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Design and Static Structural Analysis of Light Vehicle Brake Drum with Various Materials

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Abstract: The point of the study is to outline and investigation of brake drum with different material including the substitution of existing material and the mechanical properties of the drum material which is utilized to stop the movement of the vehicle at different velocities. The current material is outlined and the investigation is completed and contrasted and the proposed material.

Key words: Different, mechanical, movement, vehicle, investigation, India

INTRODUCTION

A brake drum is a metal chamber to which weight is connected by a braking component keeping in mind the end goal to capture revolution of the wheel or shaft to which the barrel is appended (Xun and Jian, 2005). A drum brake is a brake that utilizations contact created by an arrangement of shoes or cushions that press against a pivoting drum-molded part called a brake drum (Corolla and Lang, 1991). The working rule of the drum brakes includes an arrangement of shoes or cushions that make grating against a drum associated with the turning wheel (Xinchao and Dihua, 1993). Brake drum parts incorporate the back plate, brake drum, pump, wheel chamber and different springs and sticks (Qian-jin, 2008). Louis renault created brake drum in 1902. He utilized woven asbestos lining for the brake drum lining as no option scattered warmth like the asbestos lining. However, Maybach has used a less new brake drum (Huang *et al*., 2006). In the first brake drums, levers and bars or links worked the shoes mechanically. From the mid-1930's, oil weight in a little wheel chamber and cylinders worked the brakes, though small vehicles proceeded with entirely mechanical frameworks for quite a long time (Day *et al*., 1984). A few plans have two wheel chambers. The shoes in brake drums wear more slender. Mechanical and morphological properties of PP/MWNT/MMT hybrid nanocomposites is discussed (Blaschke *et al*., 2000; Selvakumar and Manoharan, 2014). An evaluation of machining parameters influencing thrust force in the drilling of Al-SiC-Gr metal matrix composites using RSM is considered (Raj, 2014). Effect of MWNTs on mechanical properties of PP/MMT nanocomposites is explained (Manoharan and Selvakumar, 2014).

Figure 1 shows the revolve shape of the light vehicle wheel drum. The revolving shape of the brake drum is modelled by the SolidWorks Software. The dimensions of the wheel drum is taken from the present light vehicle wheel drum.

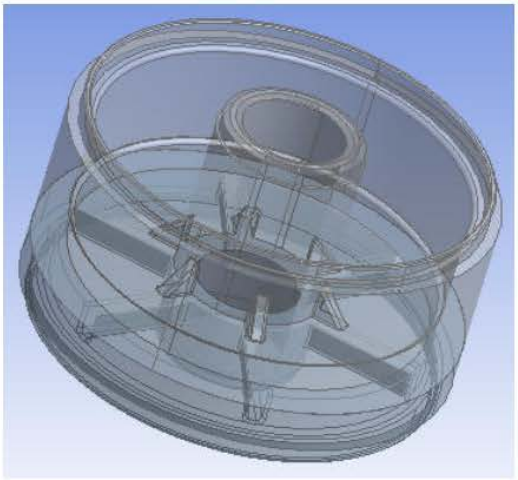

Fig. 1: Brake drum

MATERIALS AND METHODS

To make the lowlife model of the brake drum, we locate the current brake drum of Hero Honda Passion from showcase for figuring out. We can gauge all the noticeable measurements physically with determined measuring instruments to make precise and scaled model. To discover precise element area like openings plane edges, etc. CMM is finished. Utilizing CAD programming we can make CAD Model of brake drum according to estimation information we import the CAD Model (IGES) in the ANSYS WorkBench 14.5 for pre-preparing and after that the anxiety and warm investigation is done on the brake drum. The analysis includes the discritization called

coinciding, limit conditions and stacking. For examination, we bring aluminum with aluminum combinations and controlled development compounds as the material. The aluminum has been chosen in light of the properties required for the current brake drum. The aluminum amalgams has been chosen as framework for assembling the MMC in view of the simplicity of assembling.

Designing of brake drum: In the Fig. 2, the 3D Model of the light weight vehicle is modelled by the present dimensions. The 3D Model of the brake drum is created by the mechanical designing software.

