Research Paper Engineering

Stress analysis for Handle-Bar Housing at the Accelerator of two Wheeler

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ABSTRACT

The steel pipe constituting a member of the handle bar of the two-wheeler is assembled with the thermo-plastic casing and secured in place with a cross pin and the two-halves of the case are in turn secured with two screws. This assembly is subjected to DIFFRENT loads, while the rider holds the grip of the accelerator and uses it as a support. Besides, the same is also subjected to buckling loads while the rider accelerates or decelerates suddenly or even while braking.

For this dissertation work, the torsion loading (individually) is considered to be studied and analyzed using NASTRAN (or any other suitable FEA software). The torsion loads in the `clockwise' and `anticlockwise' directions are also considered for treatment over this dissertation work. Recommendation for safe load values in `torsion' would be provided at the end of the thesis. Further scope for `torsion-buckling' combined analysis would be useful to analyze the problem for occasional loads experienced of this nature.

Keywords : Handle Bar Housing, Upper casing, Lower casing

INTRODUCTION

0.1 OVERVIEW

The two wheeler and the four-wheeler industry is normally faced with challenges related to safety. The compliance of vehicle in this regard is of utmost importance while the same could be approved by the concerned regulatory authorities for being used on the public roads. Besides, all other parts and components that support and/or form an integral part of the assembly of the sub-system could be required to comply with the norms.

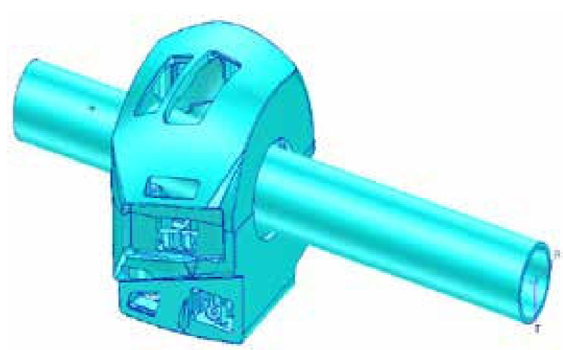
The other areas attracting compliance are the warranty claims received from the customer during usage over the field or the report filed by the concerned field Engineer observing the field test for the vehicle. The breakage and/or damage to the component could be highlighted during the time the vehicle is put to actual use. The scope of this dissertation work falls in this area where the design of the component or the sub-assembly needs to be reviewed for the sake of failure during use.

For our case, the lower case of the handle bar is met with failure near the accelerator end of the handle. A study is being initiated by the sponsoring company for identifying the source of this failure and addressing the same with modified or improved design feature/s for reducing the incidence of failure. The material in this case is Nylon-6 (30% glass-filled).

Thermoplastics are perhaps the most important kind of polymer used in the manufacturing of components. They are easy to process, can be very ductile and resistant to corrosion. Typical applications include the automotive industry, piping, containers and packaging devices. Such a large number of applications require a more detailed structural analysis which, in turn, can only be reliably performed if the material behavior is well understood. There has been a substantial research effort during the last decades to understand polymers behavior, including its dynamic response. However, it is clear that thermoplastics models still require further improvements. In any event, constitutive models rely on material parameters that must be measured. Hence, any knowledge of the response of polymers to load, temperature, environment, etc. is important. In the case of structures undergoing large strains and dynamic loads, the material model should contemplate strain rate effects on its response, as it has been discussed for polymers.

0.2 CASING OF HANDLE BAR AND ITS APPLICATION

Casing (Housing) of handle bar is an part mounted on handle bar. This casing (Housing) consist different switches, knobs, buttons etc. This part is near to accelerator on right hand side. The pictorial view is as given bellow.



This part is subjected to failure during working & within warranty period .

0.3 OBJECTIVE AND SKELETON OF PROJECT

The steel pipe constituting a member of the handle bar of the two-wheeler is assembled with the thermo-plastic casing and secured in place with a cross pin and the two-halves of the case are in turn secured with two screws. This assembly is subjected to torsion loads while the rider holds the grip of the accelerator and uses it as a support. Besides, the same is also subjected to buckling loads while the rider accelerates or decelerates suddenly or even while braking.

For this project work, the different loadings are considered to be studied and analyzed using CAE software. The different loads in the `different directions are also considered for treatment over this dissertation work. Recommendation for safe load values would be provided at the end of the thesis by analytically also.

CHAPTER NO 2
LITERATURE REVIEW
2.1 INTRODUCTION

To understand background of project work, research papers dealing with the failure theory, load acting from different direction, their effect, material properties etc topics are studied. These are summaries as given bellow .

