THERMAL BEHAVIOUR ON TURBINE BLADE BY CHANGING THE FLUID AND MATERIAL MEDIUM

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ABSTRACT

As the power generation by the steam is one of the most important factor for power production in the present world. Keeping in the mind that the scarcity of water needs an alternative source. This paper deals about theoretical, technical, economical analysis of considering sea water steam as source for power production by comparing with the pure water steam and studying various thermal behavior on the turbine blade. Preference of best material for turbine blade which will highly resists corrosion by referring latest research's also involved in this paper.

Introduction

Lot of water is demineralised & used as steam . Sea water can replace scarcity of water and increase efficiency of power .few power plants are already running by considering sea water as source. Osmotic power plant is the one of example. Turbine blade is one of the most important component which is used in power production. Blades are responsible for extracting energy from hot gases, fuels, water and convert into required electrical energy. Different types fluids are impenged on the turbine blade which will some time effects the surface of the blade. For that purpose turbine materials are manufactured with some super alloys & composite materials .so that they will resist high temperatures of gases, pressures of water, vibrations, stresses and strain induced.

These are materials normally preferred for turbine bladeGTD11, U-500, RENE 77, CMSX-10, IN 625.

In this paper Stainless Steel is considered which is an alloy containing 1% of manganese, 2% carbon & small particles of sulphur, silicon, phosphorous and oxygen Due to its high strength, non-magnetic, corrosion resistance it is used in most of engineering works.

Inconel 625 is another alloy considered for blade .Inconel 625 is an alloy of nickel, chromium, molybdenum. With various percentages of ni-58%,mo 8-10%,cr 20-30%,fe -5%,nb+Ta3.15-4.15% which is an excellent material which will resist crevice and pitting of corrosions. This is will be best choice sea water applications.

Literature Survey

Turbine blade dimensions are considered from a journal of n power-"Forces on large steam turbine blades"-the royal academy of engineering. Where the company employee had numerical analysis of forces on turbine blade. Where usage of inconel625 in turbine blade, structural and thermal analysis of blade is clearly explained in paper of P.v.krishnakanth "structural & thermal analysis of gas turbine blade by using FEM". Properties of sea water is considered from practical and experimental values keyelaby (npl) lab. Inconel Properties are considered from special metals journal website. This paper involves usage of sea water steam instead of water steam & varioustemperature, velocity, pressure distribution on turbine blade & comparing them by changing material & fluid mediums.

IV. PROBLEM SOLVING TOOLS AND TECHNIQUES

1. Identification of problem.
2. No of ways of solving the problem& considering basic journals.
3. As totally study of the power plant is still in the process considering small element in the power plant and studying about turbine blade
4. Considering basic dimensions of turbine blade from an-power journal
5. Designing 3D-geometry of blade using rhinoceros software
6. Uploading geometry & creating duct around it in ansys geometry
7. Meshing the geometry modelling.
8. Solution set up done by giving boundary conditions and then leaving for no of iterations.
9. Analysing variations of temperature, pressure,velocities on blade and duct.
10. Concluding with the results obtained

TABLE 4:1 BLADE PARAMETERS

Dimension	Value
Blade height	90cm
Radius of the blade	6cm
Thickness of blade	0.2cm
Width of blade	15cm

Rhinoceros 3D-Geometry of turbine blade

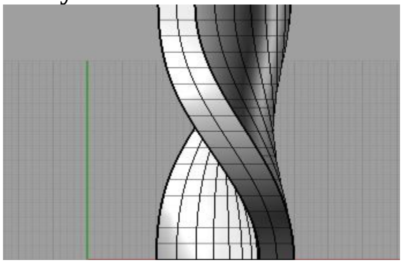


Fig 4.1

INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY ADVANCED RESEARCH TRENDS
ISSN : 2349-7408
VOLUME II, ISSUE 2(4), DECEMBER 2015

V. DESIGN

Theoretical numerical analysis is done by considering few dimensions by basic journals.3D-model geometry are done by using rhinoceros software. Fluid flow analysis on turbine blade is done in ansys fluent 2015 version.

Properties of turbine blade& fluid

TABLE 5.1: **Fluid Properties**

Properties	Steam	Sea Water Steam
Density kg/m^3	**1000**	**1029**
Specific heat j/kg	**2.02**	**3.8**
Thermal conductivity w/m-k	**0.6**	**0.6**
Viscosity	**1.05x106**	**8.9x10-4**

Table 5.2 Material Properties

PROPERTIES	STEEL	INCONEL 625
Density kg/m3	**7.60**	**0.305**
Thermal conductivity (k) w/m-k	**50.2**	**9.8**
Specific heat (cp)J/kg-k	**0.49**	**0.098**

VI RESULTS

Temperature distribution on Steel blade.

