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ASPECTS REGARDING VIRTUAL PROTOTYPING IN EXPERIMENTAL TEST

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Abstract:*The paper presents aspects concerning the using of technical modern elements in the virtual prototyping end experimental results on the physical models .The virtual prototyping is a process which uses a virtual prototype in place of physical prototype for the testing and the evaluation of specific features of designed product. The virtual prototype is created by computer such as it could assign the specific features as close as possible to the real conditions which permit its function simulation in the conditions for which is designed. The virtual prototyping permits the replacing of efficiency classical design process in the increased conditions. Based on virtual prototype is made real prototype that is used for testing.*
Keywords : *developments, prototype, test, analyses, economy.*

1. INTRODUCTION

The physical prototype manufacturing consumes much time and is very expensive. To shorten the improvement time of product, the project evaluation has to make more quickly, the results have to directly incorporate in the design process. Such as CAD and CAE systems are used, in a large measure, in automotives design, many products features are digitally available.

This assures a large base for the projects evaluation, manufacturing planning and product electronically presentation. In the industrial practice, using simulation systems already electronically makes many projects evaluations. Therefore, the virtual prototyping answers better for man-machine interface. The virtual reality is a technology, which can assure an intuitive and realistic presentation, direct manipulation of digital models.

The modern design process has the following steps:

- The Problem Formulation
- The Design Space Exploration
- The Virtual Prototype
- The Final Prototype

This paper presents the last part of the validation of a cylinder head from the point of view of mechanical and fatigue resistance using a combination of tools and methods. Our approach combines the benefits of the Finite Element Methods with classical methods with the purpose of reducing the development time and costs.

2. DEVELOPMENT PROCESS

A complete development scheme for the cylinder head is presented below. We will make a zoom on the last steps of the development, the part validation, specially the endurance test .

