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DETERMINING THE SELF FREQUENCIES OF THE MAIN COMPONENTS FOR A VARIABLE COMPRESSION RATIO ENGINE

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Abstract: *An engine with gas distribution, with rotating jacket, offers a simple solution of engine distribution with few, necessary parts. Engine vibration has always been an important issue closely related to reliability and quality, while noise is of increasing importance to vehicle users and environment. Determining the self frequencies of the engine main components like crankshaft, piston-rod, piston, rotating jacket and cylinder head, can be a useful tool in reducing the vibration and noises form the engine.*
Keywords: *self frequencies, distribution, noise, vibration*

1. INTRODUCTION

Controlling vibration and noise in vehicles poses a severe challenge to the engine designer because motor vehicles have several sources of vibration and noise which are interrelated and speed dependent. In recent years, the trend has been towards lighter engines with higher engine speeds to meet the requirements for improved performances and low emissions.
Vibration arises from a disturbance applied to a flexible structure or component. Common sources of vibration in vehicles are road and off-road inputs to suspensions, rotating and reciprocating unbalance masses in engines, fluctuating gas loads on crankshafts, gear manufacturing errors, etc.

2. DETERMINING THE SELF FREQUENCIES USING ANSA SOFTWARE

The first step for all analyzed parts: crankshaft, piston-rod, piston, rotating jacket, cylinder head is to design the parts, using the software CATIA V5, to obtain a .cad type file, necessary to be imported in the ANSA software, Figure 1. Once the .cad file is imported in to the program, the next step is to obtain the volume mesh. For this, some steps are necessary to be followed: using the ANSA modules, the geometry of the part is analyzed and the eventual errors made during the design of the part are corrected-Figure 2, then the surface mesh is realized, Figure 3. After the surface mesh is analyzed and the errors are corrected, the next step is to prepare the volume mesh, Figure 4, which will be used to determine the self frequencies of the analyzed part of the engine.These steps will be used for all the parts, but for example only the piston-rod will be shown.

