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MODELLING AND 3D PRINTING OF 2-WHEELER CARBURETOR

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Abstract - Carburetor is a most important component in fuel feed system of spark ignition engines. A carburetor is a device used by a gasoline internal combustion engine to control and mix air and fuel entering the engine. The main structure and largest component of the carburetor is the molded body made from a lightweight alloy or aluminum. This carburetor model is made in a modelling software i.e., SolidWorks and this review examines the use of SolidWorks software for modelling two-wheeler carburetors, exploring its benefits for creating accurate 3D models, simulations, and design communication. It analyzes existing research on modelling various carburetor components and functionalities in SolidWorks, considering factors like detail, design intent, and manufacturability. This study is made for the best 3D model of the carburetor.

Keywords: Carburetor, spark ignition engines, SolidWorks, 3D models, modelling.

1. INTRODUCTION

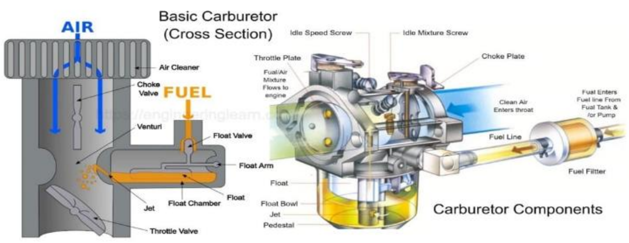


Figure 1. carburetor

A carburetor is a crucial component in the engine system of two-wheeled vehicles, commonly referred to as 2-wheelers. It plays a fundamental role in the combustion process by mixing air and fuel in the correct proportion for efficient engine operation. This introduction will provide a basic overview of the 2-wheeler carburetor, highlighting its function, components, and significance in the performance of these vehicles. The primary function of a carburetor in a 2-wheeler is to blend air and fuel in the right ratio to create a combustible mixture that can be efficiently burned in the engine cylinders. This mixture is essential for generating the power needed to propel the vehicle forward. The carburetor regulates the flow of air and fuel into the engine based on various factors such as engine speed, load, and throttle position.

2. Introduction to Modelling:

The modeling process refers to the systematic approach of creating representations or simulations of real-world systems, phenomena, or objects using mathematical, computational, or conceptual frameworks. Models are used across various disciplines such as engineering, physics, economics, biology, and computer science to gain insights, make predictions, solve problems, and facilitate decision-making

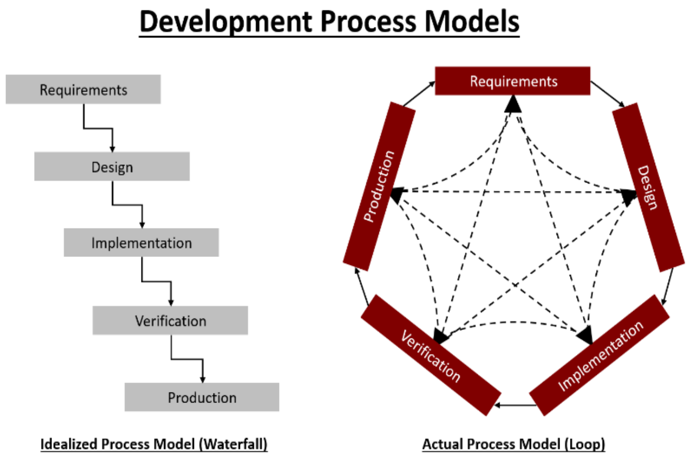


Figure 2. MODELLING PROCESS

3. Introduction to 3D Printing

Figure 4. 3D Printer

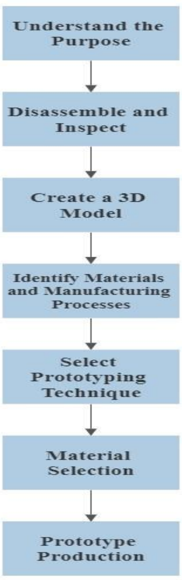
3D printing, also known as additive manufacturing, is a revolutionary technology that builds objects layer by layer. Unlike traditional methods that carve away material, 3D printing uses a digital blueprint to create intricate shapes.

The process starts with a 3D model, which is sliced into thin layers. A 3D printer then builds the object by depositing material, such as plastic or metal, one layer at a time. This allows for complex designs that would be impossible with conventional manufacturing.

