BRIEF STUDY ABOUT MARINE PROPELLER AND ITS WORKING USING FEM

DAVID RAJU N
Mechanical Engineering
Dr. Paul Raj Engineering College,

R SATHEESH KUMAR
Assistant Professor
Department Of Mechanical engineering
Dr. Paul Raj Engineering College,

Dr. KAPALA PRASAD
Assistant Professor
Department Of Mechanical
UCEK, JNTUK AP INDIA.

ABSTRACT:

A propeller is a kind of fan that transmits strength by changing rotational motion into thrust. A pressure distinction is produced among the ahead and rear surfaces of the airfoil-fashioned blade, and a fluid (consisting of air or water) is extended at the back of the blade. Propeller dynamics can be modeled via each Bernoulli's precept and Newton's third regulation. A marine propeller is now and again colloquially known as a screw propeller or screw. the present work is directed towards the observe of marine propeller running and its terminology, static simulation and float simulation of marine propeller has been achieved. In static evaluation the von misses stresses, resultant deformation; strain on blade place has been displayed due to applied load when the marine propeller hits the ice block. In Computation fluid dynamic evaluation the rate and stress trajectories with which the propeller blade pushes the water has been displayed within the results.

Key Words:*Propeller, simulation, deformations*

1.0 INTRODUCTON

A propeller is a kind of fan that transmits power via converting rotational movement into thrust. A stress distinction is produced between the ahead and rear surfaces of the airfoil-shaped blade, and a fluid (together with air or water) is multiplied at the back of the blade. Propeller dynamics may be modeled by way of each Bernoulli's principle and Newton's third law. A marine propeller is every so often colloquially known as a screw propeller or screw.

Figure1: Marine propeller

Fortunate Accident:

most of these Archimedean screw inventors recommended little to improve the configuration of the screw for use as a propulsion device. Their fundamental versions consisted of changing the quantity of convolutions or changing the diameter alongside the period of the screw. Francis Petit Smith by accident observed the advantages of a shortened Archimedean screw. in the beginning, his wooden propeller layout had two whole turns. but, following a collision on the Paddington Canal wherein half of his blade became carried away, his boat right away won speed. Smith capitalized on his observation via increasing the wide variety of blades and decreasing the blade width.

BASIC PROPELLER PARTS:

The first step to understanding propellers and how they work is familiarizing yourself with the basic parts of a boat propeller.

Blade Tip: The maximum reach of the blade from the center of the propeller hub.

It separates the leading edge from the trailing edge.

Leading Edge: The part of the blade nearest the boat, which first cuts through the water. It extends from the hub to the tip.

Trailing Edge: The part of the blade farthest from the boat. The edge from which the water leaves the blade It extends from the tip to the hub (near the diffuser ring on through-hub exhaust propellers).

Cup: The small curve or lip on the trailing edge of the blade, permitting the propeller to hold water better and normally adding about 1/2" (12.7 mm) to 1" (25.4 mm) of pitch.

Blade Face: The side of the blade facing away from the boat, known as the positive pressure side of the blade.

Blade Back: The side of the blade facing the boat, known as the negative pressure (or suction) side of the blade.

Blade Root: The point where the blade attaches to the hub

2.0 LITERATURE REVIEW

C.Chendrudu [1] in the direction of the examine of marine propeller running and its terminology, simulation and flow simulation of marine propeller has been finished. The von misses stresses, resultant deformation, pressure and regions below issue of protection has been displayed. the rate and pressure with which the propeller blade pushes the water has been displayed in the consequences.

kiambeng yeo , waihengchoong, [2] The evaluation provided a better perception to complex marine propeller shape and interaction with hydrodynamic loadings. stainless-steel Wageningen B collection three blade propeller with 250 mm diameter, EAR of 0.5 and P/D ratio of one.2 turned into followed within the evaluation. The propeller was subjected to the rotational pace of 06000 rpm. The stress distribution confirmed a effective stress vicinity at the face phase and a poor vicinity on the again section that produces the thrust era

