Design and Analysis of Cooler Fan

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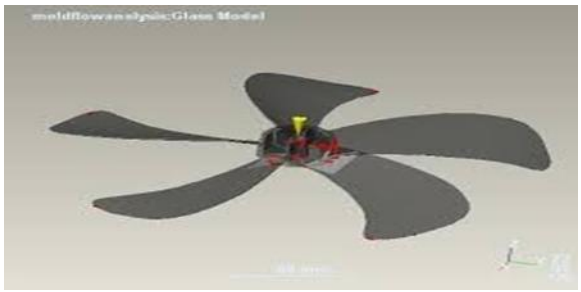
Abstract— Presently, Cooler fans are produced with 3 wings which produce low capacity of air. The material used for the wings is SS (Stainless Steel), which has more weight, consequently fan weight is more. Theproblem is rectified by designing fans with 5 wings by using ABS Plastic material. ABS offers a good balanceof impact, heat, chemical and abrasion resistance, dimensional stability, tensile strength, surface hardness, rigidity and electrical characteristics. ABS plastic remains hard, rigid and tough even at low temperatures. ABS is a great plastic product to use since it is one of the most affordable plastics resistant to strong impacts and corrosive chemicals. It is also relatively harmless since the plastic material doesn't have any known toxic carcinogens in it. ABS Plastic Usein Injection Molding As mentioned above, ABS plasticis ideal for machining, and that is very true in injection molding. It is a versatile plastic, not only in terms of being resistant to damage and impact but also in changing its qualities with the right temperature and resin additives.

Indexed Terms— Solid Edge Student Edition 2022, Cooler Fan, Simulation, NX Nastran

I. INTRODUCTION

A fan is a powered device used to create flow within a gas, usually air. A fan consists of a rotating arrangement of vanes or blades which act on the air. Fans produce air flows with high volume and low pressure. Fans are as varied in their construction as they are in their applications. These blades are primarily differentiated according the physical principle of the transfer of energy to the gas medium. Depending on the design, each fan is suitable for a number of different uses.



II. PROPOSED SYSTEM

Various thermoplastics serve different purposes based on their physical, chemical, mechanical, and electrical properties. Picking the right plastic material for a particular application requires a thorough understanding of the material. ABS plastic sheet is a versatile thermoplastic that offers a low cost, high-quality alternative to various other materials in the market. Its ease of use, cost- efficiency, and various unique properties make it a popular choice across various industry sectors.

Safety in Structural: The structural analysis of the fan represents its strength structurally. The shear stress, Von-Mises stresses confirm the safety of the design in structural. Torque Optimization: The maximumtorque is optimized for the fan.

Velocity Vectors: The velocity vectors are in conformance with the direction and the magnitude of velocity of rotation of the fan. They also represent flow of air around the blades of the fan.

Compare to present 3 wing fans these newly designed 5 wings fans will give maximum results in all factors.

III. WORKING PRINCIPLE

This Project involves in modeling and analysis of an Air cooler fan. Modeling was done by using advanced design software SOLIDEDGE 2022 STUDENT EDITION (@SEIMENS) By using the features of this software airplane was modeled. The modeling of the one blade and other parts will be done in the part module and the assembly of the individual parts was done in the assembly module. And the comparison by changing number of blades like three, two, Six, will be taken condition, working, of individual fan, will be shown, and vice-versa. Analysis was done on the outer sheet of the Air cooler fan by using same software in simulation part by case study i.e studying the 3d model. The contact analysis was done on the Air cooler fan because it is an assembly. The analysis was done at different load conditions. Comparison will be done by keen observation of results achieved form the analysis,which are tabulated.

- Design

Overall Design

- Select operational speed.
- Designing the fan at rated engine speed:[engine rpm = 1650]
- Fan Speed = 1.3 * engine rpm…(assumed)

= 1.3 * 1650
= 2145 rpm

- Pre-Processor – simulation part (case study)

Overall Process

The generic working process involves thefollowing:

1. Open/Create a project.
2. Create/Manipulate the geometry.
3. Create the mesh.
4. Check/Edit the mesh.
5. Generate the input for the solver.
6. Postprocess the results

