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From the expansion of the space of the displacements towards the transformations of the plane applied to the changing, bifurcating, intersecting and conducting lanes for the map matching

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Abstract

The odometric model gives the place to a space of displacements. We have been resolving to simulate, integrate, explain and then to validate the odometric model. The model of resolution is to be programmed in the Maple langage, with the help of a solver for Maple 2021.

Key words: Odometry, Vehicle location and navigation systems, Mobile positioning systems, Trajectory, Convergence of a model, Control of a vehicle, Example, Application.

Introduction

As one introduction, I could say that the odometric model is well known now and that everything is done for the space of displacements of a model of automation to be improved with the odometric model.

1. Lemma

There is the convergence of the odometric model with the absolute convergence until an hypergeometric function with a gamma, and moreover all this space of displacements has a structure K-completed of a group, with

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the neutral element that is the rotation of an angle of 2*Pi modulo Pi. The formula below is used to be the steering angle to integer of the mathematical function of the computed odometric model.

$$\theta(t) = -ln(\cos(t))$$

Moreover the formula below is used to be the integrated value of the mathematical terminal of the computed odometric model.

$$\beta(t) = \int_0^t cos(x)^I \, \mathrm{d}x$$

$$\beta(\Pi/2) = \int_0^{\Pi/2} cos(x)^I \, \mathrm{d}x = \Gamma(1/2 + I/2).\sqrt{(\Pi)}/(2.\Gamma(1 + I/2))$$

It deals with the value of the steering angle at the value of Pi/2. Normally the speed value of the wheels of the vehicle should always be tangential to the vehicle. Indeed the wheels are to be rolling in the direction of the vehicle. And when the vehicle is turning then the direction of the vehicle is changing of the driving direction.

2. Proof of the lemma

On one hand the space of displacements is a subgroup of the space of the transformations of the plane implies that each element of the space of displacements is the limit of a series of elements of this space of displacements. And another hand for each element of this space of displacements there exists a bounded sequence for any displacements, cf. The work of Guillaume Artus on the slavings to be given to the computer to make a robot go from one position to another in the plane [1], in the space of the displacements such that the limit belongs to this space of the displacements of the plane implies that the space of the displacements is completed in the body of the transformations of the plane.

3. Explanations about the lemma

The lemma has been fully proven so that now we can access the datas from the first series with the linearized functions in the matrix of state and measured, given by the chinese team in a paper published by the IEEE editor, I have done the primary effort to the state matrix of functions, nevertheless they did the last one to ensure the compatibility of the odometric

model with the mathematical background of mine and also to get the values with the vehicle [2]. All the datas have been computed in a table by a program under Ubuntu 20.04 with the GCC and also the GLIBC software, it used to be accessed on the DataPort of the IEEE website with the odometric key word : https://ieee-dataport.org/open-access/odometric-datas-simulation-odometric-model to give an example from an linear approximation of the odometric model with GCC. For the simulation of the odometric model please see at : https://ieee-dataport.org/documents/new-figure-simulation-odometric-model to give an example from a simulation of the odometric model with Scilab.

4. Example about the lemma

The best effort example is the half turn like maneuver. In the space of the displacements there are two arcs of circle to do for instance, instead of a rotation of Pi in the space of the transformations in the plane, and usually its can be done for more figures of maneuver with the homothety, or even with the translation. It is usually appointed the transverse function in the space of the displacements.

5. Application about the lemma

The best effort application is the map matching of the vehicle inside the road of the map to get the proper trajectory. It is to argue to go from a place to a destination with the help of the geometry of the roads. Not evident for a Cybercar to pass the different configurations of the vehicle based roads of destinations. I suggest to use the algorithm of passing doors to follow the route given by the matrix of routing of the vehicle. First of all init the position of the vehicle by detecting the two points of the segment given by the middle of its as a position of intialization. Secondly define the next targetted position of the segment of position and try to go to its middle point of repositionning. Then increment the position of definition of the target positionning of position by detecting the left and right points of the segment which are defining the targetted position in the middle. Finaly move to the targetted position in the middle. And Also stop the vehicle as soon as there are no more segments for repositionning the vehicle.

6. Conclusion

As one conclusion, I could say that the odometric model is well known now and that everything is done for the commands of a model of automation to be validated with the odometric model [3]. I should also emphase that a thesis can be done with the first issue of mine about the so called linearization of the equations of the odometric model given back by the issue of the chinese team of researchers [2]. ——————————— 1. Guillaume Artus, Pascal Morin, Claude Samson. Control of a maneuvering mobile robot by the transverse function approach : control design and simulation results. [Research Report] RR-5155, INRIA. 2004, pp.16. ⟨inria-00077042⟩; 2. Xiaocong Su, Chaoyong Zhang, Duanfeng Chu, Shidong Liu, Deng, and Chaozhong Wu, Trajectory Planning and Tracking for Autonomous Vehicle Based On State Lattice And Model Predictive Lattice, IEEE Intelligent Transportation Systems Magazine (Volume 11, Issue 2, Summer 2019); 3. Edern Ollivier. Simulation, integration and explanation of the odometric model for the purpose of the numerical analysis: A pool of trajectories for the engineers of the automation of the fair and automated vehicle. 2019. ⟨hal-02162501v10⟩.

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