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IMPROVEMENTS IN THE ACCURACY OF GPS MEASUREMENTS UNDER POOR OPERATING CONDITIONS

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Abstract. *GPS (Global Positioning System) is a three-dimensional positioning system that makes use of the latest satellites, enabling the measurement of the user's current location at any time. The use of GPS is common throughout the world, and the term 'GPS' is widely known because of the fact that GPS receivers are mounted in various devices such as car navigation systems and cell phones. There are a number of different types of GPS: standard positioning service (SPS), differential GPS (DGPS), and interference GPS. Although interference GPS has a high degree of accuracy, it requires substantial infrastructure. In contrast, although SPS and DGPS require little infrastructure, they offer less accurate positioning. If SPS and DGPS can be improved to provide a higher degree of accuracy in terms of positioning, they will be employed in more applications relevant to our daily lives than ever before. Bias errors in SPS and DGPS increase when positioning is carried out under poor operating conditions. As GPS positioning is computed from the pseudo-range from each satellite, the satellite arrangement and range in error pseudo are important in terms of improving the accuracy of GPS. In this paper, we undertake an experiment and simulation with the aim of improving the bias error of GPS under poor operating conditions.*
Keywords: GPS, Pseudo range, Satellite arrangement, Poor operating conditions

1. **Introduction.** GPS is a three-dimensional positioning system that makes use of the latest artificial satellites [1, 2]. GPS was developed in the 1970s by the U.S. Department of Defense to enable measurement of the user's position at any location at any time. GPS is not only managed for the U.S. army: it was opened up to civilian use in 1993. There are currently 29 GPS satellites, including backup satellites, and 24 of these satellites are used for actual GPS measurements. As GPS is widely used in various fields such as car navigation, GIS and related technologies [3] are familiar to many people.

There are different types of GPS according to the employed measurement method. The positioning methods used in GPS are described below.

(1) Standard Positioning Service (SPS)
(2) Differential GPS (DGPS)
(3) Interference GPS
  (3-1) Static Positioning
  (3-2) Kinematic GPS