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FLUID-DYNAMIC ANALYSIS IN VEHICLE DESIGN

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Abstract: *The design of modern automotive suspension dampers for involve many simulations and tests on test stands and road tests. An accurate analysis of the conditions of flow within the damper, the required changes to the joint effect from the compressibility of the fluid flow and reaction constructive. This study elements refers to the behavior of fluid flow within the damper, the interstitial area of the piston and the ring floating. Differences are analyzed in this paper fluid flow characteristics within the context of changing damper piston diameter holes in but keep the same surface area of the retirement of the two chambers of the piston in this paper presents a specific approach to a CFD study, conducted with the use of Ansys Fluent in the area of interest was treated as non-stationary with a deformable mesh and that was only possible using LES model.*

Key words: *vehicle rolling, damper, flow, CFD, deformable mash, spectral analyze*

1. INTRODUCTION

Shock absorbers play an important role in the suspension of the car. The main function is to reduce vibration damper body and the wheel, thereby maintaining a firm and constant contact between wheel and road. Working principle of the hydraulic damper is based on transforming the mechanical energy of oscillation energy thermic. O their correct sizing results in an increase in safety but running vehicles and passenger comfort.

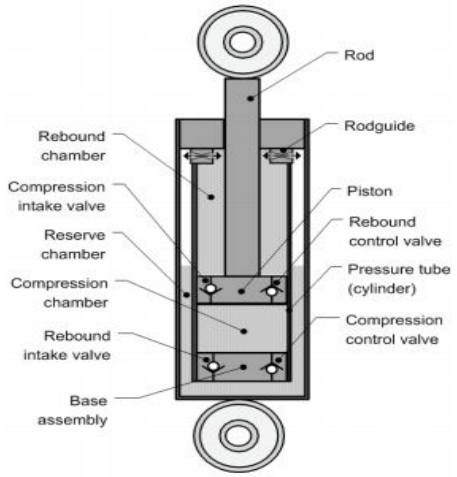

Fig.1 Damper

In the construction of a car, correct imensioning of the package arc-silencer has great importance since we are moving is stored energy from the arc passing over a bump, the compression, it try to release the energy stored by extension. This phenomenon could produces body movements would destabilize the vehicle, making driving extremely unsafe and uncomfortable. We have studied the behavior of structural elements of the piston to change the direction of travel of the piston, the piston relatively low speeds, when the critical speed is not exceeded. In these conditions the compression valve passes only the amount needed to compensate for the volume of liquid piston rod. Performing this study is necessary in order to calibrate a properly sized hole in the piston, and is produced with Ansys Fluent

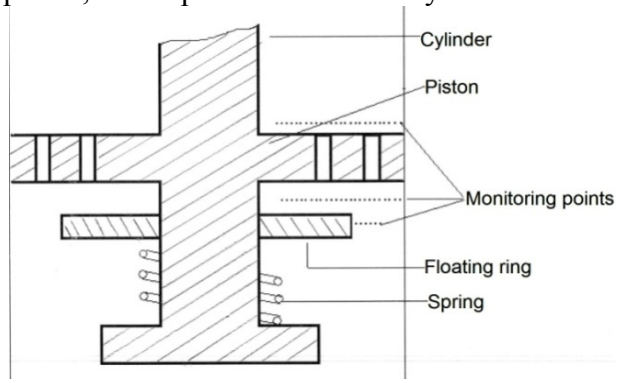

Fig.2 Piston construction

2. GEOMETRY DESIGNED

To simplify the simulation, the piston was considered fixed and mobile Wiper shutter is considered, which is pressed by a spring piston with an elasticity coefficient ka.
In the first case the simulation, the piston were made of 1 mm diameter holes, which are arranged on two concentric circles, and those in the inner circle are covered by the floating ring, on the inside diameter of the holes are closed by the Wiper shutter when in that it is attached to the piston.

For the second case simulation has grown piston diameter holes from 1 mm to 1.2 mm, but reduced the number of holes, so that the sum of the areas of these holes remains constant.