Harjeet S. Jaggi- Bhabani K. Satapathy :- had discussed ,Analytical interpretations of structural and mechanical response of high density polyethylene /hydroxyapatite bio-composites. The stress–strain diagrams corresponding to the investigated compositions are shown in . It was observed that the strain at break systematically decreases with the increase in Hap loading. In case of HDPE two distinct yielding regimes could be observed which however, disappeared in the Hap filled HDPE composites. The area under the stress–strain curves also decreased with increase in Hap content indicating Hap induced reduction in toughness. The variation in ultimate tensile strength and tensile.

Chandra S. Yerramalli, Anthony M. Waas:- In his paper, A fracture mechanics based failure criterion for unidirectional composites under combined loading has been developed. The predictions from this criterion have been compared with experimental data obtained from combined compression–torsion loading of glass and carbon fiber reinforced polymer composites of 50% fiber volume fraction. The specimens were loaded under rotation control and displacement control in a proportional manner. Comparison of the Budiansky–Fleck kinking model, specialized to a solid circular cylinder, and the new failure model against experimental data suggests that the Budiansky–Fleck model predictions do not capture the variation of compressive strength as a function of shear stress for glass fiber composites. This is because these composites fail predominantly by compressive splitting. The Budiansky–Fleck model predictions are appropriate for composites that fail by compressive kinking. The new model predictions capture the experimental results for glass composites where the compression strength is initially unaffected by shear stress but undergoes a drastic reduction when a critical value of shear stress is reached.

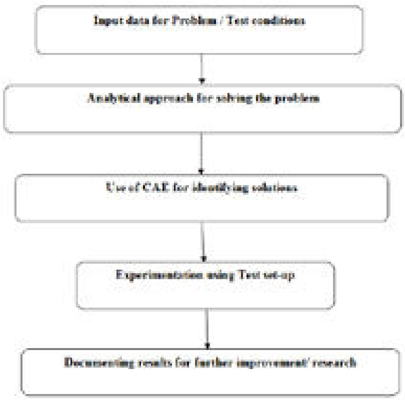
David Roy lance :- had explain that Not all deformation is elongation or compressive, and we need to extend our concept of strain to include \shearing," or \distortional," ejects. To illustrate the nature of shearing distortions, rest consider a square grid inscribed on a tensile specimen as depicted in . Upon uniaxial loading, the grid would be deformed so as to increase the length of the lines in the tensile loading direction and contract the lines perpendicular to the loading direction. However, the lines remain perpendicular to one another. These are termed normal strains, since planes normal to the loading direction are moving apart.

EBRU SEMA KOŞAROĞLU & FARAJ KHALIKOV:- discussed , In terms of material behavior, **failure** means a change in the normal constitutive behavior of a material, usually in response to excessive loads or deformations that cause irreparable changes of the microstructure. For example, compressed rock will respond elastically up to a certain point but, if the load is high enough, the rock will crush with permanent deformations. A model of crushing rock will involve a non-elastic constitutive law and is hence beyond the scope of elasticity theory. However, at issue here is the attempt to predict when the material first ceases to respond elastically, not what happens after it does so. The failure of a specimen of rock under uniaxial tension1 can be predicted if a tension test has been carried out on a similar rock – it will fail when the applied tension reaches the yield stress *Y* (see §4.2.1). However, the question to be addressed here is how to predict the failure of a component which is loaded in a complex way, with a consequent complex stress state at any material particle. The theory of **stress modulated failure** assumes that failure occurs once some function of the stresses reaches some critical value. This function of the stress, or **stress metric**, might be the maximum principal stress, the maximum shear stress or some more complicated function of the stress components. Once the stress metric exceeds the critical value, the material no longer behaves elastically.

Richard M. Christensen :- in his paper of A Comprehensive Theory of Yielding and Failure for Isotropic Materials gives that A theory of yielding and failure for homogeneous and isotropic materials is given. The theory is calibrated by two independent, measurable properties and from those it predicts possible failure for any given state of stress. It also differentiates between ductile yielding and brittle failure. The explicit ductile-brittle criterion depends not only upon the material specification through the two properties, but also and equally importantly depends upon the type of imposed stress state. The Mises criterion is a special (limiting) case of the present theory. A close examination of this case shows that the Mises material idealization does not necessarily imply ductile behavior under all conditions, only under most conditions. When the first invariant of the yield/failure stress state is sufficiently large relative to the distortional part, brittle failure will be expected to occur. For general material types, it is shown that it is possible to have a state of spreading plastic flow, but as the elastic-plastic boundary advances, the conditions for yielding on it can change over to conditions for brittle failure because of the evolving stress state. The general theory is of a three dimensional form and it applies to full density materials for which the yield/failure strength in uniaxial tension is less than or at most equal to the magnitude of that in uniaxial compression.

