

STUDIES ABOUT THE COMPUTATIONAL TECHNIQUES USED TO DESIGN AND OPTIMIZATION THE FORM OF THE FOOD INDUSTRY EQUIPMENTS - SECOND PART-

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Abstract

Beginning to the dimensions obtained about the form of the industrial food equipment, this paper presents the computational methods (SolidWorks, COSMOSWorks software's) used to design and optimization the form of the analyzed industrial food equipment.

Keywords: pressure vessels, food industry, 3d model, design, optimization

1. INTRODUCTION

The recent years have brought important changes in the way of conceiving, designing and achieving the products, changes supported mainly by the technological boom in the information technology.

Whatever the field, the design stage can be considered as a joint of the activities based on induction, deduction, intuition, experience and creativity. Through the software/hardware systems one can transfer progressively the experience of deduction and induction to an artificial "expert" which will deal with their engineering problems using methods which are particular to the artificial intelligence. In this case, such an expert system is obtained by joining several software packages which concur to achieve dynamic designs and to analyze and optimize the virtual model.

Utilization of the "expert" system make than the obtained results can be introduced in the input dates, which can create a feed-back loop. Her action is stopped then is satisfied the resistance and economically criteria's.

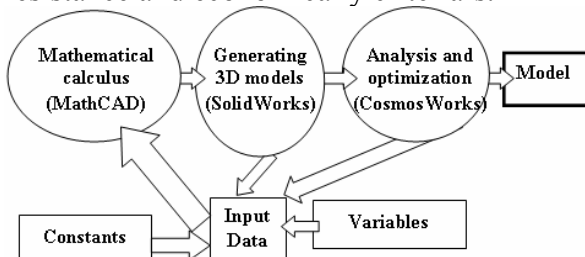
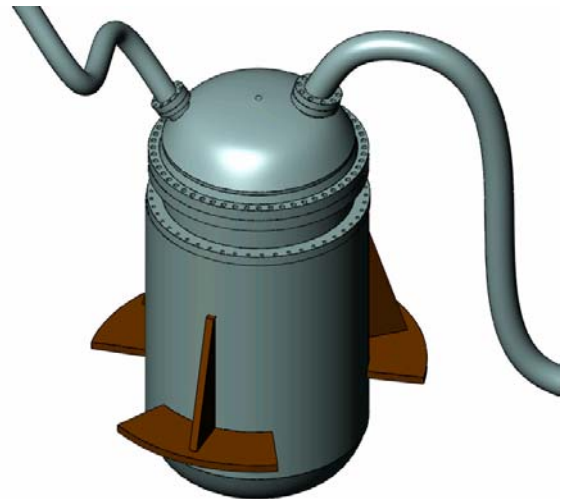


Figure 1. The logic scheme for obtain the model

In this paper we wish to facilitate the static study of some equipments in the food industry, equipments that can fit in the category of the thin-walled membrane shelling, submitted to interior pressure. To design such equipments, one must take into consideration the technical prescriptions and the norms of work security (ISCIR) which regulates this field.



After finishing the first stage, the stage of dimensional calculus of the recipient the MathCAD software following the steps defined by the designer on the input data automatically modifies this database.

2. 3D MODEL DESIGN

Using the created database, respectively the dimensions in the output, the 3D model of

the recipient can be obtained. SolidWorks (CAD system) is a solid-modeling, mechanical design system that takes advantage of the familiar Microsoft Windows graphical user interface.

Following the steps of the design with SolidWorks software a complex model of the respective equipment can be obtained, model which considers all the conceptual details of the equipment as well as the mode of interconnection of the above mentioned in the entire set of equipments (figure 2).

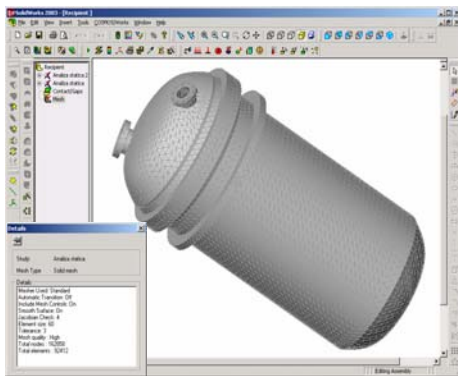


Figure 2. 3D model design

The design it is made separate for each equipment component. After this, all parts will be assembled using the same software.

At this stage it is important the design conditions for assemble/disassemble and assurance their gauges for this reason.

The identification of dimensions which not corresponding to these conditions, take to the determination of another possibilities which have like effect the regeneration of the input dates.

3. STATIC ANALYSIS USING THE CAD SYSTEM

COSMOS/Works is a design analysis system fully integrated in [SolidWorks](#). COSMOS/Works provides one screen solution for stress, frequency, buckling, thermal, and optimization analyses. Powered by COSMOS/FFE (Fast Finite Element) technology, COSMOS/Works lets you solve large problems quickly using your personal computer. Optimization studies save you time and effort in searching for an optimum design

that meets certain requirements. This version of COSMOS/Works includes major enhancements and new functionality.

In COSMOS/Works you can perform many different types of analysis relevant to the engineering design process. When loads are applied to a recipient body, the body will deform and the effect of the loads will be transmitted throughout the body. To absorb the effect of loads, the body generates internal forces and reactions at the supports to balance the applied external loads.

