

INTRODUCTION FOR A FINITE ELEMENTS ANALYSIS FOR A BURNING SPARKING ENGINE CYLINDER HEAD

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Abstract In the present paper one set the hypothesis used to simulate and analyze with FEM a burning sparking engine cylinder head. One exemplify: the way of geometric simulation, the discretisation technique for several types of finite elements and also the loading case for this type of piece.

Keywords cylinder head, stresses, deformations, finite elements analysis

1. INTRODUCTION

CAD design is a high dynamic domain. Some years ago, the numbers of profesional designing applications were: AutoCAD, CATIA or Pro/Engineer. In our times the number if these applications are big enough and the user can choose the best software for its application. One of this CAD software with a large use is SolidWorks.

2. GEOMETRIC DESIGN

One make the study on the Dacia 1.6L cylinder head engine, presented in figure 1 and figure 2 with the SolidWorks help.

The geometric modeling was made based on a real model and with the help of the paper [1]. You can see in the figure 3 some sections of the cylinder head for each cylinder.

Relative to another CAD applications, SolidWorks has the possibility to accomplish several actions to the model (real time operations) and to validate it when they are fit to our study.

In this way one can do many trials, without the fear of damaging the Many dimensions and relations between parts of the model can be applied on mouse click and it is removed the necessity of introduction too many parameters in toolbar.

Another important aspect in designing process is Undo/Redo function because you can undo as many steps as you want.

These will be automatically applied on the pieces and updated all the connections to another objects in the design.



Fig.1

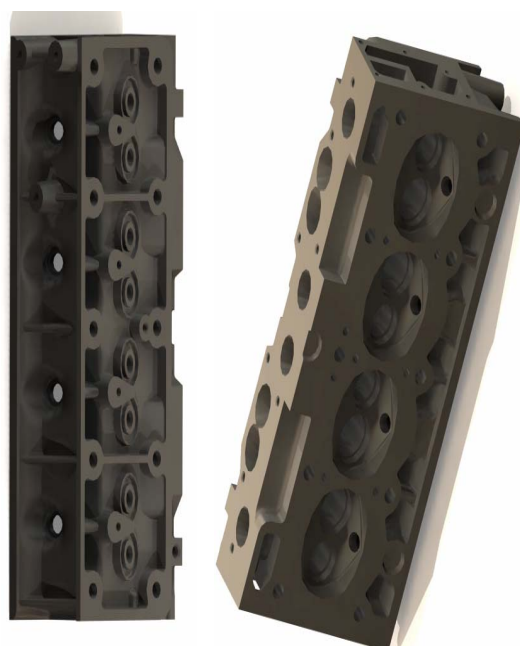
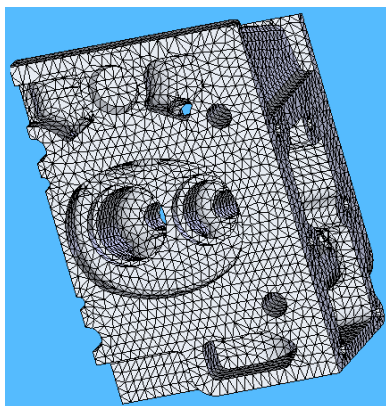


Fig.2



Fig.3

3. DISCRETIZATION



This job step is more complex because you need some experience related to elements library (choosing the type of the elements which fit to the geometrical entities of the model and for the problem necessity to solve) and some experience to realize a enough fine discretisation for good accuracy and short time to solve the problem. This observation is available for different geometric structures and/or physical entities (elements of different materials). For a good running of the structure pay attention at the nodes connection for several compounds (at the nodes compression and at the jointing the nodes with certain type of joint). A good coherence can be obtained in the discretisation phase by independently discretisation of the substructures and partial compression. One can see the way of discretisation for a cylinder head element using Cosmos application, figure 4, and AlgorV16 software, figure 5.