3.0 PROPELLER WORKS:

To recognize this idea, let us freeze a propeller just at the factor wherein one of the blades is projecting at once out of the web page (parent 2). this is a right-hand rotation propeller, whose projecting blade is rotating from pinnacle to bottom and is shifting from left to proper. as the blade on this dialogue rotates or moves downward, it pushes water down and again as is executed through your hand while swimming. on the same time, water ought to rush in at the back of the blade to fill the gap left by means of the downward moving blade. those results in a strain differential between the two sides of the blade: a tremendous strain, or pushing impact, on the bottom and a negative strain, or pulling effect, at the pinnacle side. This movement, of path, happens on all the blades around the full circle of rotation because the engine rotates the propeller. So the propeller is both pushing and being pulled through the water.

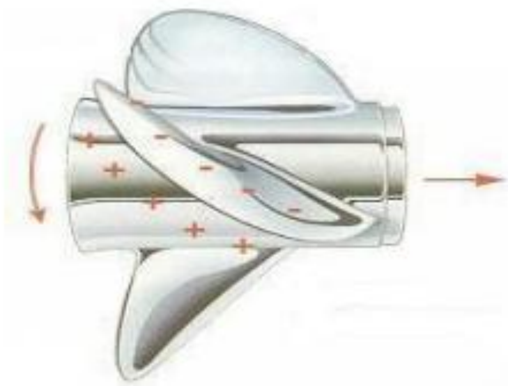


Figure: push and pull concept

FINITE ELEMENT MODELLING:

Many problems in engineering and carried out science are governed with the aid of differential or crucial equations. The solutions to these equations might offer an genuine, closed shape option to the specific hassle being studied. but, complexities inside the geometry, residences and within the boundary situations which can be visible in most actual global problems generally method that an specific solution cannot be acquired in a reasonable amount of time. they're content material to attain approximate answers that can be simply received in an inexpensive time frame and with reasonable effort. The FEM is one such approximate solution approach

Design procedure:

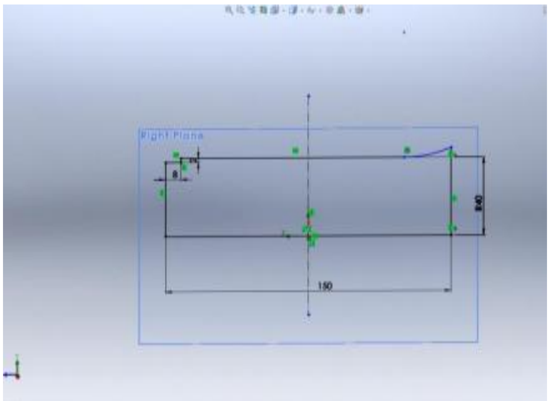


Figure: sketch of outer hub

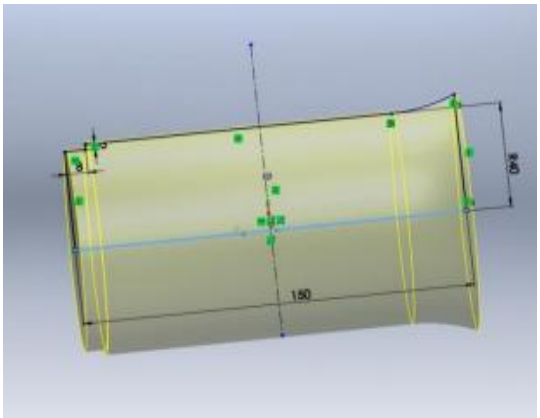


Figure: revolve of outer hub Now blade profile

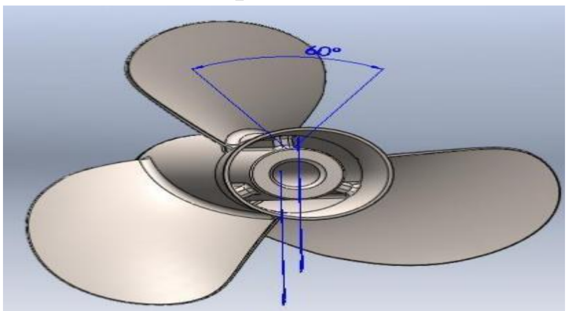


Figure: For 65 degree blade angle

4.0 STATIC ANALYSIS:

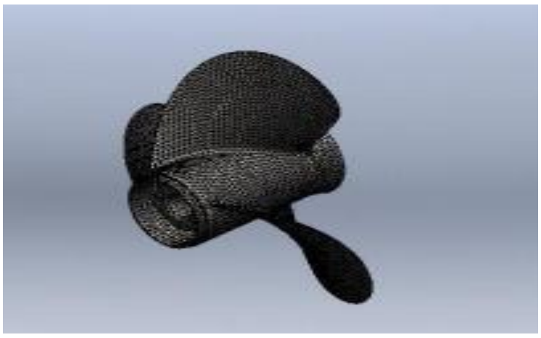


Figure: mashed model

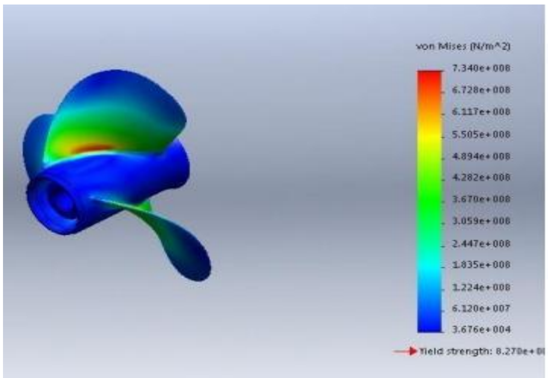


Figure: Static marine prop 60 degree-Static 2-Stress

