

Technique for order performance by similarity to ideal solution for solving complex situations in multi-criteria optimization of the tracking channels of GPS baseband telecommunication receivers

ABSTRACT

Global positioning system (GPS) has undergone intensive development, starting as an advanced specialized tool to a general-purpose gadget used in our daily lives. GPS exists in new technologies, applications, and consumer products, especially in smartphones and tablets. In a GPS receiver design, power consumption and localization accuracy are critical factors that affect the outcome of a GPS receiver system. Theoretically, increasing the number of required tracking channels in a GPS baseband receiver increases the design complexity and size of this system. Thus, power consumption can significantly increase. The receiver should acquire and track numerous satellites to improve the location accuracy of a position, thereby indicating that the receiver requires a high number of tracking channels. Thus, optimizing these tracking channels to balance the conflict among performance parameters is a difficult and challenging task. This paper presents a technique for order performance by similarity to ideal solution (TOPSIS) for solving complex situations for multi-criteria optimization of the tracking channels of GPS baseband telecommunication receiver. Nine operation modes of GPS receiver were evaluated by each design parameter, such as power consumption, localization accuracy, and time with no position available for static and dynamic positioning. Then, the TOPSIS was utilized and implemented to measure and rank the overall performance of tracking channel selection. Results of this study indicate that (1) multi-objective optimization is a reliable strategy for visualizing the trade-off among the GPS design parameters and providing a dynamic power consumption planning. (2) The best aggregated performance of the GPS receiver occurs when the number of tracking channels equals five and six for static and dynamic positioning, respectively. (3) The most frequent number of available satellites is eight, whereas the other number of satellites is a rare case to acquire. However, GPS standards require that available GPS satellites are constantly 12 at any time and place.

Keyword: GPS receiver design; Telecommunication; Global positioning system; Power consumption