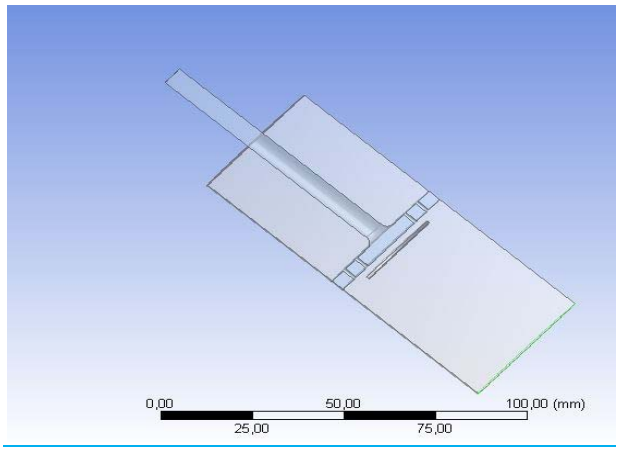

Fig.3 Damper geometry

3. MESHING AND INTRODUCING LIMIT CONDITIONS

Meshing was performed following areas of interest, ie holes in the piston and near the blade shutter. Doing so to highlight the fluid dynamics and pressure of the field you click on it, forced it to close or far from the piston. Because the shutter wiper piston moves from using a mesh dynamic.

Meanwhile in the area of interest were put pressure monitoring points, their position is presented in Figure 2.

In the order to perform the simulation, have been laid down of movement of the piston (ie input and output conditions of piston) as an alternating motion of the fluid, the piston was being considerably fix and speed variation is sinusoidal with a phase shift π, between input and output.

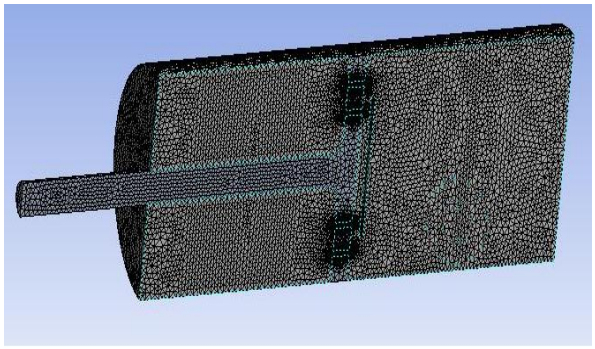

Fig.4 General mesh

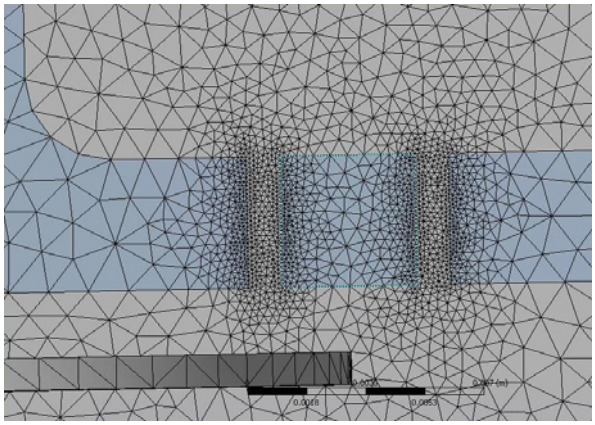

Fig.5 Mesh detail

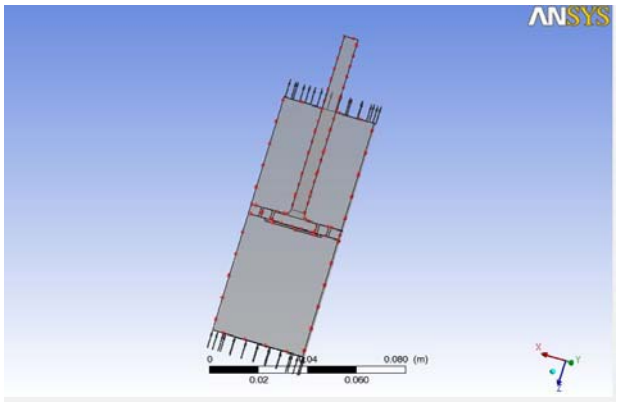

Fig.6 Conditions of entry

4. RESULTS

In the the simulations have been run a number of initial data sets to see the variation of pressure and flow rate in areas of interest, and the shutter lamella movement under the action of fluid pressure.

