

Operator Assistance System for Articulated Vehicles using a Single CP-DGPS Receiver

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Market demand for increased productivity, reduced operating and labor costs has lead to development of driver assistance technologies for operation of farm and construction equipment using embedded computers.

In our work a single Carrier Phase Differential Global Positioning System (CP-DGPS), which is also known as Real Time Kinematic Global Positioning System (RTK-GPS), receiver is used to provide the current global position coordinates of the vehicle. In this work we use a steered as well as articulated construction equipment as an application platform. The vehicle has front wheel steering capability in addition to articulation of the front frame about the rear frame at the hitch point. The means by which the vehicle steers or articulates is through electro-hydraulic pilot actuated cylinders with position sensors for feedback.

The OA system consists of a method for planning and generating a path in the form of global position coordinates for the vehicle to follow and, a method for tracking the path. For path planning, an algorithm is developed with an objective, to allow the vehicle to entirely cover a given field to reach the goal point, rather than finding the shortest path as in most path planning problems. The algorithm relies on simple geometrical and algebraic relations to generate the paths, which makes the process computationally inexpensive, which is necessary for real-time applications. For path tracking, the pure pursuit tracking method is implemented. The method is based on connecting a start and goal point with an arc, which defines the direction of travel for the vehicle.

Using a kinematic simulation software, a vehicle model for the tracking problem is developed which assumes that the tire/ground interactions are a pure rolling case. Thus far, simulations yielded satisfactory results and further experimentation on a vehicle prototype is underway.

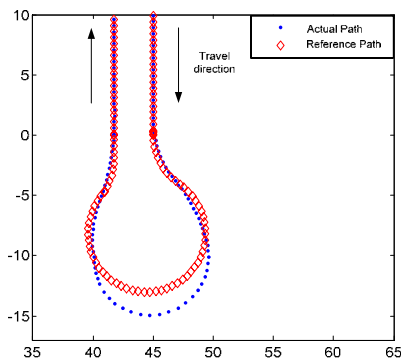


Fig.1: Example of the simulation tracking results for the vehicle while making a turn.

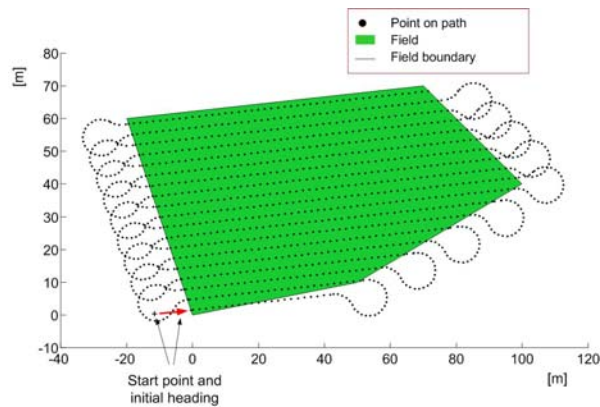


Fig.2: A field for the vehicle to traverse while following the path as returned by the path planner.