Grinding Optimization Model for Nanometric Surface Roughness for Aspheric Astronomical Optical Surfaces

Jeong-Yeol Han[1,2], Sug-Whan Kim[3], Geon-Hee Kim[4], In-Woo Han[2] and Ju-Whan Kim[4]

[1]Dept. of Astronomy and Space Science, University of Science and Technology

[2]Optical Astronomy Division, Korea Astronomy Observatory

[3]Space Optics Laboratory, Dept. of Astronomy and Space Science, Yonsei University

[4]Ultra-Precision Engineering Laboratory, Korea Basic Science Institute

Bound abrasive grinding is used for initial fabrication of the aspheric mirror for both space and ground based astronomical telescopes. In this paper, we determine the grinding parameters before grinding, trace the predict error of surface roughness during grinding, and reduce the elapsed time. We set the target surface roughness from 96.1 ~ 65.0 nm using multi-variable regression analysis method before grinding and predicted the measured surface roughness after grinding. Experiments shown the measured surface roughness from 97.4 to 64.0 nm in height and the predict accuracy of target surface roughness down to ± 5 nm in height can be reached using our model. This study developed the process optimized technique to minimize the period and cost of production against the traditional qualitative experiences as we grind the astronomical optical surfaces.