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Optimization Of Fluid Acoustic Of A Motor Bike Intake Airbox Using Fe Analysis

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ABSTRACT

Engine noise quality and level controlling in IC vehicles is the key feature of a Power train system design process of a new vehicle, so the legislation limits are also satisfied and exterior sound is provided.

In this thesis, a motor bike intake air box is analyzed for reduced noise from the engine. Different configurations of the intake air box will be considered and investigated for the reduced noise by analysis. 3D models of the original and modified configurations of intake air box are done in CREO 2.0.

Acoustic analysis is performed in CFD fluent in ANSYS 14.5 to determine acoustic power levels and pressure for all models using materials E Glass and aluminum alloy for air box and compared for the optimal model. Static structural analysis is done on the models to determine stresses and deformations

INTRODUCTION

In almost all combustion engines on the inlet an air box is an empty chamber. Air is collected from outside by air box and it is fed in to the each cylinder intake hoses. Air from the surroundings is directly driven in to individual carburetor in older engines. But in modern engines air is instead drawn in to an air box, and then forwarded to each carburetor through hoses connected individually or on to the fuel injected engines intake, so avoiding an additional manifold. The air box permits the employment of one air filter instead of the many. Developments arising from considerations regarding environmental impacts throughout the late Seventies enable the air box to gather pump gases from the housing and also the tank air vent and re-feed them to the engine.

Air from the surroundings is directly driven in to individual carburetor in older engines. But in modern engines air is instead drawn in to an air box, and then forwarded to each carburetor through hoses connected individually or on to the fuel injected engines intake. This permits the employment of 1 filter rather than several, and permits the designers to take advantage of the properties of air to enhance performance.

Noise Prediction for Air box

Reduction strategies for Intake Noise strategies for reduction of noise are for the most part divided into three varieties that embrace the strategy of putting in a resonator, the strategy of employing a sound-absorbing material, and application of a specific groove form at inlet of compressor. Recently, as studies on optimum resonators design are being actively conducted to reinforce completeness of vehicles, those embrace porous duct capable of reducing the quantity of resonators for intake system albeit a high production cost and reverse flow-type silencer wherever a resonator applied to air filter interior is hooked up while not outside exposure of the resonator. Conjointly as an optimum improvement measure of intake flow sound, heterogonous studies are being conducted on optimum shapes of the groove positioned at the inlet of compressor

LITERATURE REVIEW

The approaches developed and applied for the optimization process range from the 1D to fully 3D CFD simulation

Air box and filter play major role in getting good quality air into car engine. It improves the combustion efficiency and also reduces air pollution

Tire noise, road noise, wind noise, combustion noise, inhalation noise, etc. impacted the interior noise of an automobile

INTRODUCTION TO CAD

Cad (Computer assisted style) is that the Use of laptop computer code to style and a Product's Design method can be documented. Engineering Drawings entail the utilization Of Graphical Symbols like Points, Curves, Lines, Shapes and Planes. Basically, it offers elaborated Description concerning any element during a Graphical type.

CAD facilitates the producing method by transferring elaborated info a few product in an automatic type that may be universally understood by trained personnel. It is often accustomed turn out either two-dimensional or three-dimensional diagrams. The utilization of CAD computer code tools permit the article to be viewed from any angle, even from the within looking. One among the most blessings of a CAD drawing is that the redaction could be a V quick method as compared to manual methodology.

Introduction to CREO 2.0

CREO is developed since 2009 by PTC, and announced it using the code name Project Lightning at Planet PTC Live, in Las Vegas, in June 2010. In October 2010, PTC unveiled the product name for Project Lightning to be CREO. PTC released CREO 1.0 in June 2011.

Introduction to FEA

The finite element method (FEM) is a numerical method for determination issues of mathematical and engineering and mathematical physics. It's additionally noted as finite component analysis (FEA). Typical areas of interest include structural analysis, heat transfer, fluid flow, electromagnetic potential and mass transport. The analytical solution of these issues typically needs the answer to boundary price problems for partial differential equations. The finite component methodology formulation of the matter leads to a system of algebraic equations. The tactic yields approximate values of the unknowns at separate range of points over the domain. To solve the matter, it subdivides an outsized drawback into smaller, less complicated components that area unit known as finite parts. The easy equations that model these finite parts area unit then assembled into a bigger system of equations that models the complete drawback. FEM then uses variation methods from the calculus of variations to approximate {a solution an associate degreaser} by minimizing an associated error operate.

Introduction to ANSYS

ANSYS Mechanical is a finite component analysis tool for structural analysis, together with linear, nonlinear and dynamic studies. Providing model behavior, supporting material models and equation solvers for a large vary of mechanical style issues is done by this product of computer simulation. ANSYS Mechanical additionally includes thermal and coupled-physics capabilities which

involve piezoelectric, thermo-electric analysis thermal–structural and acoustics.