Meshing of brake drum: Routine with regards to producing a polygonal which approaches the geometric space which makes the era of the lattice. The physical reenactment for any is to make the necessary determination in analyzing cross section is utilized.

In the Fig. 3, the meshing model of the light weight vehicle wheel drum created by the ANSYS WorkBench Software. ANSYS Software is commonly used software in the industries. The 3D Model is created by the SolidWorks Software and it was extrude to the ANSYS WorkBench Software.

Analysis of disk brake: The analysis of drum brake and brake pad models are carried out using ANSYS Software using finite element method. Firstly the model files prepare in the solidworks software. Then are exported to ANSYS Software as an IGES files as shown in Fig. 4-6.

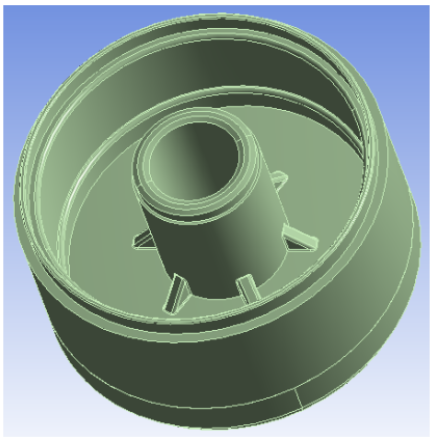

Fig. 2: 3D Model of brake drum

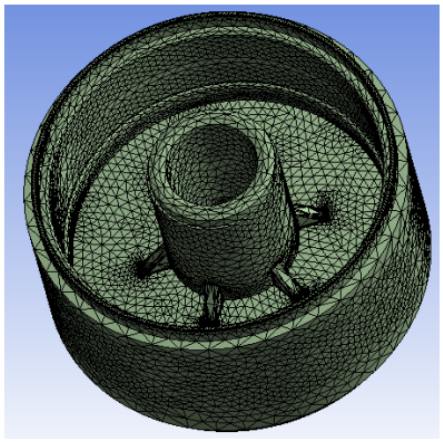

Fig. 3: Meshing model of brake drum

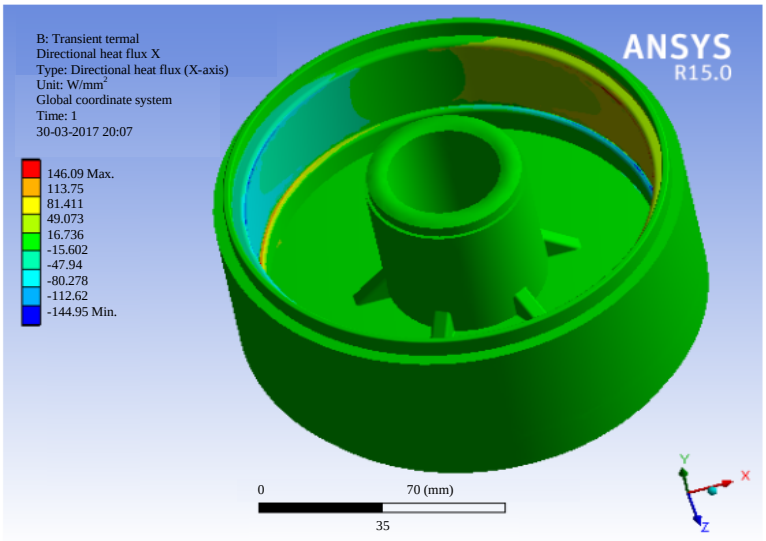

Fig. 4: Directional heat flux of brake drum

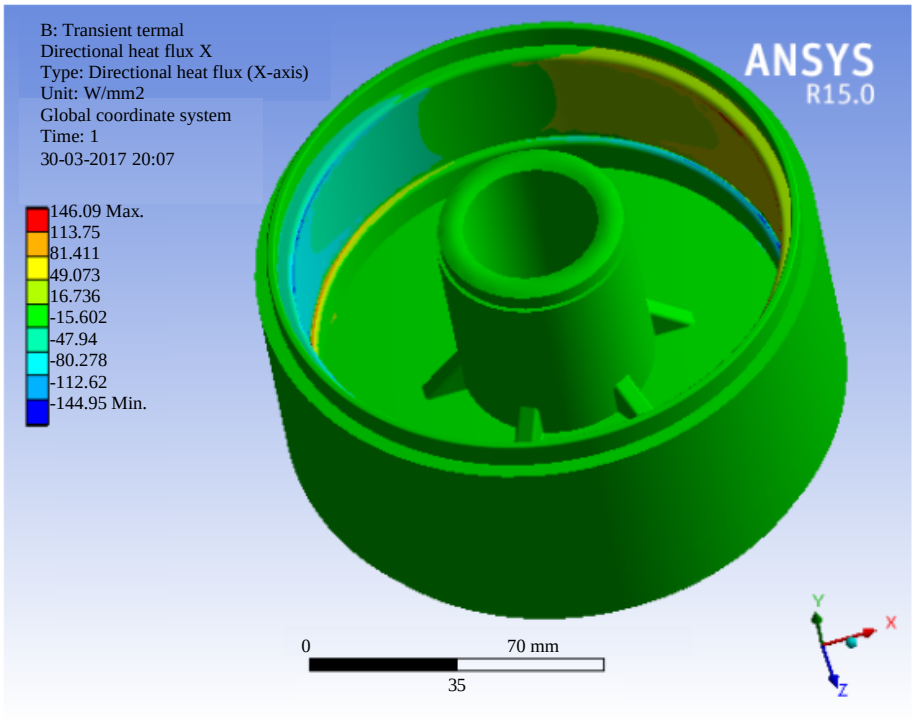

Fig. 5: Temperature deformation of brake drum

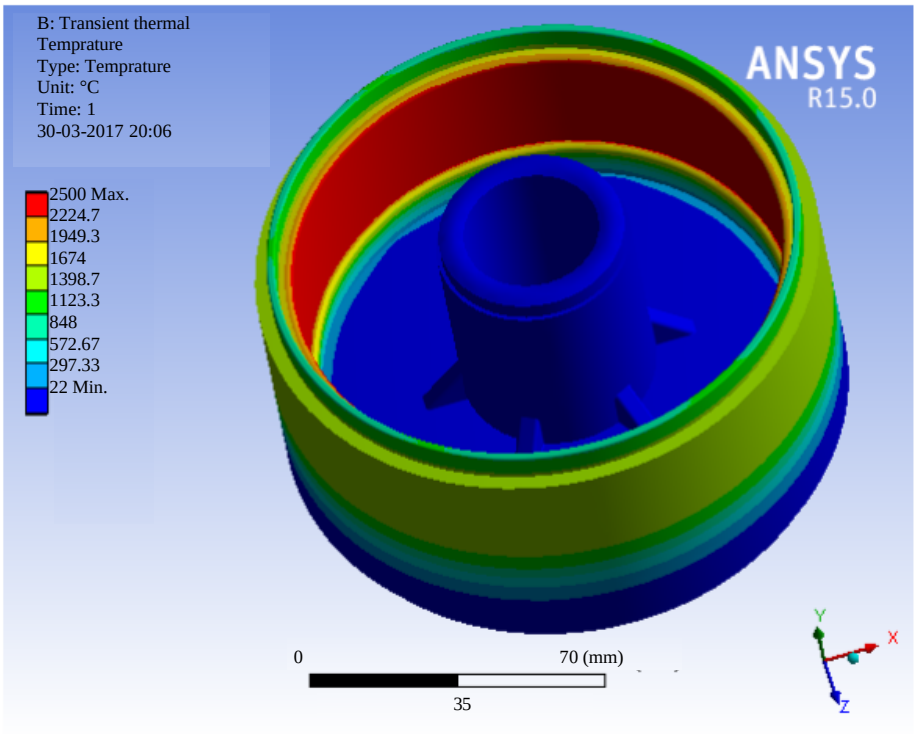

Fig. 6: Strain deformation of brake drum

Figure 4 shows the directional heat flux according the give temperature. This figure is known as the result of the brake drum which is got from the ANSYS WorkBench (Fig. 5 and 6).