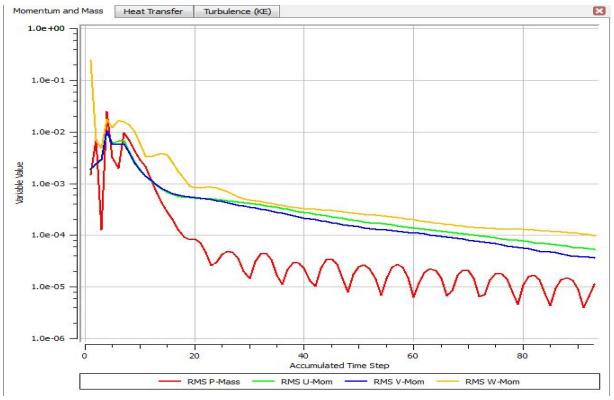

Fig.7 Root mean square

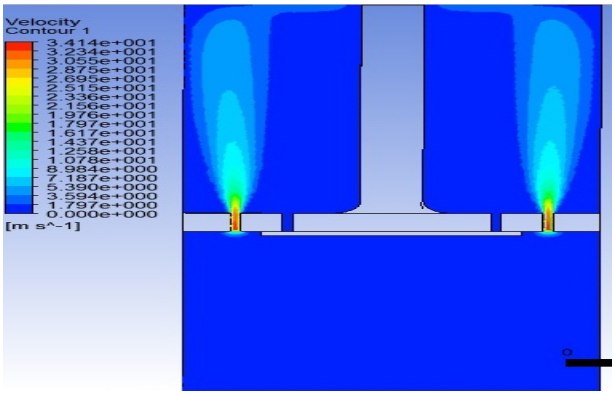

Fig. 8 Field gear with the valve locked

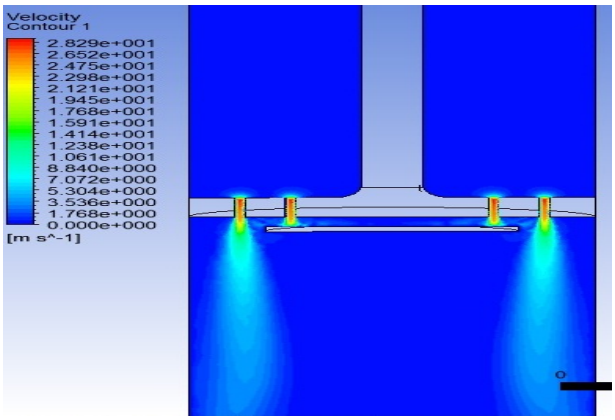

Fig.9 Field gear with the valve unlocked

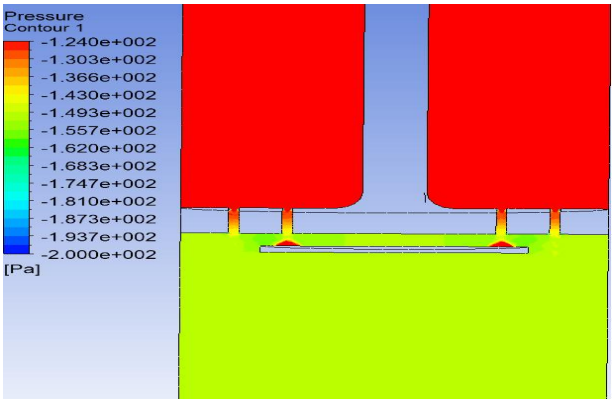

Fig.10 Field pressure

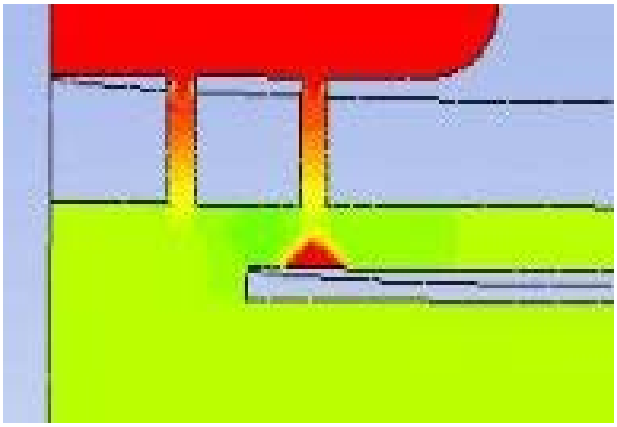

Fig.11 Zoom valve opening pressure field

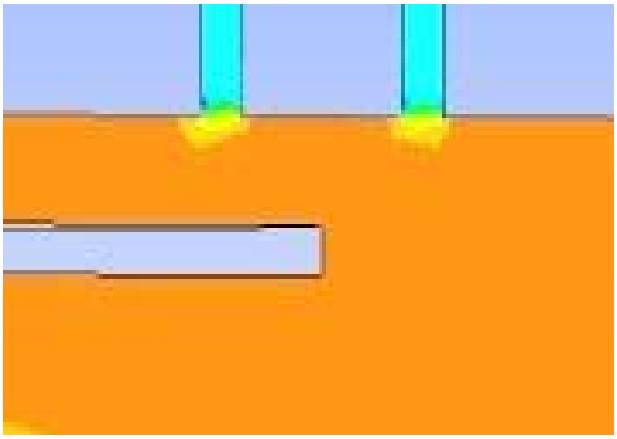

Fig.12 Zoom valve closing pressure field

Because the working fluid viscosity, solid shutter delay moves compared to the piston design which requires finesse crossing surface area in relation to surface area is covered from spring to compression phase. Pressure values at these points were exported Matcad and variation or drawn graphs presented in Figure 13and 14

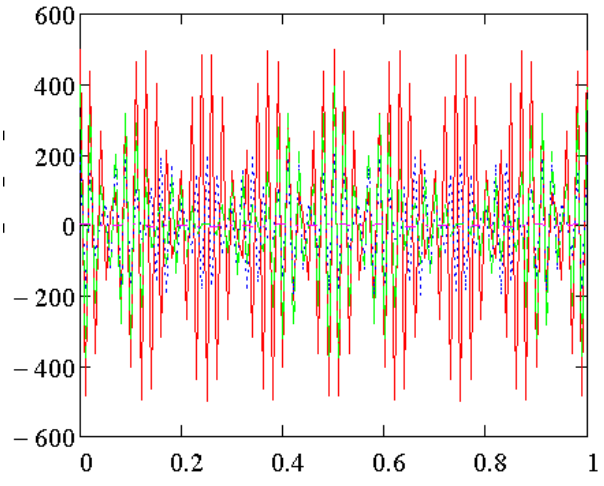

Fig.13 Pressure variation, 1mm hole

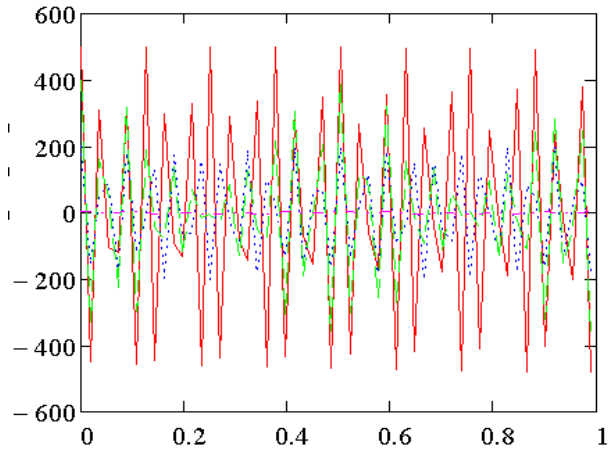

Fig.14 Pressure variation, 1.2mm hole

5. CONCLUSION

Because the working fluid viscosity, solid shutter delay moves compared to the piston, the delay is even greater as the diameters of the holes are smaller, though still the same surface area of transition between the two chambers of the damper. This delay is due to both fluid viscosity, and its behavior into the gaps between the floating the piston and ring. Damping coefficient, if a damper is not set found and how its variation should be carefully studied to safe driving combines passenger.

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ANALIZA FLUIDO-DINAMICA IN CONSTRUCTIA AUTOVEHICULULUI

Rezumat: In prezenta lucrare, sunt analizate diferentele caracteristicilor de curgere ale fluidului in contextul modificarii diametrului orificiilor din piston dar, pastrand aceeasi arie a suprafetei de trecere intre cele doua camere ale pistonului. Analiza se refera la comportamentul de curgere a fluidului in interiorul amortizorului in zona interstitiala dintre piston si inelul flotant.O analiza exacta pe acest domeniu este impusa de efectul mixt ce provine din schimbarile de compresibilitate in fluxul de fluid si reactia elementelor constructive ale acestuia.

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