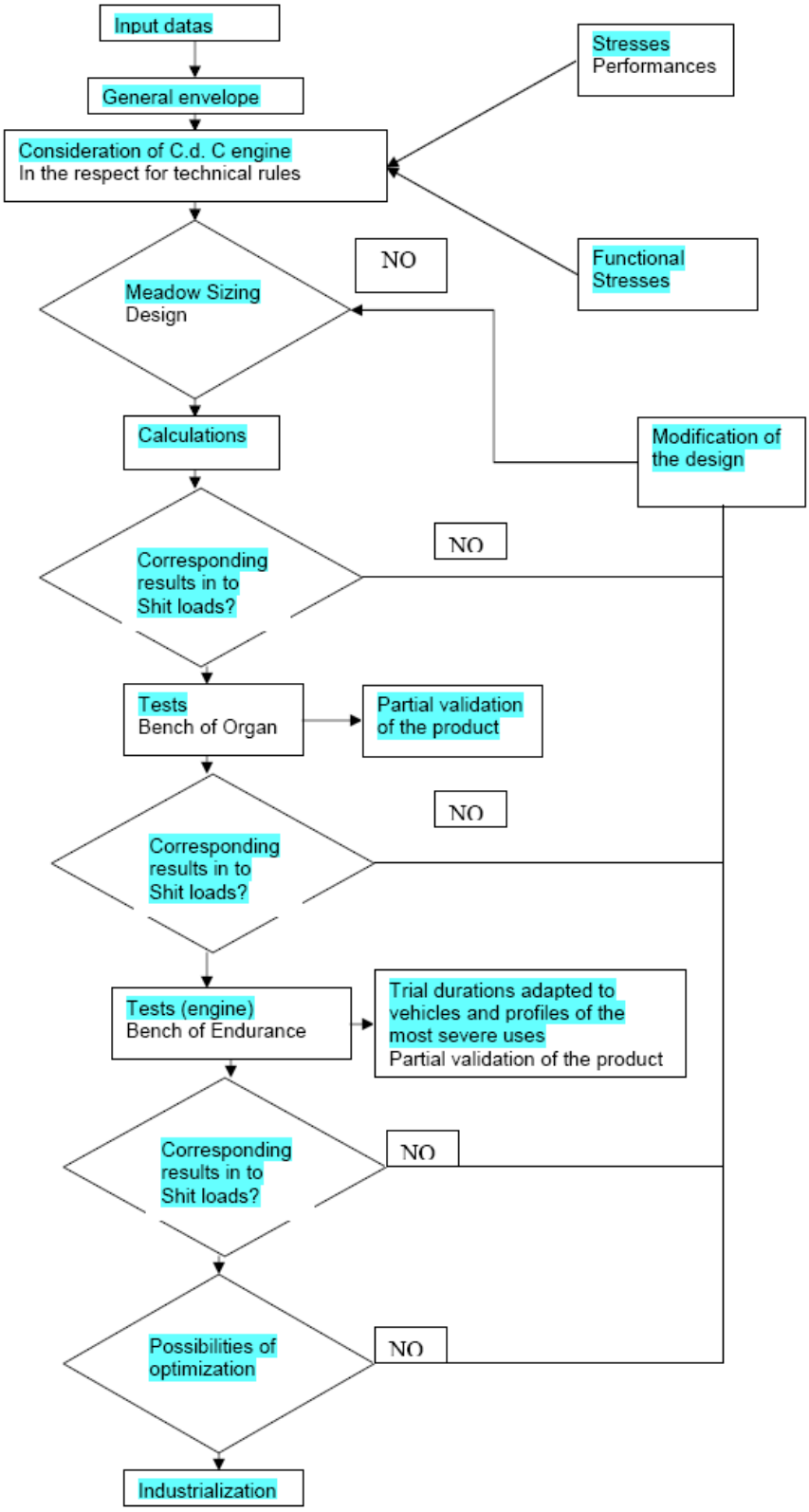


Figure1: Logical scheme

3. TEST METHODOLOGY AND RESULTS

In the validation faze of the part a simulation using the FEM was made to establish the comportment of the part to fatigue. The results show the existents of a risk zone between the two seats (figure 2)

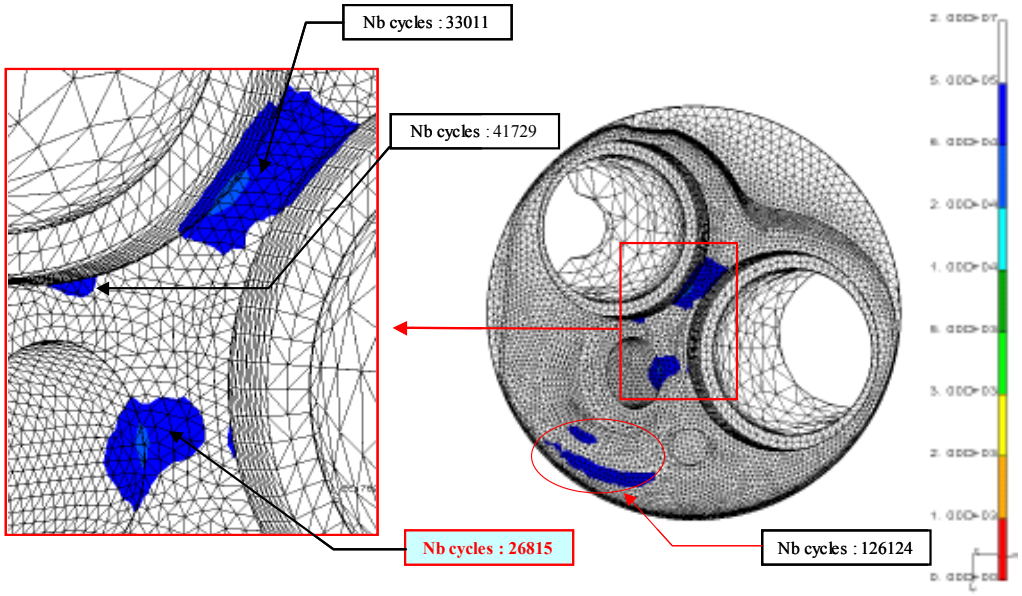
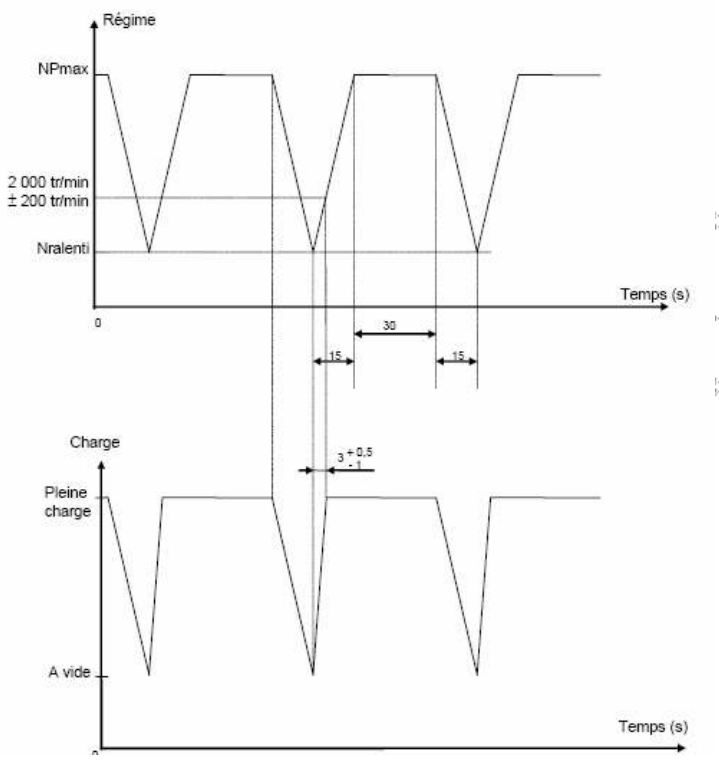