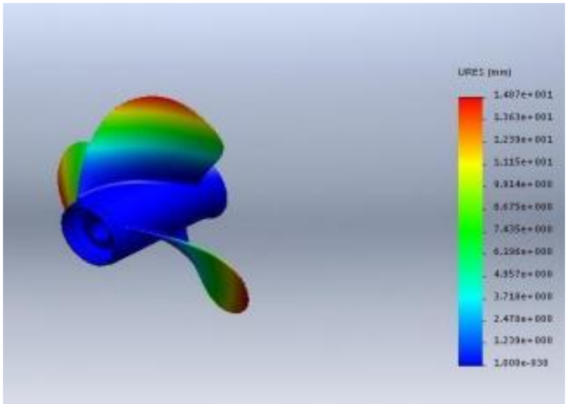


Figure: Static marine prop 60 degree-Static 2-Displacement

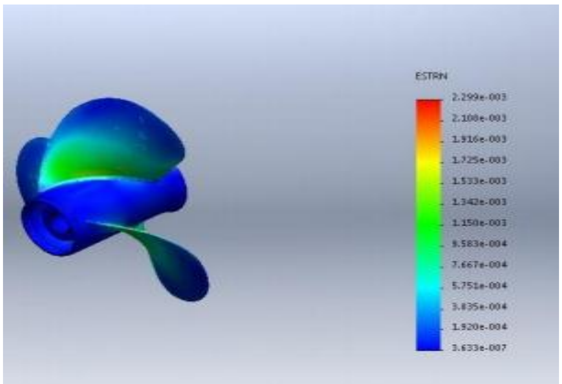


Figure: strain

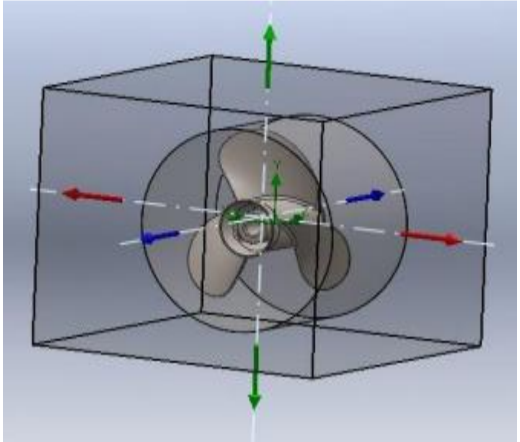


Figure: Computational domain

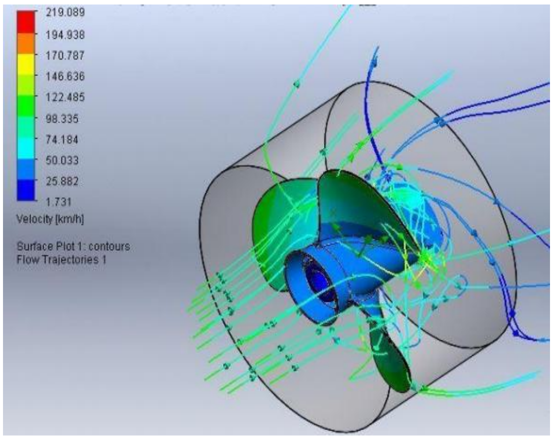


Figure: velocity Blade angle: 65 degree

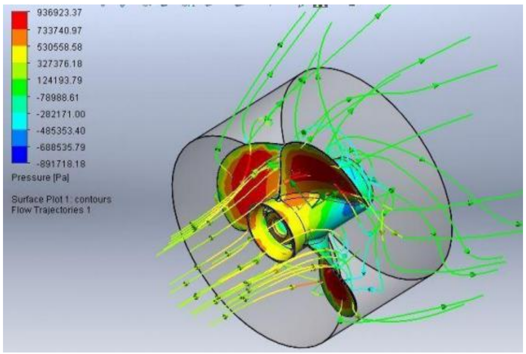
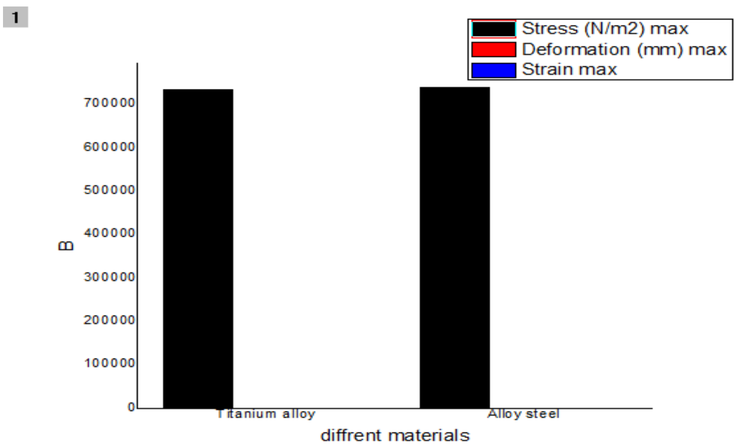


