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Research progress on precision manufacture and measurement

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As with ultra-precision parts like large dimension aspheric optical components widely used in earth observation system, surface-based observation station, the requirements of precision and product quality have increased. It becomes urgent on how to improve grinding fabrication efficiency and integrity. This report is about our research progress on the precision manufacture and measurement. It focuses on designing a large dimension ultra-precision aspheric machine tool and a complex surface measuring equipment. To keep the machining equipment has the high stability, the main parts of the machine are made of granite, and it adopts Hydrostatic guideway. In accordance with the difficult problems of grinding aspheric surfaces, an arcs surface grinding wheel was used. The machine is shown in Fig.1. The largest workpiece the machine can process is 1500mm diameter. A measuring equipment is being manufactured to measure the workpiece efficiency, which is also can be used to measure another complex surface such as gear, camshaft. The measuring equipment is shown in Fig.2. The X-axis is mounted on the granite base. The measuring column part (Z-axis) is mounted on the skateboard of X-axis. The 3D scanning probe is installed on the Y-axis sliding plate. The electrical accessories are installed in the electric cabinet such as motor drivers, power supply processors, grating rulers, motion control card and data acquisition card. CNC control technique is adopted in the system for the four-axis motion and position data acquisition. With the entered workpiece parameters, the measurement software system establishes a CAD model of the complex part, planes an automatic measurement path, and sends the commands to the control system to implement the multi-axis linkage and data acquisition. Moreover, the signal of the scanning probe is collected. After the synthesis and analysis of the data, the software presents the measurement results. The machining technology depends on the machining model, machining parameters, machining tools and measurement equipment. The grinding machining and surface digital measurement techniques could short the processing cycle of the large-scale optical parts.

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