Figure 2: Risk zones

Based on that results en endurance test was carried out on the test bench that simulates the use of the engine by the most sever client. The conditions of the tests are presented in the graphs figure 3,4:



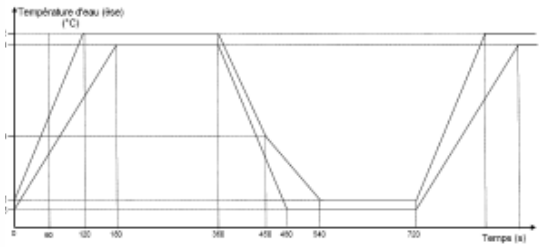


Figure 3: Test parameters

Figure 4: Test Parameters

After the test a material analyses was carried out in the risk zone do determine the modifications in the structure of the material. The part was cut as shone in the pictures bellow in figures 5 and 6

Figure 5: Cut cylinder head

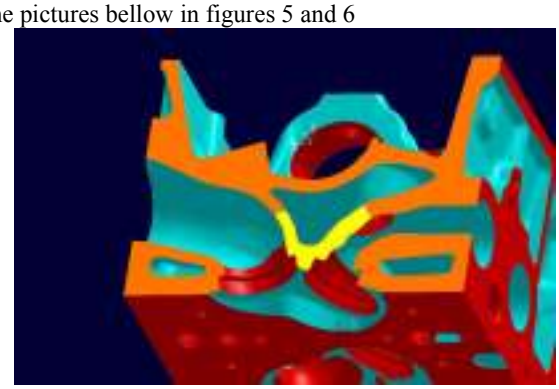


Figure 6: Analysis zone

The test reveals the existents of ranges of porosities of 1.5x0.15 mm, with a distance between ranges of 0.8-2.4 mm and a distance from the surface of 0.3 mm towards the combustion chamber and 0.5 mm towards the water chamber. The structure presents dendrites of solid solution α and network of eutectic AlSi and Al2Cu rarely constituents AlFeSi.All this modifications are inside the acceptation criteria.

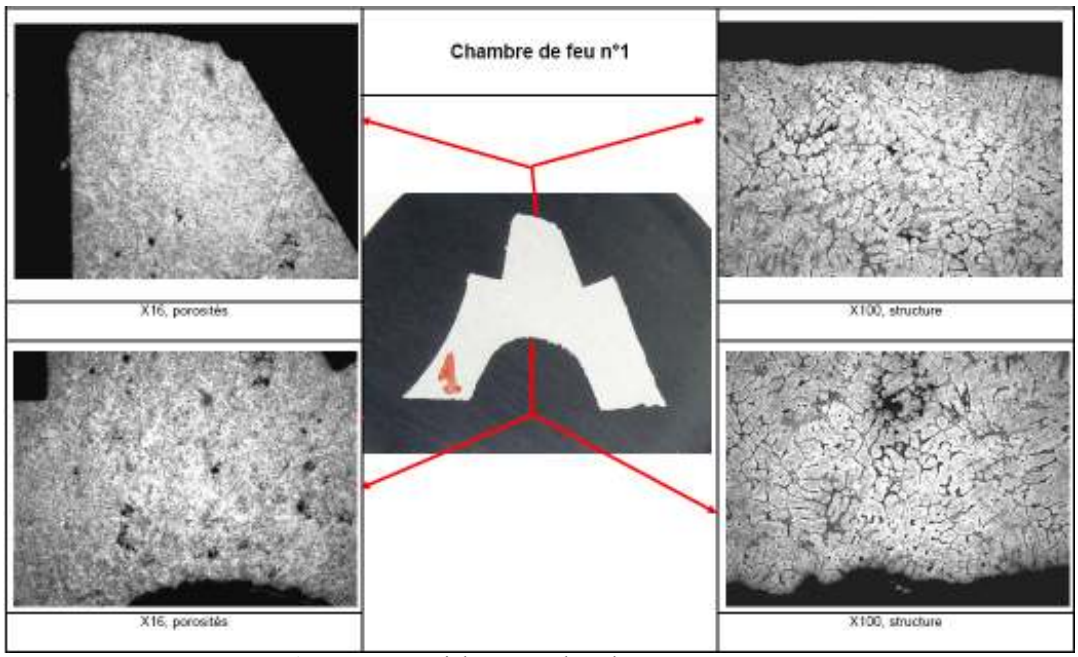


Figure 7: Material structural analyses

4. CONCLUSION

The FEM helps the reduction of the development time and costs by eliminating the tests that help determinate the critical areas in which a crack can appear. The practice shows also that this method must be accompanied by tests done one the benches who can give us an idea about the moment of the crack appearance.

In last years, at the academic level and automotives producing companies were unfurled a set of projects based on virtual prototyping and simulation which must recover and in new technical high education programs.

REFERENCES

[1] Test and Validation Department (Dacia group Renault)
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The suppliers' names, standards used and actual measurements, for the test bench of the cylinder head are strictly confidential and therefore have not been published. Only the differences were mentioned.