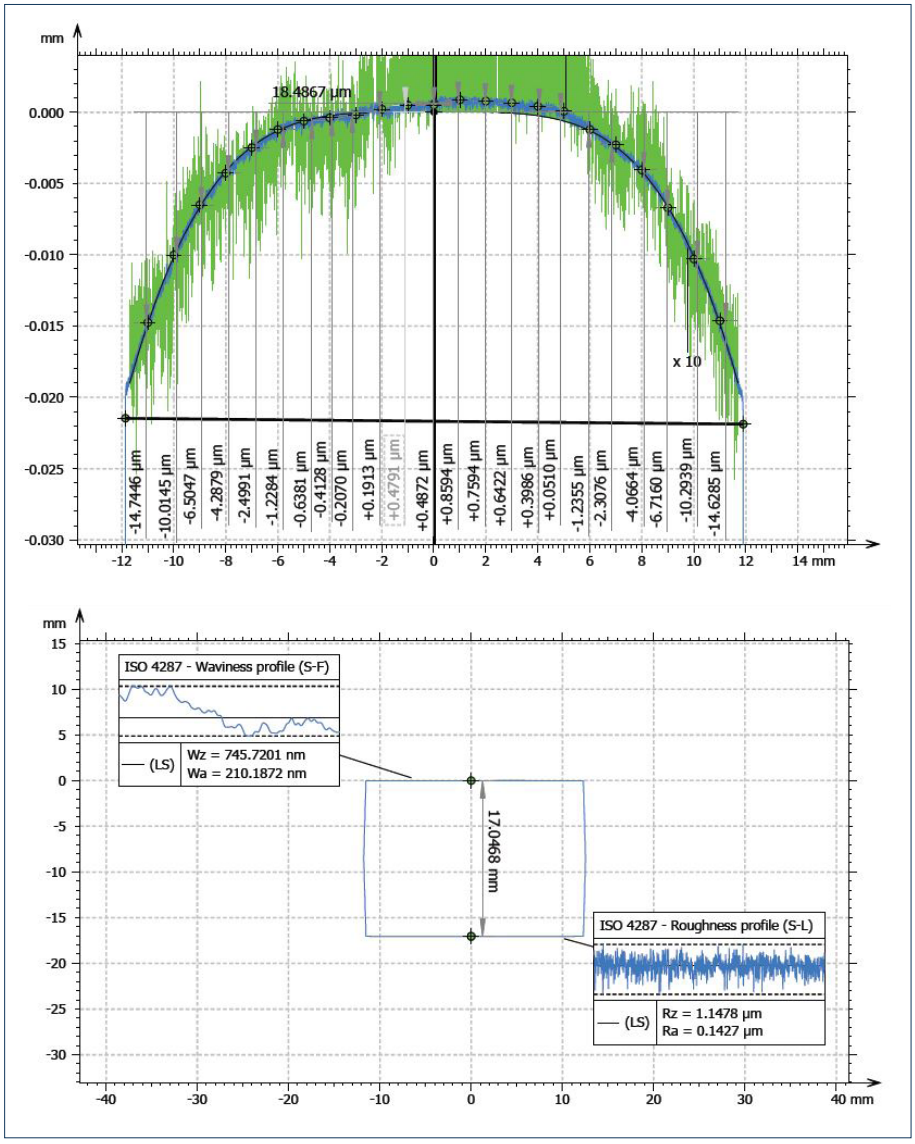


Figure 6 - Typical results of a roller bearing including:
Crown X-offset, roller drops, DXF form fit, surface finish and diameter.

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