Linear static analysis refers to the calculation of displacements, strains, and stresses under the effect of external loads based on two basic assumptions:

- All loads are applied slowly and gradually until they reach their full magnitudes. After reaching their full magnitudes, loads will remain constant (time-invariant).
- The relationship between loads and induced responses is linear. If you double the magnitude of loads, for example, the response of the model (displacements, strains, stresses), will also double.

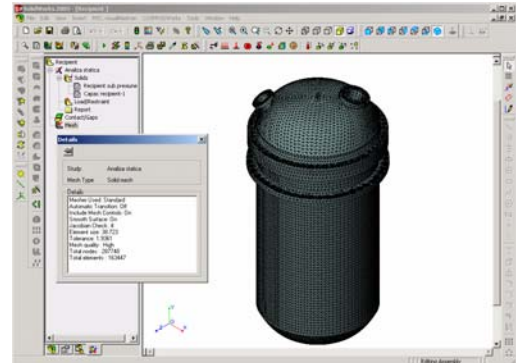


Figure 3. The mesh model

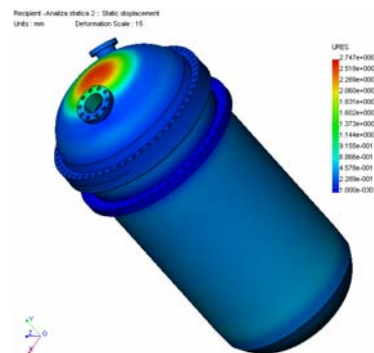


Figure 4. The finite element analyze

4. THE FORM OPTIMIZATION

After the statically analyze of the recipient (pressure vessel) it can be observed that the maximum stress appears in the ellipsoidal cover and the bottom of the recipient; the safety coefficient has the value 1.02 , more than the indicated limit: 0.9 (from the ISIR prescriptions).

Between the constructive solutions like the increase of the wall thickness or the welding of some ribs to the most loaded zone of the recipient, it is chosen the last solution which is the most economically (figure 5).

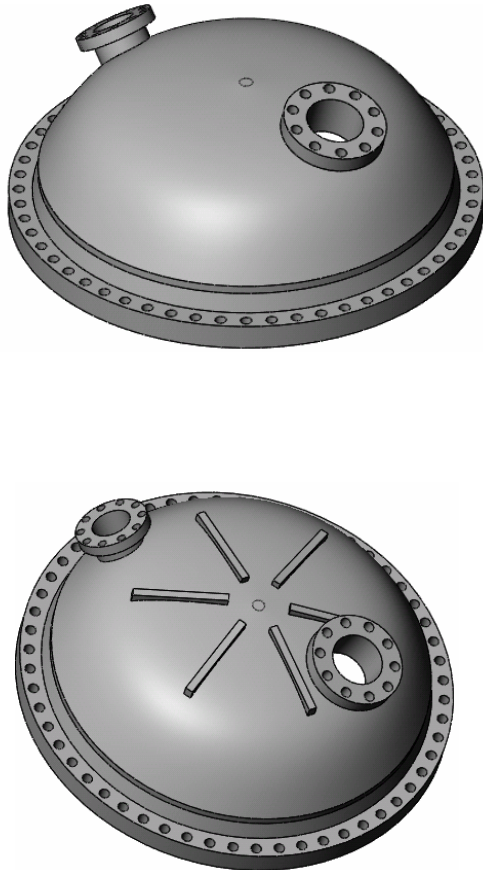


Figure 5. Optimization of the ellipsoidal cover

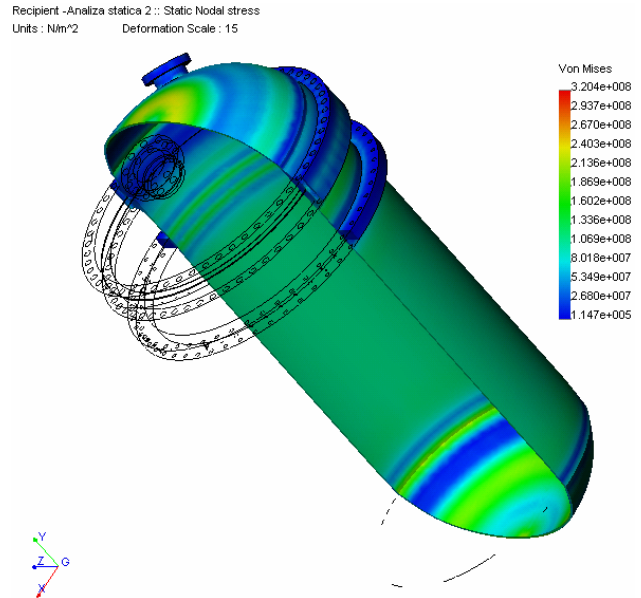


Figure 6. The stress analyses for the optimized model

5. CONCLUSIONS

Beginning to the dimensions obtained from the mathematical calculus (using Mathcad software) it is realized the recipient (pressure vessel) design, in SolidWorks software.

The finite elements analyze for the stress and deformations state of the recipient, under the action of the internal pressure p , it is realized using the CosmosWorks software, which is full integrated in SolidWorks.

Studying the obtained results, after analyze, it is realized the form optimization for the pressure vessel. For this, it is welded some ribs to the more loaded zones.

Thus, it is reduced the stress values, under the maximal limit of the design standard.

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