IV. SOFTWARE REQUIREMENTS

1. Solid edge 2022 student edition

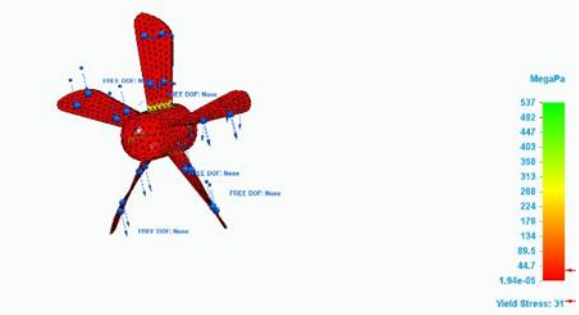
SOLIDWORKS 2019 SOLIDWORKS 2020 SO LIDWORKS 2021 Hardware Processor 3.3 GHz or higher RAM 16 GB or more PDM Contributor/Viewer or Electrical Schematic: 8 GB or more Graphics Certified cards and drivers

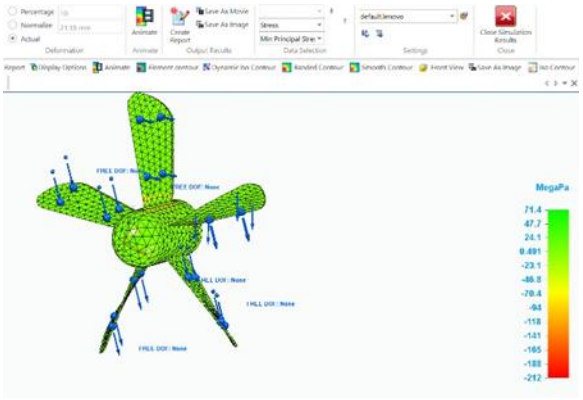
V. RESULTS

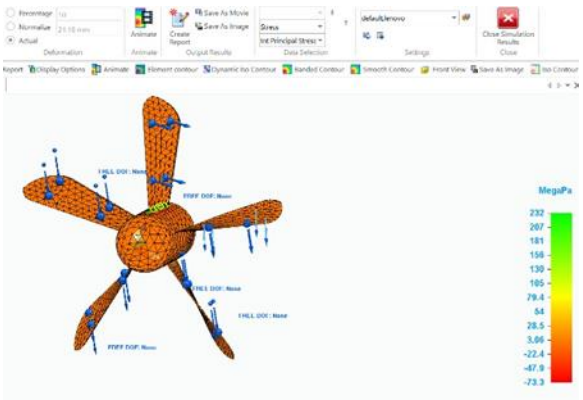
CONTOUR RESULTS

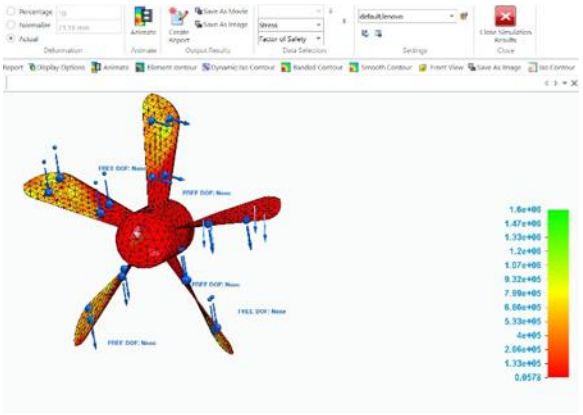
Results:

- Maximum principal stress = 6.41MPa
- Minimum principal stress= -32.8 MPa
- Maximum shear stress = 1.03e-05MPa
- Maximum Von-Mises stress = 1.8e-05MPa
- Total directional deformation = 0.18865mm
- Factor of safety = 0.0578
- Von mises stresses = 537MPa
- Int principal stresses = 237MPa
- As all stresses are below the allowable stresslimit so this design is safe in structural analysis.
- Below are contour plots of results.









VI. CONCLUSION

Various thermoplastics serve different purposes based on their physical, chemical, mechanical, and electrical properties. Picking the right plastic material for a particular application requires a thorough understanding of the material. ABS plastic sheet is a versatile thermoplastic that offers a low cost, high-quality alternative to various other materials in the market. Its ease of use, cost- efficiency, and various unique properties make it a popular choice across various industry sectors.

Presently cooler fans are made with metals. So fan weight is more and consequently high power is required for the fan rotation. In this paper we tried to rectify the problem by using ABS plastic material. We have modeled the fan using 3D parametric software Pro/Engineer. Simulation calculations are done to calculate maximum principal stress, minimum principal stress, von mises stresses, maximum shear stress, factor of safety. Mould flowanalysis is done on the fan to determine the materialfill rate, filling time, temperature distribution, weld lines, air traps before going to tool design

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