Drift-insensitive distributed calibration of probe microscope scanner in nanometer range: Approach description

Rostislav V. Lapshin

Institute of Physical Problems, Zelenograd, Russia
Moscow Institute of Electronic Technology, Zelenograd, Russia

December, 2015

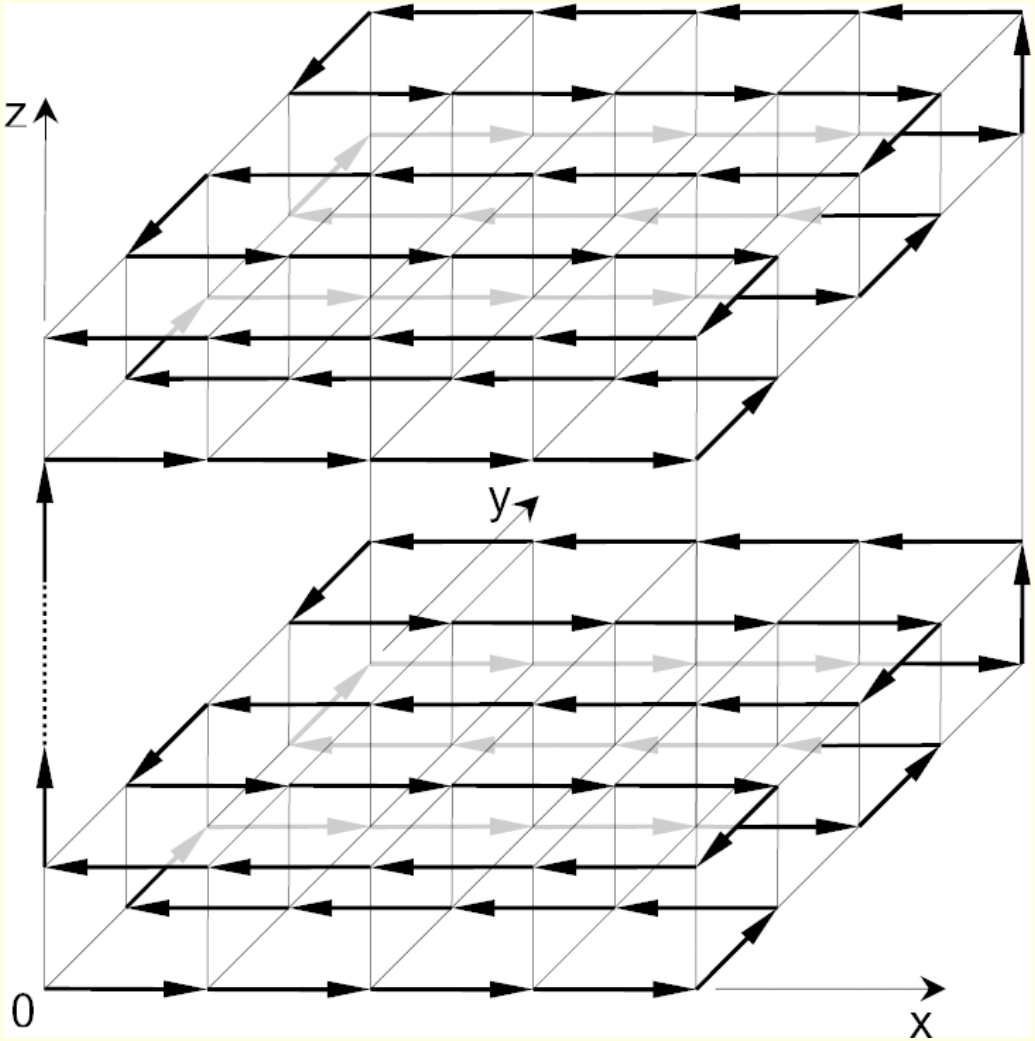
Main concept

The method of distributed calibration of a probe microscope scanner consists in a search for a net of local calibration coefficients in the process of automatic measurement of a standard surface, whereby each point of the movement space of the scanner can be defined by a unique set of scale factors

