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PHOTOGRAMMETRIC MODEL BASED METHOD OF AUTOMATIC ORIENTATION OF SPACE CARGO SHIP RELATIVE TO THE INTERNATIONAL SPACE STATION

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Abstract. The technical problem of creating the new Russian version of an automatic Space Cargo Ship (SCS) for the International Space Station (ISS) is inseparably connected to the development of a digital video system for automatically measuring the SCS position relative to ISS in the process of spacecraft docking. This paper presents a method for estimating the orientation elements based on the use of a highly detailed digital model of the ISS. The input data are digital frames from a calibrated video system and the initial values of orientation elements, these can be estimated from navigation devices or by fast-and-rough viewpoint-dependent algorithm. Then orientation elements should be defined precisely by means of algorithmic processing. The main idea is to solve the exterior orientation problem mainly on the basis of contour information of the frame image of ISS instead of ground control points. A detailed digital model is used for generating raster templates of ISS nodes; the templates are used to detect and locate the nodes on the target image with the required accuracy. The process is performed for every frame, the resulting parameters are considered to be the orientation elements. The Kalman filter is used for statistical support of the estimation process and real time pose tracking. Finally, the modeling results presented show that the proposed method can be regarded as one means to ensure the algorithmic support of automatic space ships docking.

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