1003-68-988   **M. Sun*** (`msun@gp.as.ua.edu`), Department of Mathematics, Tuscaloosa, AL 35487, **C. Liu**, Department of Mathematics, The University of Alabama, Tuscaloosa, AL 35487, and **H. Fujiwara**, Department of Physics and Astronomy, The University of Alabama, Tuscaloosa, AL 35487. *Digital Image Processing in Nanoscale Materials Research.* Preliminary report.

Researchers in nanoscale science and engineering rely heavily on various images and other measurements of samples for their work. But researchers can hardly be fully satisfied with the available imaging instruments. It takes years to have improved imaging instruments available commercially and they usually cost at least hundreds of thousands of dollars. Practically, no one can afford to get timely upgrades of such major equipment long before reaching its designed life time. Thus the question is how to use mathematical analysis and numerical techniques to expand the built-in capabilities. The article addresses the issue of extracting geometrical features of material grains based on raw digital images. To extract reliable geometrical features of material grains, we first need to reduce noise, and enhance edges and domains of raw digital images. We are then interested in grain size distribution, feature separation distribution, and shape irregularity. We develop special purpose filters and other enhancement procedures based on specific dominant grain shapes (spherical, cubic, or hexagonal) of sample. After description of the procedures, several real images are used to demonstrate the effectiveness of our procedures. (Received October 01, 2004)