Digital Metrology Solutions

3518 Briar Drive
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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)
    Rp, Rv, Rt, Rpm, Rvm, Rtm, Rz
  - Averaging Parameters
    Ra, Rq, Rsk, Rku
  - Slope/Spacing Parameters
    Sm, Dq
  - Bearing Ratio Parameters
    Bearing Ratio Curve and analysis
    Htp
  - Waviness and Form Parameters

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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

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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

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An Introduction to Roundness (continued)

Special Topics in Roundness Measurement and Analysis:

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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