差分測定を利用した形状復元アルゴリズムの研究

Study on Algorithm of Reconstructing Topography Based on Topography Difference

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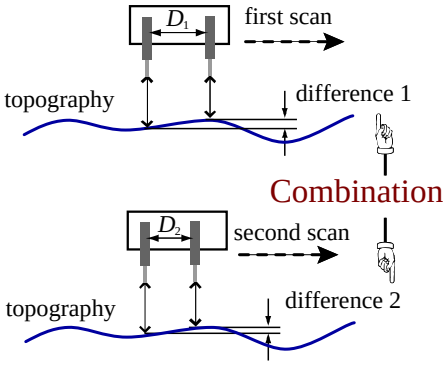
Objectives

- 差分測定を利用した形状復元アルゴリズムとして2種類の手法を研究している.
  - 空間周波数法 (SFR)
  - 連立方程式法 (EQU)
- 測定手法:2個のプローブを利用してプローブ間隔D_1とD_2 で2度のスキャン測定を行う. 得られた2組の差分測定から形状を復元する.

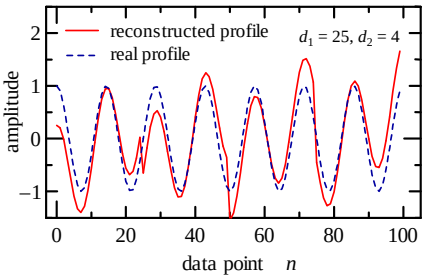


Spatial frequency domain method

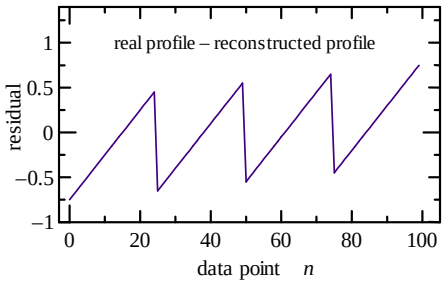
- A new condition of parameters is derived ($L \times s = P \times D_1 \times D_2$)

scan length L	sampling interval s	coefficient P	probe interval 1 D_1	probe interval 2 D_2
200 mm	0.5 mm	10	4 mm	2.5 mm

- Calibration of systematic errors is achieved in the presence of random errors



Simulation result without calibration of systematic errors

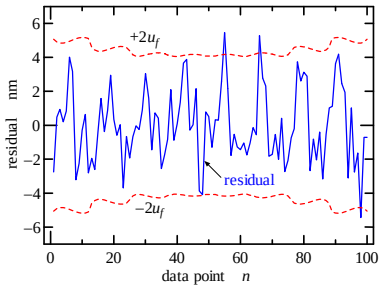


Residual which gives agreement to theoretical calculation

Matrix equations method

- Uncertainty is calculated and confirmed by simulations

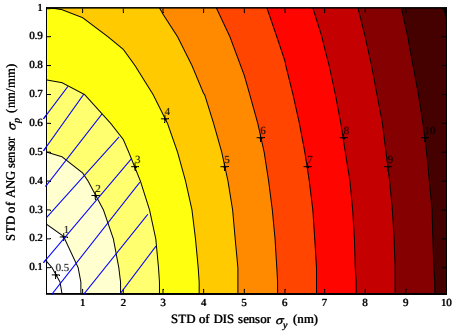
$$\mathbf{Y} = \mathbf{AX} + \boldsymbol{\varepsilon} \qquad \mathbf{S_p} = (\mathbf{A}^{\mathrm{T}}\mathbf{S}^{-1}\mathbf{A})^{-1}$$

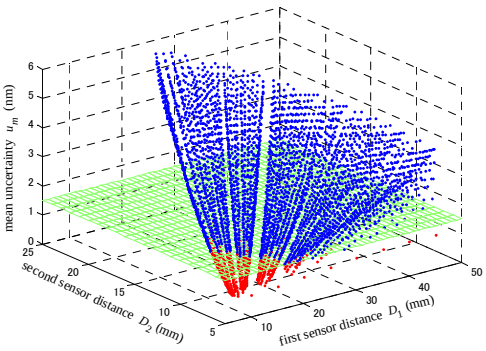


CI: 95%

uncertainty (red) and simulation result (blue)

- Available parameters is selected in two cases
  - Select available distance sensors and angle sensor to ensure a satisfied uncertainty
  - Select available sensor intervals to ensure a satisfied uncertainty





Ref.) X.Chen, K.Kotani, K.Takamasu: Study on algorithm of reconstructing topography based on topography difference, Euspen2007, Bremen, Germany, 2007