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应用

无源测距定位系统设计中的GDOP分析

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摘要：

几何精度因子（GDOP）是衡量一个定位系统精度的重要标准之一。为分析三维空间中GDOP随几何位置关系的变化，构建了GDOP分析模型。对GDOP的解算算法和典型四基站三维无源定位系统的分析表明，测距精度最终导致的定位精度会随着用户处于不同的相对几何位置而产生明显波动和规律变化。在以球体作为几何参考体的情况下，GDOP在不同“经线”或“纬线”上会出现不同程度的波动或近似为常数；延径向向外GDOP不断增大；基站点处出现GDOP的间断点。这些分析结果可以作为用户选择基站或操作区域的基本判据，并可为无源测距定位系统基准站点的布设提供参考。基站周边应当设定适当的保护距离以保持用户的定位精度；用户应当尽可能在参考几何体内部运动；在系统设计中，应当充分考虑用户的活动区域等限制因素。

关键词： 几何精度因子分析 三维 无源测距定位系统 几何相对距离

Analysis of GDOP in the Passive-ranging Location System Design

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Abstract:

Geometric dilution of precision (GDOP) is one of the most important factors for judging whether a positioning system is of high-accuracy. An analysis model of GDOP is constructed, which can help to analyze the variations of GDOP going with the changes of geometrical position in the three-dimensional space. With the analysis of both calculation arithmetic of GDOP and typical 3-dimensional passive-ranging positioning system of 4-stations, we get that positioning accuracy, of which the ranging accuracy is the root, will obviously fluctuate and regularly change following the variations of user’s position. Using a sphere as the geometrical reference, GDOP will fluctuate variously or be almost constant at different “longitudes” and “latitudes”, increase along a radial, and be discontinuous near a base station. These results could provide useful information for the users to select the stations and work area, which also can give the designers of passive-ranging positioning system some advices about deploying stations. Firstly, for the purposes of maintaining a proper positioning accuracy, safe distance should be suggested around the stations. Besides, the users should stay in the reference geometry, if possible. At last, in the beginning of a design, the factors, such as the limit of users’ location region, should be taken into account.

Keywords: analysis of geometric dilution of precision three-dimensional passive-ranging positioning system geometric relative distance

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