Correction of non linear lateral distortions of scanning probe microscopy images — •Michael Schnedler, Phillip Weidlich, Verena Portz, Dieter Weber, Rafal E. Dunin-Borkowski, and Philipp Ebert — Peter Grünberg Institut, Forschungszentrum Jülich GmbH, 52425 Jülich, Germany

The inverse piezo electric effect is commonly utilized to position the tip or cantilever with atomic precision in scanning probe microscopes (SPM). Although the properties of modern piezo electric materials are well known, their application in SPMs requires a calibration of their lateral and vertical positioning, which is usually achieved by acquiring images of atomic lattices and comparing them with the perfect periodical arrangement of the atoms of a crystalline surface. Hence, the calibration is optimized for a nanometer scan range. However, sometimes the measurement requires scanning parameters that exceed the designated linear range of the calibration. Then, nonlinear effects of the piezoceramic actuators, like hysteresis creep, drift, and a nonlinear dependence of the displacement on the applied voltage often result in image distortions. Therefore, a methodology for the correction of scanning probe microscopy image distortions occuring in large scanning ranges is demonstrated. It is based on the determination of displacement vectors from the measurement of a calibration sample. By moving the pixels of the distorted scanning probe microscopy image along the displacement vectors an almost complete correction of the nonlinear, time independent distortions is achieved.