Roundness Measurement

The Requirement

The roller bearing seats for gear and engine shafts are subject to high demands in respect of roundness, smoothness and waviness. Chatter marks can lead to increased noise and excessive roughness to wear. Since the creation of chatter marks during the grinding process cannot be forecast, 100% check of the resulting form would be ideal, in order to ensure that no defective parts get through

For this task, a peak-to-trough roundness deviation of 1-2 microns has to be measured in seconds, and periodic waviness on the order of 0.02 – 0.1 microns captured. A roughness measurement in addition provides a complete check of grinding quality.

The Solution

The part to be measured is positioned as required either vertically or horizontally, and rotated, in 2 seconds, using a precision axis (no more than 0.1 microns eccentricity). The optical measurement system, OS 500, captures gradients and calculates roundness and waviness from these. A check of the roughness can also be done using the optical roughness characteristic value, So.

Cam shafts

Roundness and roughness measurement on a gear shaft bushing (Measurement IBTL, Kuppenheim)

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Roundness Measurement

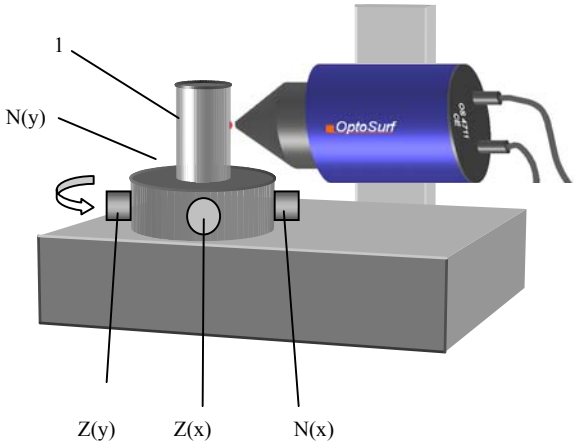
Results

The OS 500 is mounted such that the measurement beam is perpendicular to the surface of the part. To avoid eccentricity errors, the part must be centred and levelled and uniformly rotated.
Appropriate help is available in the software. Equidistant measurement points on the circumference (local gradient angle of the surface) are captured, from which the software calculates a roundness diagram (linear or polar). A Fourier transform then yields the periodic parts (order and amplitude), which are displayed diagramatically or as values. As the measurement method permits the simultaneous capture of the surface roughness, this is also derived seamlessly on the circumference. The characteristic value, So, can be compared with the roughness depth values Ra or Rz when the manufacturing method remains constant, provided correlation with a profilometer has been done previously. The So value reacts to changes in the surface texture and defects, caused, for example, by inadequate trueing or disturbances in the coolant flow.

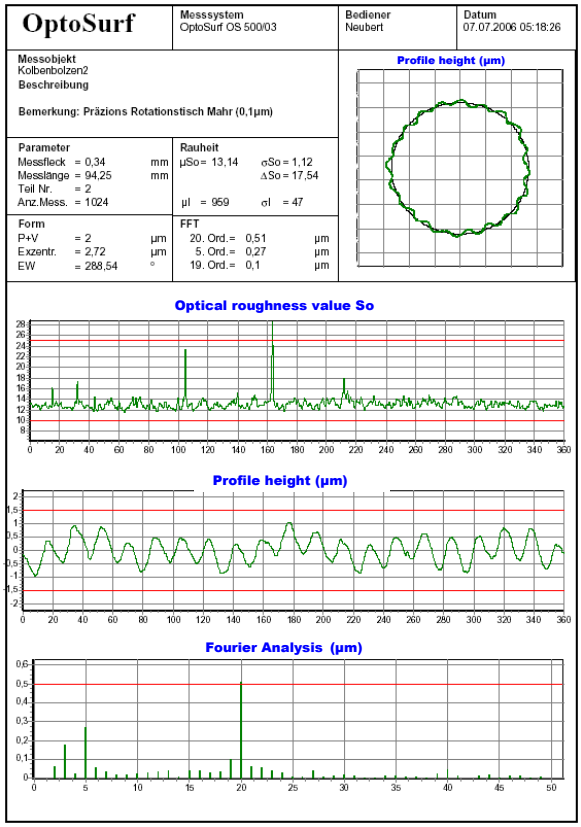
The example on the right shows measurement of a piston bolt with chatter marks of the 20th order. The roundness shows a peak-to-trough deviation of 2 µm. The average roughness value ((µSo) is 13.4µm in which the large maximal deviation (ΔSo) of 17.5 µm is caused by a surface defect.

Points to Note

Surfaces should be cleaned before measurement. Normally, wiping with a cloth or cleaning with compressed air is suffiicient.



OS 500 Sensor with vertical precision rotation axis.
(1) Test object, (Z), (N) Centring and levelling axes



Piston Bolt Measurement Record from OS 500

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