SURFACE REVERSAL METHOD ALGORITHM DEVELOPMENT

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INTRODUCTION

PROBLEM STATEMENT
Existing surface reversal method used to define the datum definition of surface tool missed to consider any error that exist during the process and the surface of tool. This may result in an inaccurate of the surface topography result.

Figure 1: Schematic diagram of surface reversal method used to measured the surface topography of cylindrical tool.
To simulate the surface reversal method in MATLAB as the first step before continuing with error estimation process.
METHODOLOGY

Surface Data Preparation

- Requirement of simulated surface
- Obtaining surface dataset
- Construction of surface dataset

Surface correlation

- Rotate surface B by 180 degree
- Load image and conduct cross-correlation
- Reduce the extended size after correlation process
- Find maximum match point
PREPARATION OF SURFACE DATASET

1. Obtaining surface dataset
   - Required an anisotropic type of surface
     - with distinguishable and clear orientation
     - Electroplated diamond tool
   - Used Confocal Laser Scanning Microscopy (CLSM)
     - scan point by point
     - Data information assembled into areal topography

2. Construction of surface dataset
   - Construct two surface (A, B)
     - A(original), B(rotate 180 degree) + inclination
   - Used 3D Cartesian Coordinate system
     - Arrange surface data along x-axis and y-axis
     - interval (2\(\mu\)m \(\Delta x\), 2\(\mu\)m \(\Delta y\))
     - Colour indicate height of surface
SURFACE CORRELATION

Rotate surface by 180 degree

Load image and conduct cross-correlation

Reduce the extended size

Find maximum matching point

• Required a grayscale image
• Convert data into image file
• Load into workspace
• Correlate surface data using 'Normxcorr2' function

• Indicate the best match point between two surfaces
• Compulsory for next process
RESULT & DISCUSSION
1. Data measured using CLSM consisted 997 and 808 data on x-axis and y-axis.

2. Both surfaces are constructed as below:

- Original surface data
- Reduced into x(300) and y(200)

- Surface data is rotate by 180 degree
- Add an inclination of <1 degree
- Reduced into x(300) and y(200)
PRE-PROCESSING AND SURFACE CORRELATION

PRE-PROCESSING

Surface A + Surface B'

SURFACE CORRELATION

- Rotate B by 180 degree
- Convert surface data into image type file, (PNG. file)

- Normxcorr2 correlate both surface by normalizing the data
- Maximum point obtained at position, x,y (540,409)
• Normxcorr2 enlarge the data size.
• Filter method applied had reduce the data size to original.
• Reduce the unnecessary data and error.
CONCLUSION

1. Successfully developed the simulated surface pair.
2. Successfully normalized two surfaces.
3. Successfully reduce the enlarge data size.
4. Successfully developed algorithm for surface correlation to get the best match position.
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