Stress and strain deformation: In Fig. 5, the temperature deformation is showed. The above result is taken from the ANSYS WorkBench Software. The blue color in the fig denotes the minimum temperature in the wheel drum. The red color denotes the maximum temperature of the wheel drum.

Figure 6 is denotes the strain deformation of the light vehicle wheel drum. The deformation value is taken from the ANSYS WorkBench Software according the thermal conditions.

RESULTS AND DISCUSSION

For examinations of the outcomes got from the static investigation result (Table 1-3) it is reasoned that aluminum 2102 show slightest anxiety and minimum disfigurement and strain an incentive on same static load condition. The result of all materials which has been taken from the ANSYS WorkBench is tabulated in Table 3. From the modal examination result tables it is reasoned that aluminum 2102 shows less distortion comes about for given recurrence. Henceforth, for both structural and modal analysis aluminum 2102 done effectively. It is best appropriate material for brake drum for the light vehicle.

Table 1: Existing properties of brake drum

Properties	Values
Volume	680.14 mm^3
Material (Al alloy)	
Coordinates (type)	Cartesian
Mass	6.652e-003 kg
Nodes	201
Elements	140

Table 2: Properties of proposed material

Materials	Al 5210
Density	10.32 g/cm^3
Yield strength	28 MPa
Compressive strength	3600 MPa
Modulus of elasticity	240 GPa
Vickers hardness	2471
Thermal conductivity	0.12

Table 3: Results of ANSYS WorkBench

	Results		
Materials	Stress	Displacement	Sliding contact
Aluminum	18.25	0.48e-3	0.854e-5
Aluminum 2102	11.56	0.32e-3	0.201e-4
Cast iron	25	0.85e-3	0.125e-4

CONCLUSION

Thus, the modeling and analysis part shows the strain and stress constants in the field of research and the values has been derived.

REFERENCES

Blaschke, P., M. Tan and A. Wang, 2000. On the analysis of brake squeal propensity using finite element method (No. 2000-01-2765). SAE International, Warrendale, Pennsylvania, USA. http://papers.sae.org/2000-01-2765/

Crolla, D.A. and A.M. Lang, 1991. Paper vii (i) brake noise and vibration-the state of the art. Tribol. Ser., 18: 165-174.

Day, A.J., P.R.J. Harding and T.P. Newcomb, 1984. Combined thermal and mechanical analysis of drum brakes. Proc. Inst. Mech. Eng. Part D. Transp. Eng., 198: 287-294.

Huang, J., C.M. Krousgrill and A.K. Bajaj, 2006. Modeling of automotive drum brakes for squeal and parameter sensitivity analysis. J. Sound Vibr., 289: 245-263.

Manoharan, N. and V. Selvakumar, 2014. Effect of MWNTs on mechanical properties of PP/MMT nanocomposites. Biosci. Biotechnol. Res. Asia, 11: 135-141.

Qian-jin, M.X., 2008. Transient temperature simulation of a braking drum. Mach. Des. Manuf., 6: 1-31.

Raj, A.M., 2014. Evaluation of machining parameters influencing thrust force in drilling of Al-SiC-Gr metal matrix composites using RSM. Intl. J. Eng. Technol., 6: 2426-2434.

Selvakumar, V. and N. Manoharan, 2014. Mechanical and morphological properties of PP/MWNT/MMT hybrid nanocomposites. Intl. J. Eng. Technol., 6: 2351-2356.

Xinchao, Z. and G. Dihua, 1993. The experimental and simulational analysis on drum brake squeal by structurally closed-loop coupling model (No. 931879). SAE International, Warrendale, Pennsylvania, USA. http://papers.sae.org/931879/

Xun, M.A. and Q.I.N. Jian, 2005. Thermal stress coupling analysis of brake drum based on FEM. Mach. Des. Res., 1: 1-21.