Fig.4

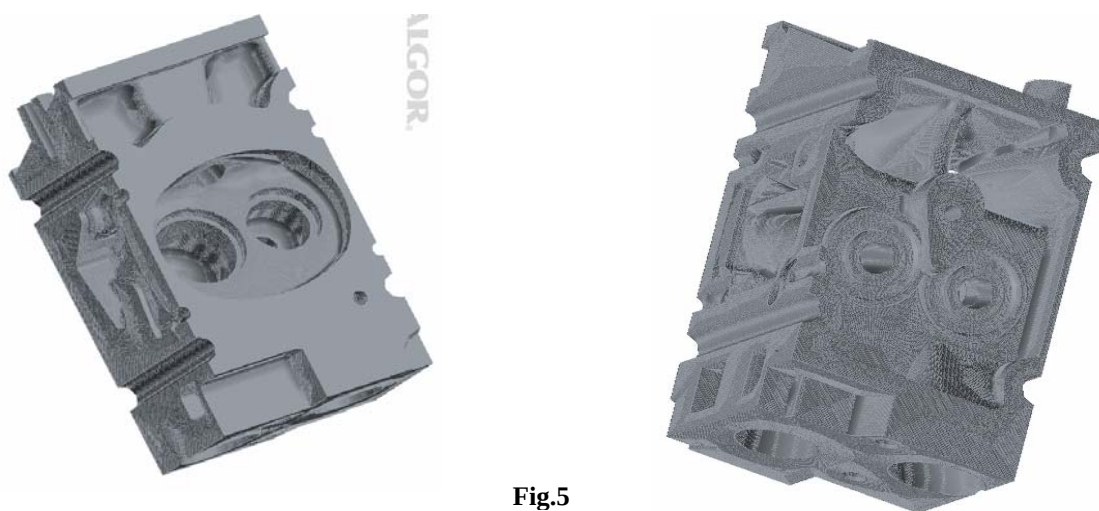


Fig.5

4. FINITE ELEMENTES ANALYSIS

During the function cycle the cylinder head is subjected to mechanical loads due of gases force pressure and bolts grip force. In the same, due of unequal heat of the different zones (with a temperature difference of 100 - 200 °C) the cylinder head is subjected to important thermal stresses. These can cause deformation and finally cracks in the bridge between admission and evacuation area. Additional stresses can appear because of the constructive pieces mounted on the cylinder head [1].

For the beginning one presents an analysis when we take into accounts only the mechanical loading. This is mean that the piece is loaded with the maximum pressure from inside the burning room having 3.5 – 5 [MPa] values [2]. The cylinder head is fixed in its constraints area (made with its 10 double-ended bolts).

Because one studies only one element of the cylinder head one set symmetry conditions.

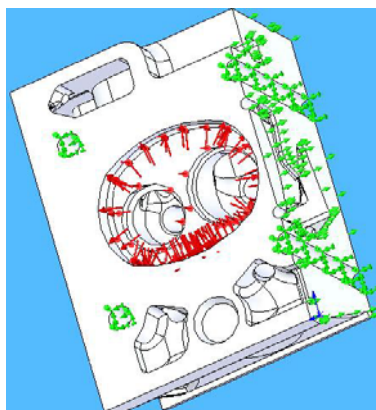


Fig.6

The analysis was made with Cosmos application from SolidWorks software. One can see the way of constraining and loading the model in figure 6, in figure 7 the resulted displacements and in figure 8 the von Mises equivalent stresses.

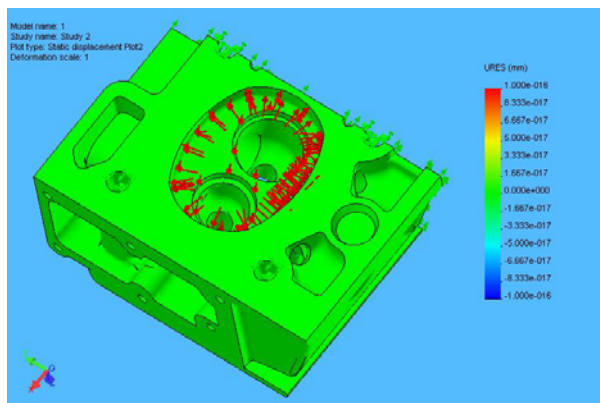


Fig.7

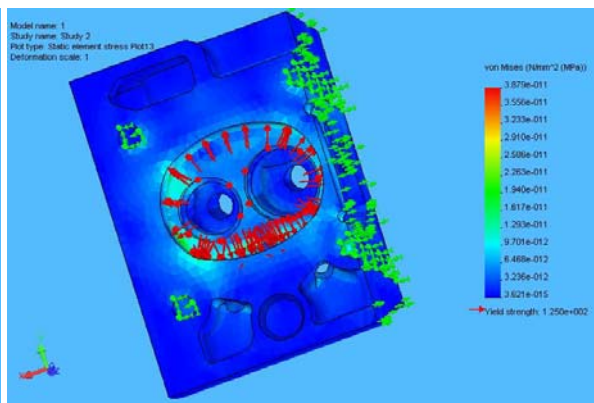


Fig.8

5. CONCLUSIONS

As you can see, the mechanical loads are reduced as values, which mean that between the valves are reduced too. Conclusively, the mechanical loads can be enclosed in the secondary loading area.

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