Intelligent CNC machining and metrology for precision large aspheric surfaces for next generation optical payloads

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Satellite optical systems of around 1m in aperture is gaining much attention from both in and around Korean space science community. Regardless the aperture size of optical payload, prior development of efficient fabrication technology at part, sub-system and system levels are essential precursors to meet the demanding production schedule for such optical systems. We report an intelligent machining approach for high precision CNC grinding for large optical surfaces of up to 2 m in work-piece size. This new approach is concerned with 1) parametric machining intelligence incorporating the novel 'floating' trajectory management. 2) optimum machining regime for surface form and texture in nanometer scale and 3) efficient form assessment capability. The technical details and the experiments undertaken are presented. The results imply that the new machining technique can increases the production throughput greatly by removing the loose abrasive lapping and the initial polishing from the traditional processes of large optics fabrication. This intelligent machining approach forms an efficient and cost-effective solution to the technical challenges for rapid production of large precision optical elements for next generation optical payloads and ground support equipments.