Seung Hyun Jeong- Seon Ho Park :- have presented develops a reliable stress-based topology optimization method (STOM) that incorporates the static failure criteria for the brittle and ductile materials denoted in Since the introduction of topology optimization (TO) for continuum stiff structures in the late 1980s, numerous works have investigated its theoretical and practical applications. For example, compared to size and shape optimization methods, optimal topological layouts do not necessarily require the initial designs for various mechanical conditions. Thus, several topology optimization methods, such as the homogenization based method [1–6], the solid isotropic with penalization (SIMP) method ,the level set method, and the element connectivity parameterization (ECP) method , have been developed and applied to a variety of engineering problems. Unfortunately, few studies give enough investigation into the topology optimization of element-wise stress constraints as well as the various static and dynamic failure criteria, which are mathematically not differentiable with respect to both the TO design variables and the principal stresses. Consequently, this paper presents a new TO framework that utilizes the STOM for the static failures given in by introducing differentiable formulations of these static criteria with differentiable maximum and minimum operators .The design variable is density assigned to each element in design domain to determine whether an element in design domain should be modeled as void or solid. The number of the design variables is NE. If the design variable ce approaches to its lower bound, the eth element should be modeled as ‘‘void’’. Otherwise, if the design variable approaches to one, the eth element should be modeled as ‘‘solid.’’

CHAPTER NO 3
METHODOLOGY
3.1 FLOW DIAGRAM



3.2 SCOPE OF WORK/ STEPS FOR EXECUTION
- Identify the inputs – Specs for Test conditions
- Check the existing physical sub-assembly on the field
- Explore the existing 3D models / drawings for components
- Evaluate the part design for fit and function
- Review the existing assembly for the given application
- Perform analysis using suitable CAE software
- Study the results of analysis
- Generate a revised layout for the component/s
- Review the Design for the Case/ Housing
- Finalize the specifications
- Conduct trials for experimentation
- Document the results for validation

CHAPTER NO 4
DRAWINGS OF HANDLE BAR CASING
1) 2-D Drawing of Handle bar casing.