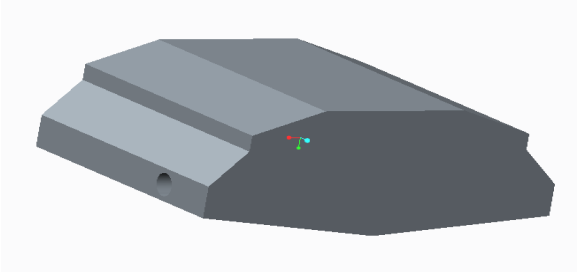
Introduction to CFD

Computational Fluid Dynamics (CFD)) is that the fluids engineering simulation utilizing modeling (mathematical physical drawback formulation) and numerical ways (discretization ways, numerical parameters, solvers & grid generations first off, we've got a fluid drawback. to unravel this drawback, we must always recognize the fluid physical properties by utilizing hydraulics. Then we will employ mathematical equations in order to explain these physical properties. This can be Navier-Stokes Equation and it's the CFD governing equation. Because the Navier-Stokes Equation is analytical, man will know it and can solve them on a bit of paper

3D MODELING AND ANALYSIS OF AIR BOX

3D Modeling In CREO 2.0

In the original model the inlet and outlets are on the same side of air box but it's a curved pipe. In the modified model 1, the inlet is on left and outlet is on right of air box. In the modified model 2 the inlet and outlet are on same side of air box with a straight pipe.

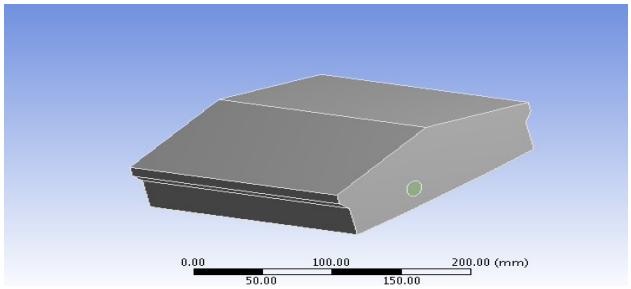


CFD ANALYSIS

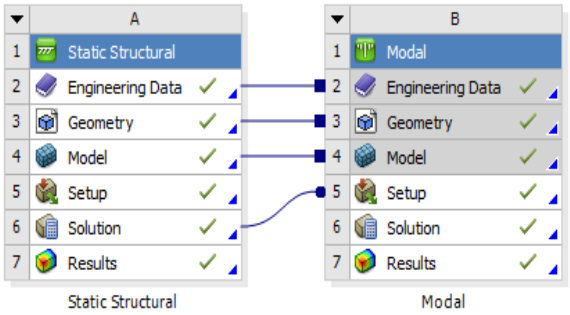
After modeling the air box part in CREO 2.0 it is saved in .igs format.

Open CFD Fluent in ANSYS Workbench and import the saved .igs file in to ANSYS.

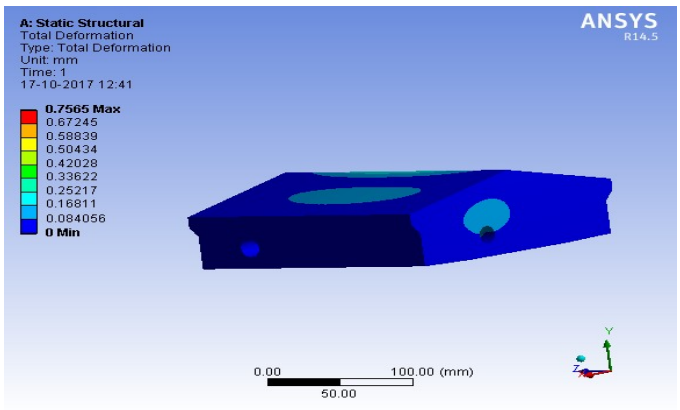
Edit the Model to enter in to the Meshing module



STRUCTURAL-MODAL ANALYSIS FOR AIR BOX



Static Structural Window in ANSYS Workbench



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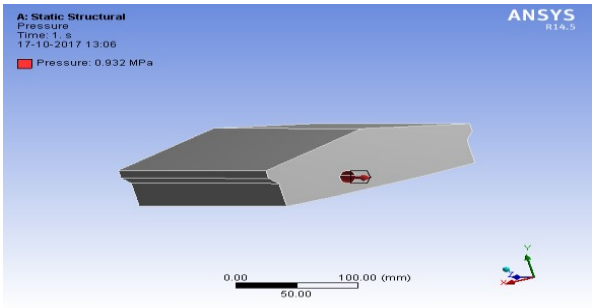
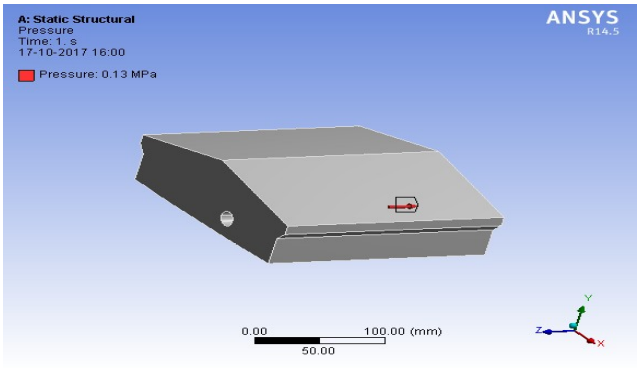
Total Deformation for E-glass

