

ABSTRACT

The present paper aims to present the didactic and research activity conducted by the candidate in the post doctoral period in two important areas of everyday life, namely the fields in which we encounter cardanic transmissions (with many applications) predominantly in the automotive field, and in the use of polyethylene pipes and fittings in the natural gas transport and distribution.

The first topic comprises the research the candidate completed during the last three years in a beautiful and dangerous area - the field of natural gas transport and distribution, covering the problems observed during thirteen years of activity.

The first chapter provides a brief introduction to the natural gas domain by presenting some aspects regarding the general framework and the means of obtaining polyethylene, but also the general (mechanical, thermal, etc.) characteristics related to it.

The second chapter reviews the current state of the research on the suggested topic, the types of the existing materials and the procedures for obtaining the fittings. Also presented here are the machines and the equipment used in making the assemblies and the way they work. The errors that occur and should be avoided as well as the correct steps of welding the high density polyethylene are highlighted.

The third chapter represents an important point in starting these researches, underlining the problems encountered in everyday practice by the welding machine operators through a questionnaire filled in by approx. 170 persons. The majority of the interviewees are employees in the field of natural gas polyethylene pipelines exploitation, sellers, teachers, all closely related to the studied field. The resulting conclusions gave a clearer direction to the orientation of the research.

The fourth chapter focuses attention on the exact area to be studied by mentioning the points to be approached, which resulted from the inquiry conducted by means of the questionnaire.

The fifth chapter presents the theoretical studies on this topic, the analytical calculations on the domain of the literature filtered for the chosen topic, as well as the finite elements research of the phenomenon. The most common elements of the everyday practice have been analyzed by simulating the behavior of these elements in practice. We analyzed the phenomenon of crack formation due to external elements, but also aspects related to the behavior of the polyethylene when a squeeze off tool acts on the pipe in order to stop the gas flow.

The sixth chapter is related to the tests performed on the welded assemblies and on the polyethylene pipe, taking into account all the elements acquired by means of the questionnaire and resulted from the theoretical study. The first step was linked to the welding phenomenon and the evolution of temperatures in the welding areas. An important element here is the area where the temperature is at its highest that should not be mechanically loaded while welding because there is a risk that the parts would deform and the assembly would be compromised. Different mechanical tests have been carried out here to determine which areas can be deformed if the equipment is used correctly or not. The elasticity modulus for the polyethylene pipe was experimentally determined, followed by the observation by means of the Aramis software of the way in which the polyethylene pipe is deformed when it is subjected to radial stress.

At the end, conclusions were drawn and observations were made regarding the obtained results, stating the measures to be taken in various situations.

The second topic is related to the continuation of research in the field of the doctoral thesis topic related to cardan transmissions. The first chapter is a brief introduction to the cardan transmissions domain, covering a few elements which need to be considered when designing them.

The second chapter introduces us to the current state of the cardan transmissions and details their components, the types of construction and the areas of their use. It can be noticed the vast field in which the cardan transmissions are encountered, ranging from tractors and combines, to automobiles and boats. The bibliographic study covers the cardan transmissions manufacturers and the relatively few data related to the tests to which the components of the cardan transmission are subjected.

The third chapter is related to the theoretical analysis of the cardan transmission, highlighting the most important and common mathematical relations that have been applied for verifying the model taken into account from Dacia 1307. As a result of these verification calculations, it has been observed that most of the analyzed parts are too oversized and can be optimized in terms of decreasing the equivalent stresses. The entire cardanic transmission assembly was three-dimensionally modeled in Solidworks software and the stresses and the deformations were highlighted by means of Cosmos software. We observed that the element closest to the allowable stress is the cardan joint, which also resulted from the questionnaire inquiry as being the most problematic element in exploitation, and therefore requiring a thorough study. Various optimizations have been made regarding the non-functional

dimensions of the components of the Dacia 1307 cardan transmission. We consider that this study can be taken as a model for any existing cardan transmission from any vehicle or machinery.

Chapter four is the chapter dedicated to the experimental tests that focused specifically on the elements that the questionnaire study, the analytical study and the finite element research proved as raising problems. It is a chapter that reconfirms what has been determined so far. The stresses and the deformations have been highlighted by means of rapid prototyping conducted with the three-dimensional color printer on the optimized models.

The last chapter contains the conclusions and the suggestions on improving the functionality and the usage of cardan transmissions.