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Wykorzystanie metody pozycjonowania SBAS w procedurze podejścia do lądowania statku powietrznego

Application of the SBAS positioning method in the aircraft approach procedure

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Gliwice 2022

Abstract

This doctoral dissertation concerns the issue of determining quality parameters of SBAS (Satellite Based Augmentation System) satellite positioning in air transport. The paper focuses on implementing a modified mathematical model to determine the quality parameters of aircraft positioning based on the EGNOS+SDCM solution. According to the literature review, studying the quality of SBAS satellite positioning in air navigation is critical, particularly, to improving flight safety. Thus, the aviation industry strives to increase the level of safety for air operation by implementing SBAS support systems. It should be emphasized that recent in Poland aviation experiments concerned only one type of satellite augmentation systems, i.e. EGNOS System. For this reason, the main objective of the research was to develop a method to improve the quality parameters of aircraft positioning using the SBAS - SDCM and EGNOS systems. The aim of the dissertation was achieved by creating a computational strategy for determining the values of the accuracy, continuity, availability and integrity parameters of SBAS positioning. The paper presents a weighted mean model to determine the quality parameters of satellite positioning with the use of linear coefficients from the EGNOS+SDCM solution. The proposed mathematical model was adapted to two SBAS support systems, i.e. EGNOS and SDCM. Noteworthy is the fact that the developed algorithm uses linear coefficients as a function of the reciprocal of the number of tracked GPS satellites for which SBAS corrections were obtained in the SBAS positioning model.

Based on the research results, it was found that the weighted mean model in the EGNOS+SDCM solution allowed to improve the accuracy of determining the vertical coordinate h from 1% to 14% in comparison to the standard arithmetic mean model and up to 66% in comparison to a single SBAS/EGNOS solution. In addition, the application of the EGNOS+SDCM solution results in an increase in the nominal results of availability and continuity by 50% compared to the arithmetic mean model. Moreover, the values of the integrity parameters HPL/VPL determined using the weighted mean model improved by 1 to 14% compared to the standard arithmetic mean model. It should be emphasized that the obtained results of scientific research also meet the ICAO technical standards regarding the use of SBAS systems in the approach to landing procedure.

Therefore, the obtained research results confirm the validity of the thesis that the use of EGNOS and SDCM support systems in the landing approach procedure improves the quality parameters of satellite aircraft positioning.

Keywords: EGNOS, SDCM, accuracy, integrity, continuity, availability, approach procedures