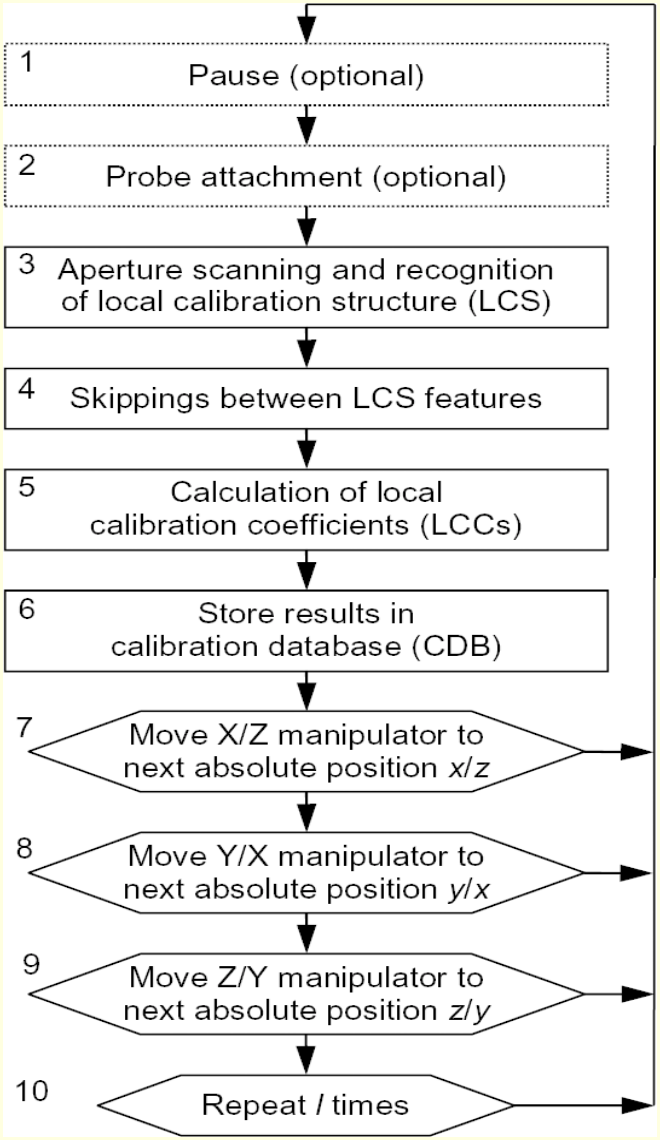
Applied methods

- Feature-oriented scanning (FOS)
- Feature-oriented positioning (FOP)
- Counter-scanned images (CSIs)

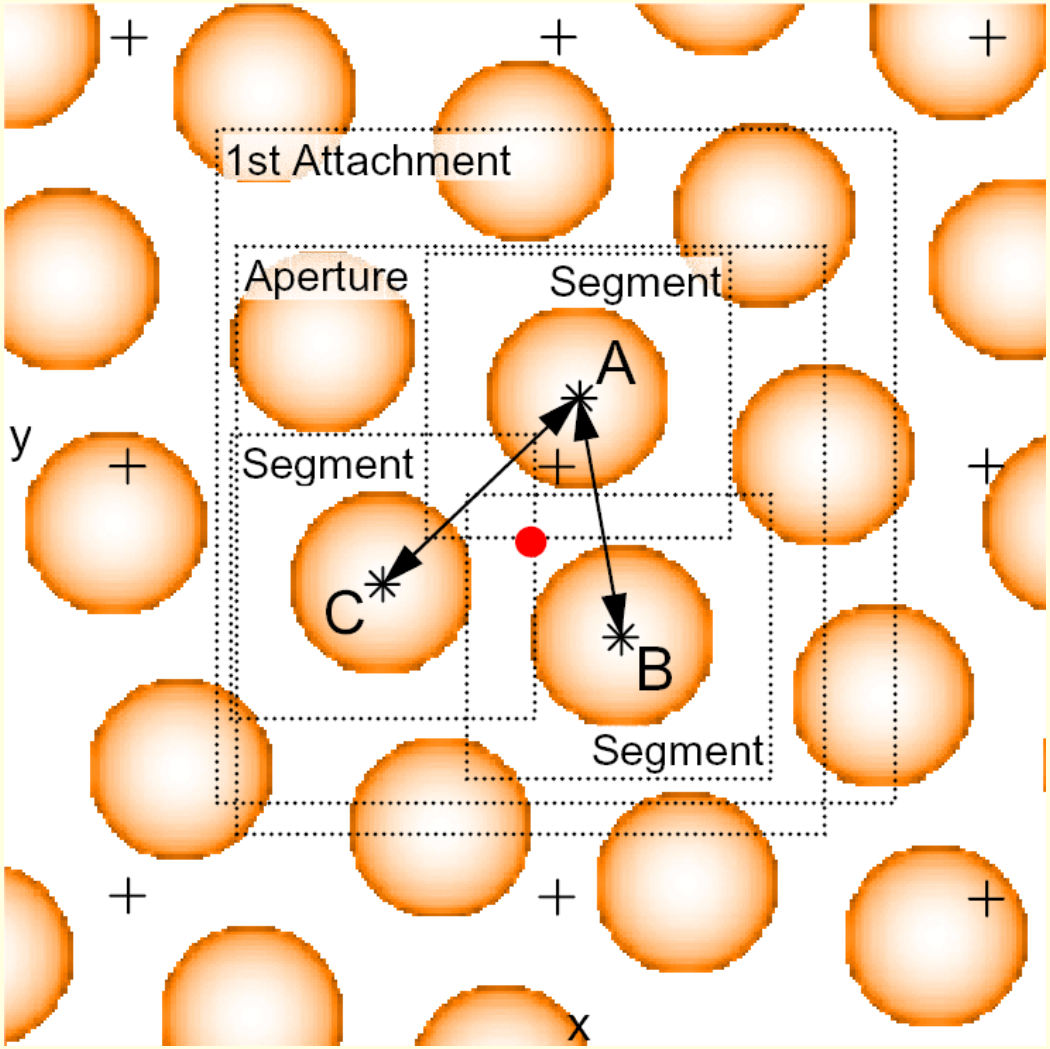
Partitioning the scanner movement space with a net



Simplified flowchart of the distributed calibration



Local calibration structure ABC of a standard surface



Application fields

- Accurate calibration of a probe microscope scanner in nanometer and subnanometer ranges
- Automatic characterization of lattice crystal parameters and surface defects
- Analysis and certification of SPM operation: measurements of thermal drifts, creeps, nonlinearities, nonorthogonalities, and spurious couplings

Conclusions

- A method of automatic distributed calibration has been suggested that allows excluding errors caused by static nonlinearities, nonorthogonalities and spurious couplings of a probe microscope piezoscanner
- The calibration database obtained during calibration is insensitive to microscope head thermal drift and piezoscanner creep because of the application of the feature-oriented scanning methodology
- The lattice constant of a crystal has been used as a nature length standard of nanometer range

I am grateful to Oleg E. Lyapin for his assistance in the preparation of this presentation