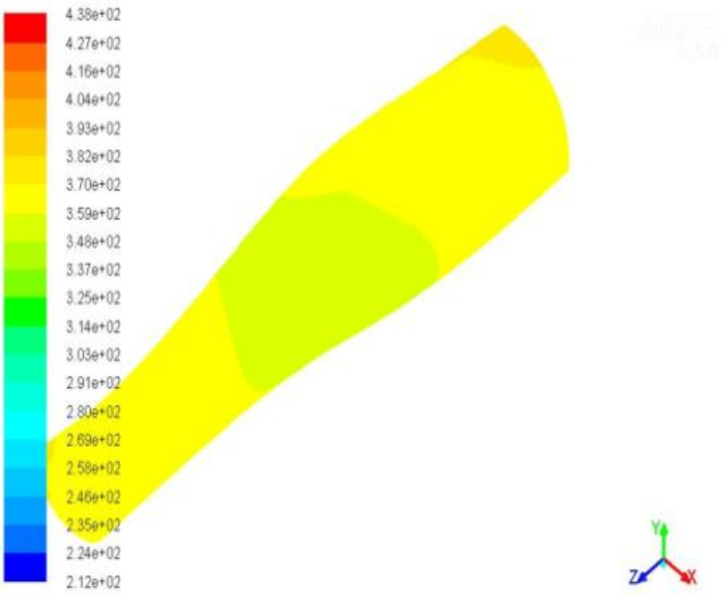


Fig6.1: Temperature distribution on Inconel625 blade

INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY ADVANCED RESEARCH TRENDS
ISSN : 2349-7408
VOLUME II, ISSUE 2(4), DECEMBER 2015

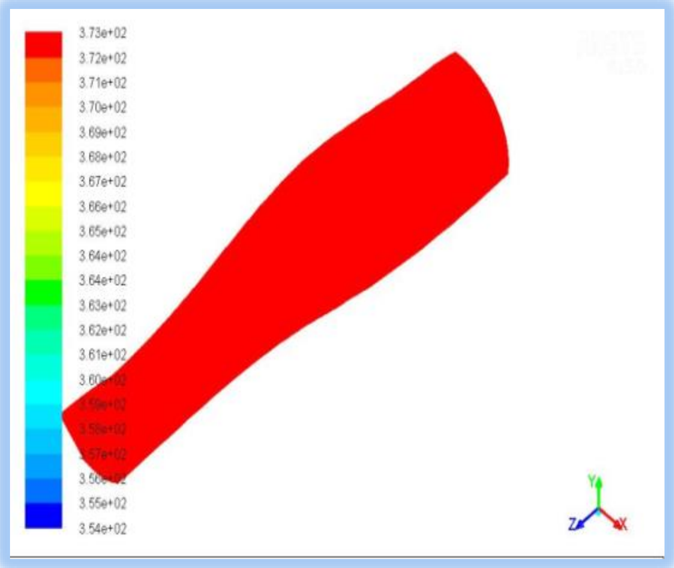


Fig 6.2: Comparison of different fluids on inconel625

PURE WATER STEAM

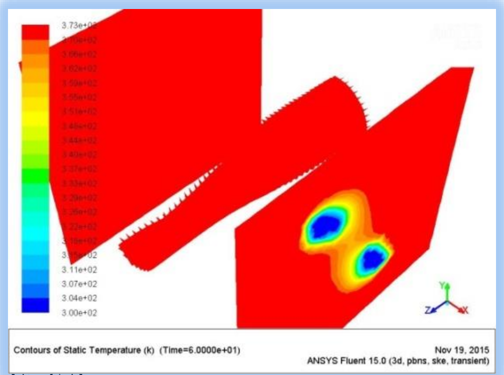
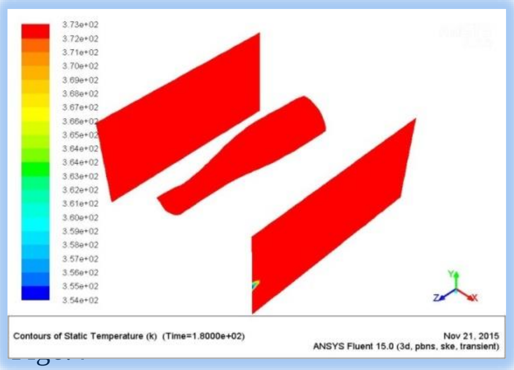


Fig6.3

SEA WATER STEAM



Conclusions

From above data it is clear that

1. As compared to steel, Inconel 625 can high resist sea water steam.
2. As compared to water Steam, Sea water steam is highly efficient because heat loss is very low which ultimately increase the efficiency of power plant.
3. On other side if cost is considered as compared to steel inconel625 cost is low.

So from above points we conclude that we can adopt usage of seawater steam for power production.

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