Aluminum

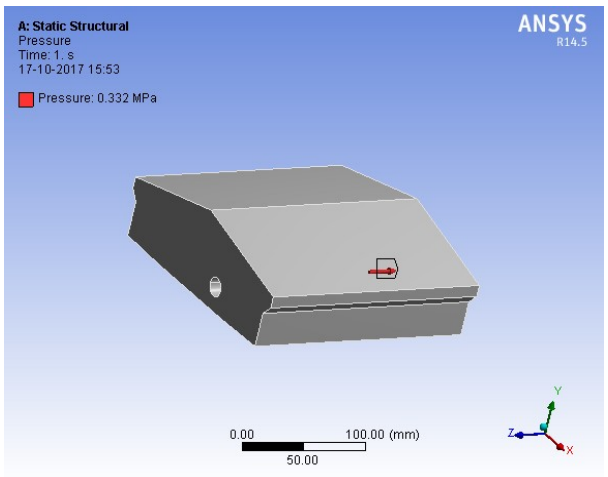


Pressure Is Applied To the Air Box and It Is Taken From the CFD

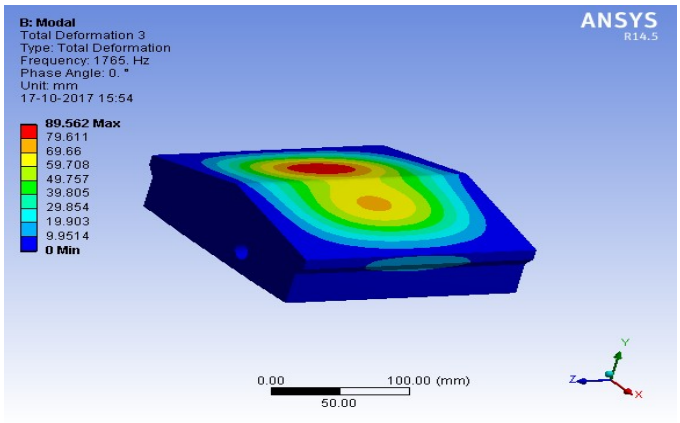


Pressure Is Applied To the Air Box and It Is Taken From the CFD-Modified Modal 2

E-Glass



Pressure Is Applied To the Air Box and It Is Taken From the CFD-Modified Modal 2



Mode 3 for E-Glass Material -Modified Modal 2

RESULTS & DISCUSSIONS

By observing above result table, we can say that

1. Considering pressure(Pa) result

a. The aluminum material is taken and used for the air box, by observing results for original and modified model, 99% of pressure is reduced at the modified model. Similarly, for modified modal 1 and 2, 2nd modal getting 83.7% less pressure.

b. The E-glass material is taken and used for the air box, by observing results for original and modified model, 99.2% of pressure is reduced at the modified model. Similarly, for modified modal 1 and 2, 2nd modal getting 83.62% less pressure.

c. Now, compare to aluminum and E-glass for original modal. The pressure is increased 2.6% for E-glass. For modified modal 1 and 2 pressures is 1.23% and 2.2% increased.

2. Considering Acoustic power level (dB) result

d. The aluminum material is taken and used for the air box, by observing results for original and modified model, 3.82% of dB is reduced at the modified model. Similarly, for modified modal 1 and 2, 2nd modal getting 0.5% less dB.

e. The E-glass material is taken and used for the air box, by observing results for original and modified model, 2.2% of less dB at the modified model. Similarly, for modified modal 1 and 2, 2nd modal getting 1.14% less dB.

f. Now, compare to aluminum and E-glass for original modal. The Acoustic power level (dB) is decreased 2.7% for E-glass. For modified modal 1 and 2 pressures is 1.13% and 1.17% decreased for E-glass.

Modal Analysis

By observing above result table, we can say that

1. Considering Frequency (Hz) result

a. The aluminum material is taken and used for the air box, by observing results for original and modified model, 0.2% of Frequency is reduced at the modified model. Similarly, for modified modal 1 and 2, 2nd modal getting 0.141% less Frequency.

b. The E-glass material is taken and used for the air box, by observing results for original and modified model, 0.81% of Frequency is reduced at the modified model. Similarly, for modified modal 1 and 2, 2nd modal getting 34.08% less.

c. Now, compare to aluminum and E-glass for original modal. The Frequency for modified modal 2 is 23.5% is decreased for E-glass.

So, the Frequency (Hz) is gradually decreasing for original to modified 1 to modified 2 for each material and modes.

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