Impeller Water Pump: Team C3

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Aim of the Project

The aim of the project is to design, manufacture and test a functional water impeller pump with the task of pumping a fixed amount of water in the shortest amount of time.

Objectives

- Research water impeller pumps and their existing designs.
- Create concept designs of the impeller pump.
- Select and proof the final concept design.
- Design parts and assembly on SolidWorks.
- Manufacture the impeller pump using manual mills and lathe machines.
- Manufacture parts of the pump using CADCAM software.
- Test the pump to validate efficiency and functionality.

Background

Water impeller pumps are indispensable devices used for providing efficient and reliable fluid transfer. They are used in a wide variety of applications such as wastewater treatment, water supply and HVAC Systems.

Water impeller pumps work by using a rotating impeller that creates suction which draws the fluid in through an inlet, centrifugal force then forces the fluid outward which increases the fluid pressure. The pressurized fluid is then discharged through the outlet. This process is then repeated which provides continuous flow.

Design

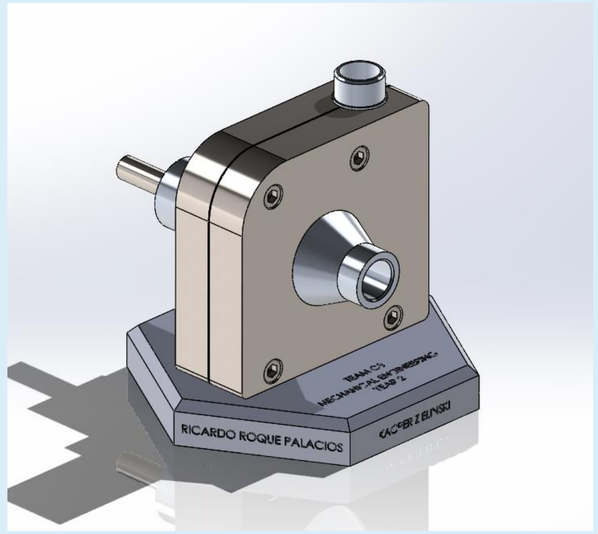

Figure 1: Completed SolidWorks model of our water impeller pump.

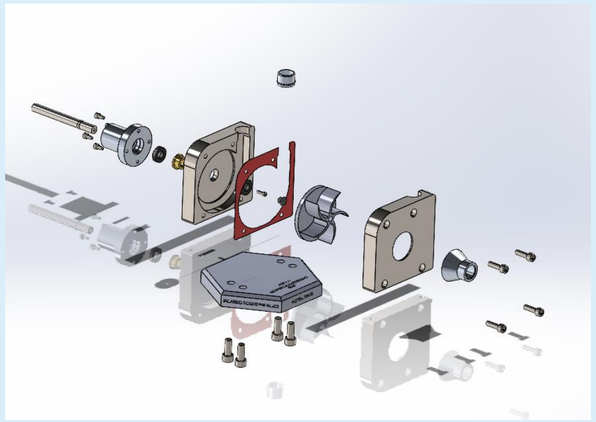

Figure 2: Exploded view of the water impeller pump.

SolidWorks was a vital tool that we used in designing and manufacturing our water impeller pump. The SolidWorks software aided us in exploring new designs, visualising our final concept design and created drawings with dimensions and tolerances which we could reference when machining our designs in the workshop and while using SolidCAM.

Manufacture

- The production of the impeller pump involved the utilization of various machines, including manual mill, the lathe, as well as CNC mill and 3D printer.

Figure 4 & 5: Mill and lathe used to machine parts of the pump.

- The lathe was used to create the main parts of the model such as the inlet cone, outlet, shaft and back support.

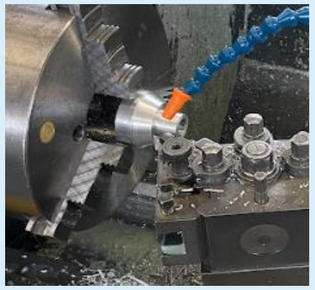

Figure 5 & 6: internal and external machining processes for inlet cone.

- The manual mill was responsible for producing the split casing which allowed us to form the involute shape on the inside using a boring bar and a rotary table.
- The CNC mill was used to cut out the base and the impeller. The CNC aided a lot when machining the impeller as due to its complex nature, it would be extremely difficult to do it precisely on a manual mill.
- The 3D printer was used to print out a cover cap for the impeller.

Conclusion

- Understanding of how a water impeller pump operates is crucial in designing and manufacturing a functional water impeller pump.
- Creating concept designs allowed us to think outside the box and explore different ideas.
- The team came together and manufactured a fully functional water impeller pump.
- While the current design fulfilled the projects requirements, there is room for further advancements which could be achieved by changing the number of vanes present on the impeller or changing the involute shape to one which would be the most efficient to improve on the overall output done by the pump. The team had to change designs and add new parts to allow for better optimisation of the pump along with ease of manufacture due to having to create parts manually.

References

- https://theengineeringmindset.com/pump-impellller-basics/
- https://eddypump.com/blog/impeller-selection-guide-types

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