DYNAMIC VEHICLE POSITIONING AND ORIENTATION TECHNIQUES FOR INSPECTING ROAD SURFACE OR GUIDING CONSTRUCTION MACHINES

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ABSTRACT

Traditional surveying tasks (i.e. mapping of road surfaces for constructing the as-built layout) or new promising applications (i.e. paver guidance), requiring high geometric element accuracy, could well be served by dynamic positioning techniques. They can provide the basic data for constructing the bearing diagram (change of bearing along the road sections) to determine the geometric elements (i.e. the radius of horizontal curve). One technique to calculate the bearing is to use the coordinates of three consecutives points, which however are sensitive to the distance between them. Thus, their position errors degrade the bearing accuracy as well as the significant error to determine the bearing change when the vehicle moves slowly. In this paper a new technique is proposed using a GPS-based configuration with three receivers on the moving vehicle. They are installed on a moving platform forming a triangle providing the relative position of those three points with high accuracy, since they commonly "phase" most of the systematic errors of the positioning system are eliminated. As a result, the pitch, roll and lead rotations could be obtained with high accuracy as well.

The method is based on the DGPS technique using RTK/OTF capability expected to provide position accuracy that could be better than *0.5cm* horizontally and *1cm* vertically. Experiments were conducted for assessing the configuration performance in the field and statistically testing the resulting accuracies against the theoretically expected. The experimental work has proven that determines the radius of a curved road section with the same accuracy as traditional methods. However, it appears to be very sensitive in recognizing that the machine moves within a circular path, and the most importantly in significant short distance. Additionally, this configuration provides continuously position and orientation data of high accuracy that satisfies the paver guidance operation.

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