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50. Internationales Wissenschaftliches Kolloquium
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Development of Family of Pipes Lines Inspection Robots

ABSTRACT

This paper concerns the development of a family of robots for pipelines inspection. Pipes are used in many different situations, for example to supply water and gas in urban centers or to circulate air in HVAC systems, not to mention diverse industrial applications. Pipelines should be inspected from time to time and robots are frequently used to perform this task. However, the diversity of diameters, paths and environmental conditions make it difficult for a single robot to adapt itself to all these situations. With this in view, a family of robots was developed to overcome these limitations. The design was based on a concurrent engineering approach together with the application of many DF-X statements such as modular design, design for assembly, manufacturing, maintainability, control and others. This paper presents all the steps involved in the system development from the formulation of design specifications to the execution of performance tests in the field

Introduction

Pipe lines has high level of standarization and the variation on diameter, material and assembly they will differs mainly on diameter, path and aggressiveness. Inspite of this all of then must be inspected since its assembly, and periodicaly throw its life time. In order to attain diferrent requirements a family of robots was developed.

The Design Process

The desgin process started following the recommendation of VDI 2221, 2222, 2224, Pahl & Beitz [1] and Krauser [2,3] but during the first steps was detected the necessity to improve the

design process and make it more dynamic in order to save time and reduce costs. The design development was done using a new approuch based on concorrent engineering and appling many DF-X statements, as modular design, design for assembly, manufacturing, maintenance, control and others.

Following the design approuch proposed by Rosenfeld, Forcellini et al [3], the conceptual design was bring into to informational design, and both tasks were deloped in parallel, one complementing the other in a concurrent like engineering. During the requirements survey an association with a correspondent DF-X were done, this allow to improve de dinamic and the systematic to functional and detailed design.

Since the design requires diferents engineering skill, so the develoment was carried out by a mechanical and an eletronics development teams, on three diferents universities, set appart from 800 km each one. The design management was done using internet resources for on line conferenc and meeting, with a comum bata base. The control and tracking devices were also developed in a concurrent manner, with the mechanical and eletrônic teams carrying through all the design task together.

Conclusion

After the detailed design a pre-series of robots was manufactures and tested on diferents envoirements. Those test were done in order to colect data to feed back the design process. The results shown that only minor correction were necessary, and the design approach used in the develoment shown to be very dynamic on provide information, coordenation and answers the develoment team.

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