Figure: Pressure

Figure: 60 degree angle blade

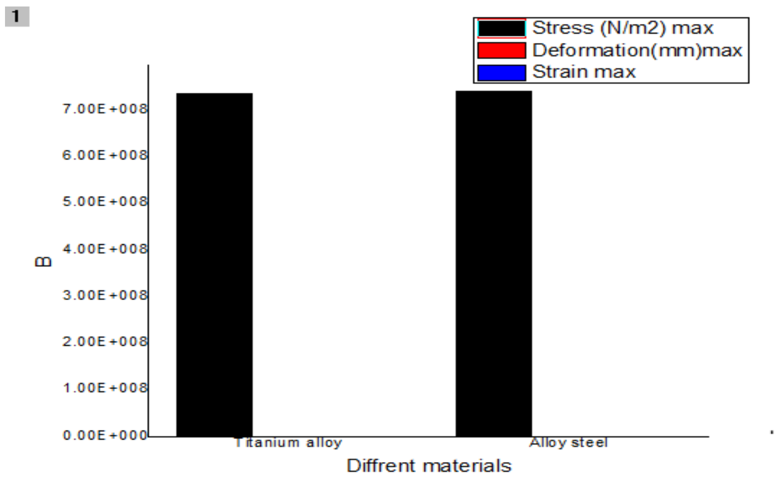
Material	Stress (N/m2) max	Deformation(mm)max	Strain max
Titanium alloy	7.34014e+008	14.8708	0.00448769
Alloy steel	7.38169e+008	7.96394	0.00231996



Graph:: 60 degree angle blade

Figure: 65 degree angle blade

Material	Stress (N/m2) max	Deformation(mm)max	Strain max
Titanium alloy	7.34678e+008	15.5916	0.00441292
Alloy steel	7.395e+008	8.3566	0.00227855



Graph: 65 degree angle blade

CONCLUSIONS:

- quick study approximately marine propeller and its operating is achieved in this task
- by the usage of strong works 2016 software program marine propeller of three exclusive blade angles 60 diploma, 65 diploma and 70 degree is finished through using one-of-a-kind instructions and functions in stable paintings software.
- Simulation static analysis on marine propeller is performed through using solid work simulation module
- Simulation, waft evaluation on marine propeller is executed by way of using strong paintings glide simulation module.
- Static evaluation is accomplished with the aid of deciding on distinct fabric i.e. titanium alloy and alloy metal for every blade angle on given load circumstance.
- Static analysis result values i.e.: pressure, strain and deformation due to load is mentioned and tabulated.
- 60 diploma angle blade is displaying least deformation fee evaluate to 65, 70 deg blade angles.
- 70 diploma perspective displaying least pressure values compare to other two angles blade. Alloy metal is showing least deformation evaluate to titanium alloy however the weight ratio of alloy steel is extra than titanium alloy and titanium alloy displaying least max pressure fee compare to alloy steel.
- As evaluate to alloy metallic and titanium alloy, titanium can pick for marine propeller reason of weight ratio and power in opposition to pressure.

REFERENCES:

1. *Taylor, D.w, "The Speed and Power and Ships",Washington,1933*
2. *J.E.Conolly, "Strength Of Propellers", reads in London at a meeting of the royal intuition of naval architects on dec1.1960,pp139-16*
3. *Terjesonntvedt, "Propeller Blade Stresses, Application Of Finite Element Methods" computers andstructures,vol.4,pp193-204*
4. *Chang-sup lee, yong-jikkim,gun-do kim and in-siknho."Case Study On The Structural Failure Of Marine PropellerBlades" 5. M.jourdian, visitor and J.L.Armand. "Strength Of Propeller Blades-A Numerical Approach", the socity of naval architects and marine engineers, may24-25,1978,pp20-1-21-3.*
5. *G.H.M.Beek, visitor, lips B.V.,Drunen. "Hub-Blade Interaction In Propeller Strength", the socity of naval architects and marine enginers, may24-25,1978,pp19-1-19-14*
6. *George W.Stickle and John L Crigler. "Propeller analysis from experimental data" report No.712, pp147-164.*
7. *P.Castellini, C.Santolini. "Vibration Measurements On Blades Of A Naval Propeller Rotating In Water With Tracking*

Laser Vibromneter "Dept. of mechanics, university of Ancona,pp43-54

8. *W.J.Colclough and J.G.Russel. "The Development Of A Composite Propeller Blade With A CFRP Spar" aeronautical journal, Jan 1972,pp53-57*
9. *J.G.Russel "use of reinforced plastics in a composite propeller blade" plastics and polymers, Dec*
10. *1973pp292-296*