

# IARES ROVER AND THE CINEMOMETER METHOD

S. Pol<sup>1</sup>, L. Rastel<sup>1</sup>, M. Maurette<sup>1</sup>, A. Benain<sup>2</sup>, M. Llibre<sup>3</sup>, and C. Lambert<sup>3</sup>

<sup>1</sup>Centre National d'Etudes Spatiales, France

<sup>2</sup>Magellium, France

<sup>3</sup>Office National d'Etudes et de Recherches Aérospatiales, France

## ABSTRACT

Considering the current robotic approach of planetary exploration, it has become necessary to develop reliable autonomous navigation algorithms. Within the scope of the Exomars project, the CNES is therefore developing technologies to bring a rover sufficient autonomy in terms of navigation.

Regarding the Exomars mission specifications, the major part of the CNES' robotics developments lies in autonomous navigation, based on one hand on stereovision for 3D environment reconstruction, and on the other hand on classical odometry for the rover localization, being itself backed up by visual motion estimation through a Kalman filter.

This presentation aims to present both the IARES platform and the odometry method.

The rover used is the CNES' prototype exploratory planetary vehicle, developed by VNII Transmash, called IARES<sup>1</sup>. IARES is a highly flexible planetary explo-

ration demonstration rover mainly for autonomous navigation and locomotion studies. It has 19 degrees of freedom, including six active, steerable wheels and has several motion modes. The IARES rover is equipped with

two stereobenches, one for navigation and the other one for visual motion estimation. It also has an attitude unit and a differential GPS for test purposes. All those perception devices allow to perform localization algorithms, among which the cinemometer method.

These odometry algorithms, first initiated by the ONERA, make it possible to estimate the 6D trajectory of a vehicle by using only the measurements of its internal configuration parameters (angles around the various axes of the vehicle and in particular around the spin axes of the wheels). Associated to this pure odometry, there is a Kalman-type position and attitude corrector using the position and attitude measurements provided by the localization systems.

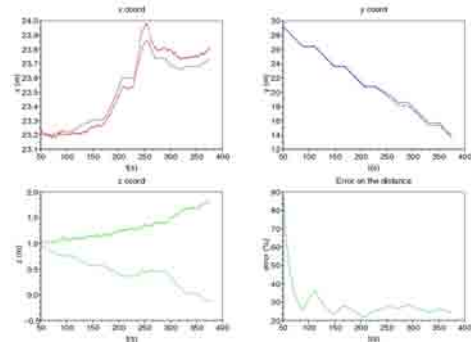


Figure 2. Cinemometer's localization results



Figure 1. IARES rover

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<sup>1</sup>stands for 'Illustrateur Autonome de Robotique mobile d'Exploration Spatiale' which means 'Autonomous Space Exploration Robotics Illustrator'

The final paper shall contain :

- a detailed description of the IARES rover,
- a description of its perception devices,
- a broader description of the cinemometer method,
- tests results.

The ongoing autonomous navigation test campaign, performed on a Mars-like environment, shall also be described.

Key words: Robotic Autonomy; Rover Localization; Odometry; ExoMars.