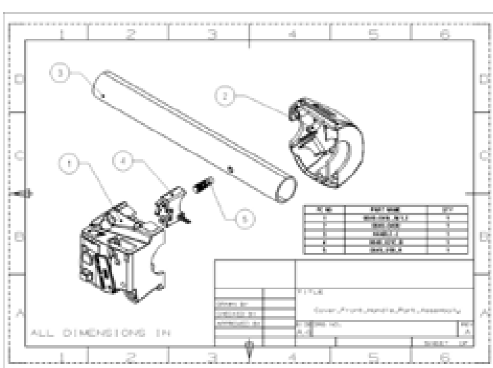


Fig.4.1 Handel bar casing

2) 2-D Drawing of Lower casing

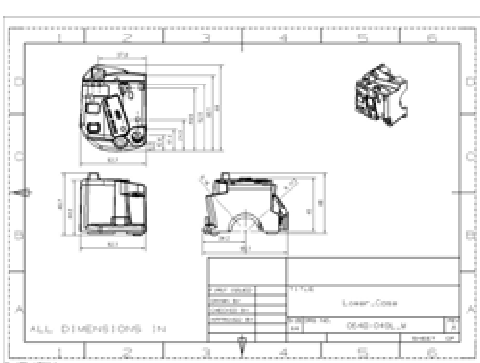


Fig. 4.2 Lower casing

3) 2-D Drawing of Upper casing

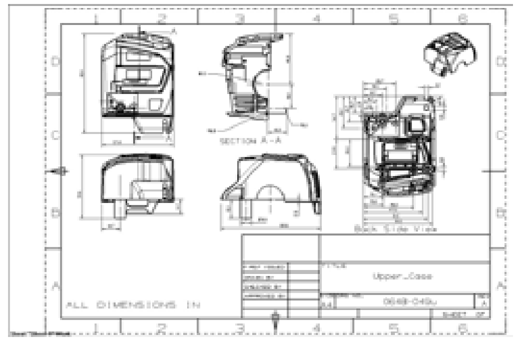


Fig.4.3 Upper casing

CHAPTER NO 5
Modeling of Handle bar housing
1) Handle Bar Assembly

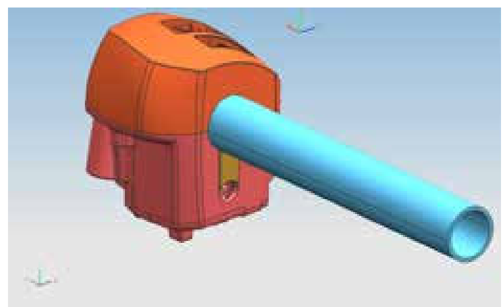


Fig.5.1:-3-D Model of Handel Bar Assembly

2) Upper casing

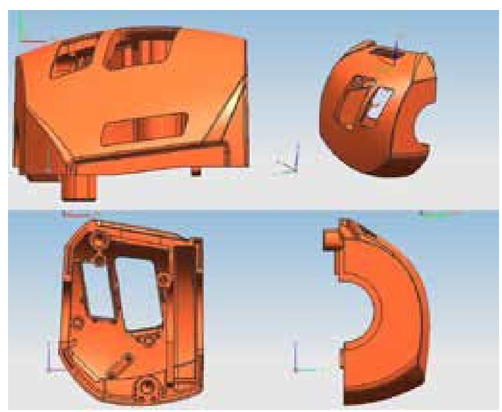


Fig.5.2:-3-D Model of Upper casing

3) Lower casing

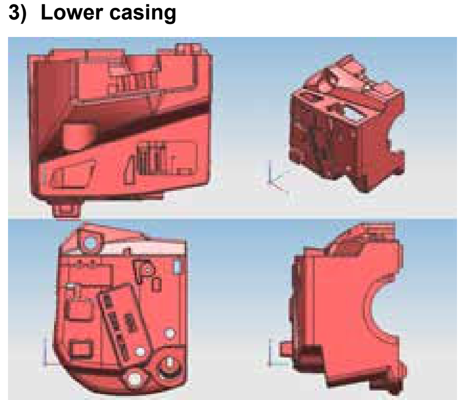


Fig.5.3:-3-D Model of Lower casing

CHAPTER NO 6
ANALYSIS of Handle bar housing

Fig.6.1-Trial analysis of Upper casing

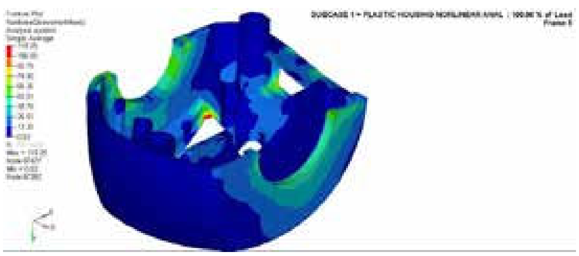


Fig.6.2-final analysis of Upper casing

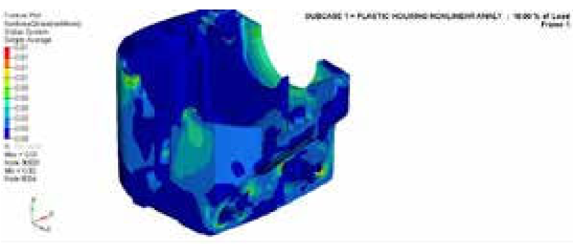


Fig.6.3-Trial analysis of Lower casing

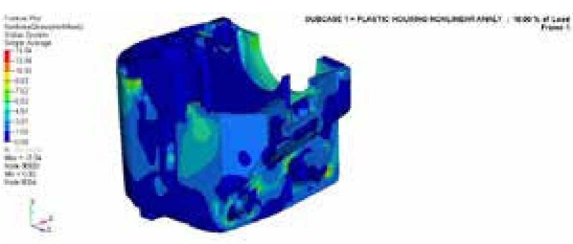


Fig.6.4-final analysis of Lower casing

CHAPTER NO 7
EXPERIMENTATION & VALIDATION

Experiments are to be conducted on a the test rig at the company premises. The assembly would be mounted on the rig and the frequency of the cyclic loading for torque and or buckling would be set based on the historical data as well as the input received from the analysis data (simulation).

Failure can be predicted before the modified component is produced through the use of software which rely on FEA principles. The prediction at the component design stage ensures that the chosen geometry is compatible with the conditions of use. Close collaboration between Component designers, Process Engineers and the Test Engineers assures the compliance with very short development times.

The parameters influencing the performance of the subject application are listed below:

- Type of material
- Mechanical properties of the material
- Thickness of the component at a given section
- Method of assembly and type of joint with mating parts
- Type and magnitude of force exerted
- Frequency of loading

Validation

The results obtained by the CAE software would be compared with the Test report to be received from Sponsoring Company. A good concurrence should point to favorable assessment of the work under study. The claims for the dissertation work would be sought for validation with respect to the lab test report or the field test report furnished by the Sponsoring Company.

CHAPTER NO 8
Results & Conclusion

After checking handle bar casing and their respective parts for different load , we conclude to change the material for handle bar housing. For new material again take some readings and make sure for safe stresses.

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