Automatic astronomical coordinate determination using digital zenith cameras

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Abstract
Celestial positioning has been used for navigation purposes for many years. Stars as the extra-terrestrial benchmarks provide unique opportunity in absolute point positioning. However, astronomical field data acquisition and data processing of the collected data is very time-consuming. The advent of the Global Positioning System (GPS) nearly made the celestial positioning system obsolete. The new satellite-based positioning system has been very popular since it is very efficient and convenient for many daily life applications. Nevertheless, the celestial positioning method is never replaced by satellite-based positioning in absolute point positioning sense. The invention of electro-optical devices at the beginning of the 21st century was really a rebirth in geodetic astronomy. Today, the digital cameras with relatively high geometric and radiometric accuracy has opened a new insight in satellite attitude determination and the study of the Earth's surface geometry and physics of its interior, i.e., computation of astronomical coordinates and the vertical deflection components. This method or the so-called astrogeodetic vision-based method help us to determine astronomical coordinates with an accuracy better than 0.1 arc second. The theoretical background, an innovative transformation approach and the preliminary numerical results are addressed in this paper.

Keywords: digital Zenith cameras, SIFT, astronomical latitude and longitude, motion coherence theory

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