



An Introduction to Surface Texture

- **Product Implications (the function of surfaces)**
 - Load Carrying, Sliding, Sealing, Rolling, Appearance
- **Process Implications (the manufacture of surfaces)**
 - The material removal/modification process
Single-Point Processes, Milling, Grinding, Honing, Lapping, EDM, Plateau Honing
- **The Graphical Representation of a Surface**
 - Aspect Ratio
Profile graphs vs. Microscope Images
- **Measurement Methods (the specification and control of surface)**
 - From Fingernails to microscopes and Hockey Pucks to Laser Beams
 - Stylus-Based Measurement
Skidded and Skidless systems
Advantages/Disadvantages
 - Considerations when buying/using surface texture instrumentation
- **Wavelength Analysis & Filtering**
 - Example: Books on a Table
 - Separating roughness and waviness
 - Moving averages and the Gaussian Filter
 - The Filter “Cutoff”
- **Parameters**
 - Extreme Parameters (peaks and valleys)
R_p, R_v, R_t, R_{pm}, R_{vm}, R_{tm}, R_z
 - Averaging Parameters
R_a, R_q, R_{sk}, R_{ku}
 - Slope/Spacing Parameters
S_m, D_q
 - Bearing Ratio Parameters
Bearing Ratio Curve and analysis
H_{tp}
 - Waviness and Form Parameters



An Introduction to Surface Texture (continued)

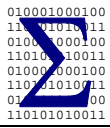
Special Topics in Surface Texture Measurement and Analysis:

Note: these are not covered during the basic class, but can be address offline or through custom training.

- Repeatability/Uncertainty of surface measurements**
- Comparison of various national and international standards**
- Testing/Calibration of surface texture instruments**
- Going beyond roughness and waviness**
 - Wear Analysis, Geometry Measurement, Profile Tolerances, etc.**
- Research trends in surface metrology**
- ISO 13565-1**
 - Valley suppression filtering**
- ISO 13565-2**
 - Rk, Rpk, Rvk, RMr1, RMr2**
- ISO 13565-3**
 - Rpq, Rvq, Rmq**
- Measurement and Specification for Plateau Honing**
- Measurement and Specification for Sealing Surfaces**
 - Bandpass Waviness**
- Advanced Filtering Topics**
 - Types: (ISO, 2CR, 2RC, PC, Gaussian, Spline)**
 - Phases & Transmissions**
- Other topics of interest**

An Introduction to Roundness

- **Product Implications (the functional aspects of roundness)**
 - Fitting, Rotating, Sealing, Rolling, Interfaces
Roundness vs. Cylindricity
Chatter and vibration
- **Process Implications (relating to roundness)**
 - Boring, turning, reaming, grinding, honing, lapping, superfinishing/microfinishing, drilling, etc.
 - Spindle Errors, Vibration, Structural Implications, Chucking of thin-walled components
Chatter & Lobing
- **Measurement Methods for Roundness**
 - Measurement of Multiple Diameters
Ovality vs. Roundness
 - V-Block Methods
Angle vs. Lobing Implications
 - Rotation on Centers
 - Polar (Spindle-based) Instruments
Centering and Leveling
 - Considerations when buying/using roundness instrumentation
Probe Alignment Issues
- **Frequency Analysis and Filtering**
 - Example: Roundness of a U.S. Quarter
Including or excluding the serrations
The tip radius/surface interactions
 - “Harmonic” or “Fourier” analysis.
 - Moving Averages and the Gaussian Filter
 - The filter “Cutoff”
- **The Roundness Value**
 - ASME Y14.5 Definition
 - Reference Circles
LSC, MZC, MIC, MCC
GD&T Standards vs. Metrology Practice
 - Additional Parameters
Eccentricity, Concentricity, Runout
 - Related Parameters
Circular Flatness, Perpendicularity, Tilt, Face Runout
Cylindricity



An Introduction to Roundness (continued)

Special Topics in Roundness Measurement and Analysis:

Note: these are not covered during the basic class, but can be address offline or through custom training.

- Repeatability/Uncertainty of surface measurements**
- Accuracy Improvement through reversal**
- Chatter analysis via “brick-wall” filtering**
- Circumferential Wear Analysis**
- Cam Lobes and Lift Profiles**
- Outlier detection and removal**
- Dealing with discontinuous surfaces or partial arcs.**
- Sector Roundness and conformable interfaces**
- Cones and conicity**
- Tip Radius and Filter Cutoff Selection**
- Advanced Filtering Topics**
 - Types: (ISO, 2CR, 2RC, PC, Gaussian, Spline)**
 - Phases & Transmissions**
- Other topics of interest**