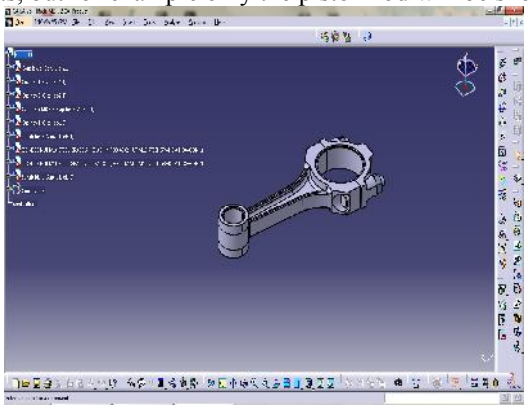

Figure 1 – Designing the part using to obtain the .cad file

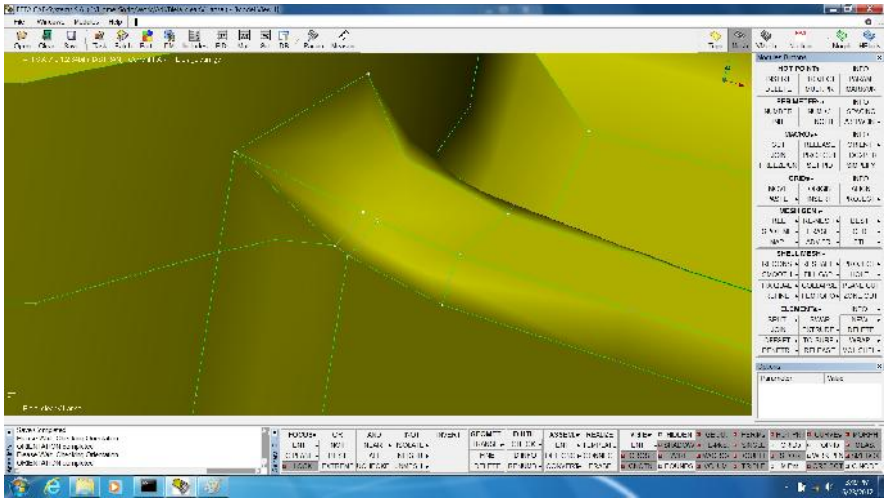

Figure 2 – The design errors of the part geometry are corrected

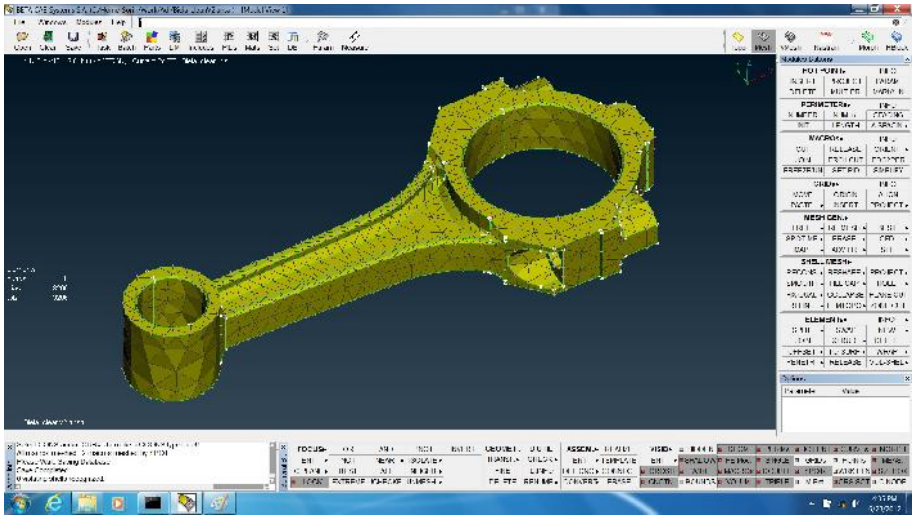

Figure 3 – The surface mesh is analyzed for errors

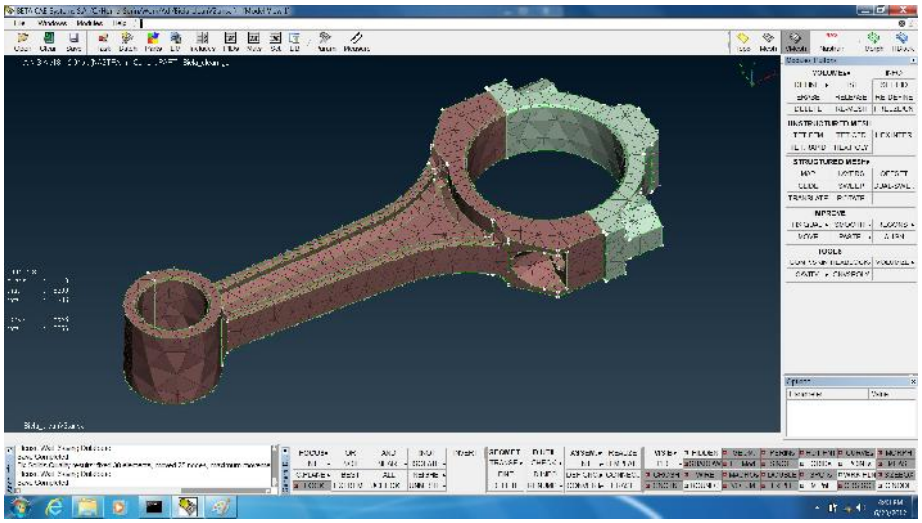

Figure 4 – The volume mesh is obtained

After all these steps are done, in the specialized module of the ANSA software that will do the analysis, the characteristics of the material of the part need to be inserted, characteristics like the weight of the part, the density of the material, the Young modulus and the Poisson coefficient. At the analyze end, the self frequencies of the parts are obtained and also a spectrum of the values, Figure 5.

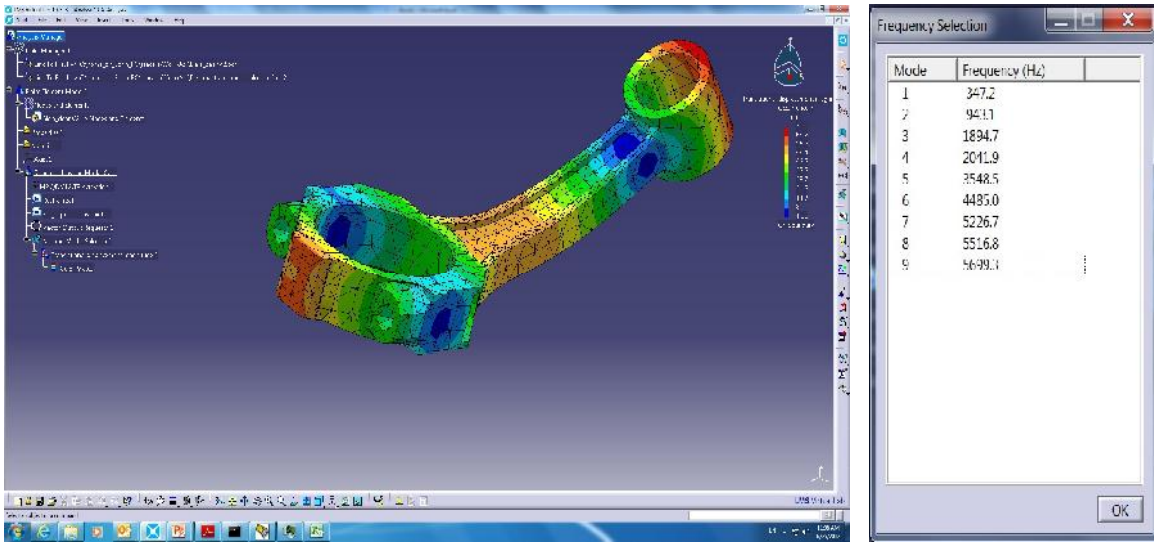

Figure 5 – The spectrum of frequencies of the analyzed part and the frequencies

3. CONCLUSIONS

The spectrum contains the natural characteristics of the system and depends only on the distribution of the masses and the elastic properties of the studied part. He is not influenced by the initial positions and velocities or by the forces which charge the system.
The results of this analysis are important to be known because they can be compared with the results obtained in laboratory conditions and the material or the design of the part that causes vibrations can be modified or eliminated.
While noise and vibrations analysis has in recent years been aided by developments in finite element and multi-body system analysis software, there is still an underling need to apply basic vibration and noise principles in vehicle design.

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