

ALTERNATIVE POSITIONING NAVIGATION BY MULTI NAVAIDS

One of the most important tasks of modern navigation systems is accurate determination of vehicle position in airspace. Global navigation satellite systems (GPS, GLONASS, GALILEO) with their functional augmentation systems (EGNOS, WAAS, MSAS, LAAS) play a major role in coordinates determination. This is due to the availability of worldwide usage and high precision positioning in comparison with other available methods. However, global navigation satellite systems (GNSS) have several disadvantages, such as pure geometric factor of the satellite segment, large spatial variation in ionospheric delay and interference from ground based radio equipment that reduce the positioning accuracy and can lead to a complete inability of vehicle location coordinates determination.

Numerous researches have been proven the advantages of the usage of Navigation Aids as alternative positioning means. Positioning by Navigation Aids is an alternative to satellite navigation in air transport development strategies. Current algorithms applied in air transport use simultaneously only two ground stations to determine the location of aircraft. Research of the best pair of ground stations for positioning are discussed in many scientific studies. However, the accuracy of positioning may be increased due to the usage of all available ground stations and coordinates information integration that is available on board.

One of the possible solutions of the problem of the air vehicle positioning is integrated navigation positioning system using all available navigation aids in some point of airspace. In particular, air transport widely uses distance measurement (DME, TACAN) and angle based (VOR, NDB, TACAN) navigation aids that may be used to determine the location of a moving object in addition to their main purpose. The accuracy of this method depends on the amount of available radio beacons, their type and geometry of the relative position in particular area. An aircraft location is going to be determined not only by distance measurement and angle based principles, but also with their combinations such as VOR / DME, NDB / DME, VOR / NDB, VOR / DME / NDB, that are based on the usage of all available navigation signals in a certain airspace.

The usage of positioning algorithms by all navigation aids within the area faces the problem of avionics equipment amount limitation. The solution of this problem at the existing equipment is possible through the usage of data prediction algorithms and its mixing with data from navigation aids.

References

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