INTRODUCTION:
The two wheeler and the four-wheeler industries are normally faced with challenges related to function and 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 housing of the handle bar is being investigated for possible areas of failure. A study is being initiated by the sponsoring company for identifying the source of this failure and its location. This would further be complemented with a revised design or improved design feature/s for reducing the incidence of failure. The typical material for the housing, in this case, is LM6 or equivalent Aluminium alloy. The Handle bar (grip area) is typically made of CRCA steel pipe.

LITERATURE REVIEW

- G.C. Tsiatas, J.T. Katsikadelis mentioned in their paper a new modified couple stress model is developed for the SainteVenant torsion problem of micro-bars of arbitrary cross-section. The proposed model is derived from a modified couple stress theory and has only one material length scale parameter. Using a variational procedure the governing differential equation and the associated boundary conditions are derived in terms of the warping function. This is a fourth order partial differential equation representing the analog of a Kirchhoff plate.

- F. Gabrielli, S. Paganelli, J. Schiro, P. Pudlo, M. Djemai, their paper aims to propose an experimental protocol that allow to measure the steering behavior of drivers under equal tracks Method. The experimental platform proposed in this paper in order to measure the steering actions with control and disabled groups. This platform reproduces the driving position and simulates driving conditions. In addition, the platform offers a fully instrumented steering wheel and is compatible.

- Jia-Hua Lin, Raymond W. McGorry, Chien-Chi Chang in this paper hand-handle interface is seldom considered in contemporary upper limb biomechanical analyses of pushing and pulling strength. A laboratory study was designed to examine if handle rotation in the frontal plane (0-horizontal, 45, and 90-vertical), anterior tilt (0-parallel to the frontal plane, and 15), and distance between two handles (31 and 48.6 cm) affect pushing strength and subjective rating of handle preference. A special testing station was constructed to elicit upper limb push exertions that involved minimal contribution of the torso and legs.

- K. Jayaprakash, Y.M. Desai, N.K. Naik presented vibration induced fatigue analysis of cross-ply [0n/90n]s cantilever beam under tip impulse loading. As a first step, vibration induced stress for the given tip impulse loading was evaluated using modal analysis. Viscous damping model was used for evaluating the stress state as a function of time.

OVERVIEW OF ANALYTICAL APPROACHES

Modern analytical techniques used in treating incompressibility effects in finite element codes are based on the Hellinger-Reissner and Hu-Washizu variational principles [Zienkiewicz and Taylor, 1989]. Well-known applications of these principles include assumed strain methods, such as: the mixed method of [Herrmann, 1965]; the constant dilatation method of [Nagtegaal, Parks, and Rice, 1974]; the related B-bar methods of [Hughes, 1980] and [Simo, Taylor, and Pister, 1985]; the Hu-Washizu methods of [Simo and Taylor, 1991]; the mixed assumed strain methods used with incompatible modes by [Simo and Rifai, 1990]; and selective-reduced integration methods. Another class of approaches is the so-called assumed stress methods, which are used by researchers such as T.H.H. Pian and S.N. Atluri and their co-workers.

Mixed methods usually have the stresses, strains, dilatancy, or a combination of variables as unknowns.
The earliest mixed method is the so-called Herrmann formulation. A modified form of the Hellinger-Reissner variational principle is used to derive the stiffness equations. A pressure variable (energetically conjugate to the volumetric strain) is introduced in the form of a Lagrange multiplier. Herrmann's approach has been used since the mid-1960s and 1970s in FEA codes such as Marc, TExGAP, and various in-house codes developed by leading solid rocket propellant manufacturers.

The constant dilatation method of [Nagtegaal et al., 1974] decouples the dilatational (volumetric) and distortional (isochoric) deformations and interpolates them independently. Appropriately chosen functions will preclude mesh locking. The B-bar method of Hughes is a generalization of this method for linearized kinematics. Selective-reduced integration under integrates the volumetric terms. However, all these methods can be shown to be equivalent under certain conditions [Malkus and Hughes, 1978].

For elastic materials without energy dissipation, the above criterion reduces to an equality. ‘Marc’ material parameter evaluation solves a constrained optimization problem to assure the stability of energy functions. [Tabaddor, 1987] has shown the existence of multiple solutions with more than one stable solutions in pure, homogeneous modes of deformation using perturbation method. These instabilities do not usually occur in the actual structure and are often the result of the mathematical abstraction of the real material. The numerical algorithms in Marc enable the user to avoid these instabilities.

**SCOPE OF WORK/ STEPS FOR EXECUTION**
- Explore the existing 3D models / drawings for Handle bar
- Review the existing assembly for the given application
- Perform analysis using suitable CAE software
- Establish a baseline through this result
- Propose Design alternative for one or two input parameters
- Conduct CAE analysis for this revised Design
- Finalize the specifications
- Conduct trials for experimentation
- Document the results for validation

**METHODOLOGY (FLOW DIAGRAM):**

1. Input data for Problem / Test conditions
2. Analytical approach for solving the problem
3. Use of CAE for identifying solutions
4. Experimentation using Test set-up
5. Documenting results for further improvement/ research

**EXPERIMENTATION:**
Experiments are to be conducted on the test rig at the client 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 relies 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

For this proposed work, the attempt would be to vary one or two of the parameters to evaluate the change in the result for meeting the desired objective.

**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.

**REFERENCES**
2. Driving simulation protocol to determine steering strategies F. Gabrielli, S. Paganelli, J. Schiro, P. Padlo, M. Djemai
3. Effects of handle orientation and between-handle distance on bi-manual isometric push strength Jia-Hua Lin, Raymond W. McGorry, Chien-Chi Chang
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5. Robust joint modeling of mean and dispersion through trimming N.M. Neykova, P. Filzmoser, P.N. Neytcheva