3D printing offers many advantages. It allows for rapid prototyping, minimizes material waste, and enables on-demand manufacturing. This technology is transforming various fields, from engineering and medicine to design and manufacturing.

4. Process

4.1. Methodology



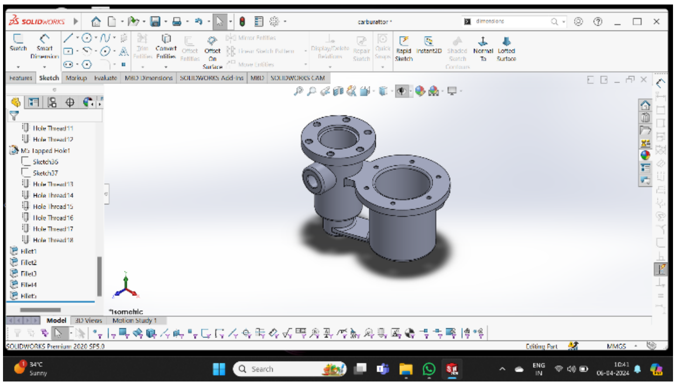
1.CAD Modeling

Create a 3D Model: Use CAD (Computer-Aided Design) software such as SolidWorks, Autodesk Fusion 360, or Blender to design the carburetor.

Design the external structure of the carburetor, including intake ports, mounting flanges, and fuel inlet/outlet.

Model internal components such as throttle valve, venturi, fuel jets, idle adjustment screws, and float mechanism.

Ensure that internal passages and chambers are accurately designed for proper air and fuel flow.



2. Design Optimization

Iterative Design Refinement:

Modify the CAD model based on simulation results to improve airflow dynamics and fuel atomization.

Ensure that the design is structurally sound and can withstand operational loads and vibrations.

3. Preparing for 3D Printing

Convert CAD Model to STL Format: Export the finalized 3D model into STL (Stereolithography) file format, which is compatible with most 3D printing software.

Slice the Model: Use slicing software (e.g., Ulti maker Cura, Prusa Slicer) to generate toolpaths and slicing instructions for the 3D printer based on the chosen printing technology.

4. 3D Printing

Set Up the 3D Printer:

Choose an appropriate 3D printing technology based on the selected material (e.g., FDM for plastics, SLA for resin).

Calibrate the 3D printer settings including layer height, print speed, and temperature according to the material specifications.

Start Printing:

Load the 3D printer with the selected material and initiate the printing process.

Monitor the print progress to ensure quality and address any potential issues such as warping or layer adhesion.

5. Post-Processing

Remove Support Structures:

Once printing is complete, carefully remove any support structures used during the printing process.

Surface Finishing:

Perform post-processing techniques such as sanding, polishing, or chemical smoothing to improve the surface quality of the printed carburetor.

6. Testing and Validation

Functional Testing:

Install the 3D-printed carburetor onto a test engine and conduct performance tests under various operating conditions (idle, acceleration, load).

Verify that the carburetor delivers the required air-fuel mixture and functions effectively within the two-wheeler's engine system.

7. Finalization and Integration

Documentation:

Prepare detailed documentation including design files, printing parameters, simulation results, and test reports for future reference and quality assurance.

Production Integration:

Integrate the 3D-printed carburetor into the production process, ensuring compatibility and scalability for manufacturing.

5. Conclusion

The literature reviewed provides a comprehensive understanding of the design, analysis, and optimization of carburetor, particularly in the context of two-wheeler vehicles. The studies cover various aspects, including traditional and modern carburetor designs, material choices, manufacturing techniques, and performance evaluations. The findings reveal a continuous effort towards improving carburetor functionality, efficiency, and environmental sustainability. While traditional carburetors remain prevalent due to their simplicity and cost-effectiveness, modern advancements such as computational fluid dynamics (CFD) simulations, rapid prototyping, and additive manufacturing techniques offer opportunities for enhancing performance and addressing environmental concerns. Additionally, studies exploring alternative materials like eco-friendly plastics and ceramic composites highlight the importance of material innovation in carburetor design. Overall, the literature underscores the significance of ongoing research and innovation in optimizing carburetor performance to meet the evolving demands of the automotive industry, balancing efficiency, cost-effectiveness, and environmental considerations.

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