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PERFORMANCE OF TRADITIONAL FISHING VESSEL PROPULSION BY VARIABLE OF PROPELLER SHAFT ANGLE STUDY CASE IN KAMPUNG WADAS BOJONEGARA BANTEN INDONESIA

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Abstract

Research on performance of traditional fishing vessel propulsion by variable of propeller shaft in Kampung Wadas, Bojonegara was done. The fisherman is not attention to the propeller shaft angles and hydrodynamics of ships, they are only oriented to the payload capacity and quantity of catches. This research attempt to the improvement of propulsion performance of traditional fishing vessel by determine of propeller shaft angle. The study aimed to get the propeller shaft angle to generate the optimal characteristic propulsion such as Torque, Efficiency and Shaft Angle. The results show the propeller shaft angle of 22 ° was given optimum speed of fishing vessel and power of engine.

Keywords: *traditional fishing vessel, open water test, propeller, propulsion, shaft angle*

INTRODUCTION

Traditional fishing vessel that used in coastal areas is built with specific techniques and skills of the craftsmen ship. The traditional vessel built with non-modern technology and has many weaknesses in-term of resistance and propulsion analysis. Generally, the fishing vessels operating in the Kampung Wadas, Bojonegara, Banten is not consider to the propeller shaft angles and hydrodynamics aspect, they are only oriented to the payload capacity. Most of fishermen only use they experiences when operating the fishing vessel regarding to the propulsion aspect.

Actually, in the concept of ship propulsion the angle of shaft propeller is one that can affect to the power efficiency and fuel consumption.

1. Basic theory

a. Propulsion

The propulsion system is a system from engine to the propeller for ship operation. Ship Propulsion System consists of three main components, such as: prime mover (main engine), transmission system and propeller.

b. Flow velocity

The measurement of the speed of water flow from any variation of different angles can be expressed:

$$V=L/T \qquad (2.1)$$

where:

V: Flow velocity (m / s)
L: The length of the test track (m)
T: Time (s)

c. Velocity of flow average

Knowing how the flow velocity in sea water density 0.8985 m / s in the corners that have been determined.

$$\frac{\rho 1}{\rho 2} = \frac{v1}{v2} \qquad v2 = \frac{v1 \cdot \rho 2}{\rho 1} \qquad (2.2)$$

where:

V*water*: *velocity of water flow rate in the density of seawater*
ρ1 ɤ: The density of sea water (1030 kg / m³).
ρ2 ɤ: Density of fresh water (1000 kg / m³)

$v1$ The flow velocity in the density of sea water (m / s)

$v2$: The flow velocity in the density of fresh water (m / s)

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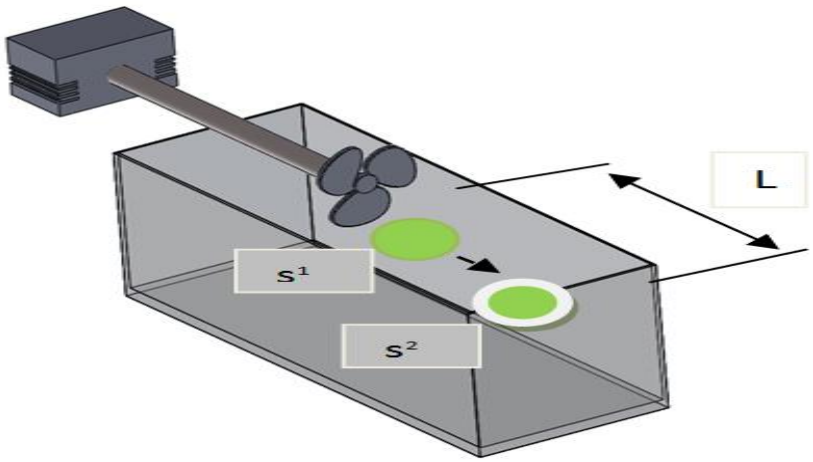

Figure 1 Schematic Diagram of Water Test

d. Power and Torque

The value of the power can be solve using the following equation:

$$PB = 2.\pi.Q.n \quad (2.3)$$

$$PS = PB.\eta GB \quad (2.4)$$

$$PD = PB.\eta S.\eta GB.\eta PD \quad (2.5)$$

$$PT = T.VA \quad (2.6)$$

$$Q = \frac{PB}{2.\pi.n} \quad (2.7)$$

where:

PB = power engine (W)
PS = Power to the propeller shaft (W)
PD = Power at the propeller (W)
PT = total power (W)
Q = torque (N.m)
n = Rpm
ηGB = Efficiency gear box
ηS = Efficiency shaft
ηPD = Efficiency propeller
T = Thrust vessel (N.m)
VA = water flow rate of each variable angle (m/s)

d. Open water efficiency

Some equation for the find out the open water efficiency are:

$$KT = \frac{T}{\rho \cdot n^2 \cdot D^4} \quad (2.8)$$

$$KQ = \frac{Q}{\rho \cdot n^2 \cdot D^5} \quad (2.9)$$

$$J = \frac{Va}{n \cdot D} \quad (2.10)$$

$$\eta_0 = \frac{J}{2.\pi} \cdot \frac{KT}{KQ} \quad (2.11)$$

$$T = \frac{SHP \times \eta_P \times \eta_{rr} \times 75}{ve} \quad (2.12)$$

where:

n = 3768 rpm.
KT = Coefficient *thrust*.
Ae/Ao = Blade area ratio.
η_p = efficiency propulsion.
P/D = Ratio ranges from average leaf to its diameter.
J = Advance number.
KQ = Coefficient torque.
η_0 = efficiency*open water*.
η_{rr} = efficiency Rotative.

METHODOLOGY

The experiment for measure the flow rate was done with five test angle of propeller shaft (22 °, 24 °, 26 °, 28 °, 30 °). The sketch of experiment modelling used 3D *Software SolidWork 2010*. Figure 2 show the methodology of experimental research.

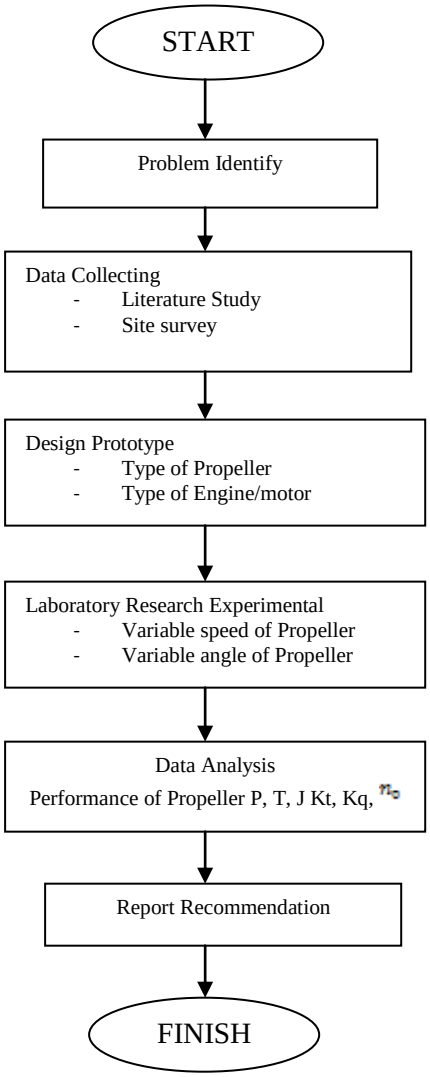

Figure 2. Flowchart of Research

RESULTS AND DISCUSSIONS

The results of the experiment of effect of propeller shaft angle to the performance of propeller is shown in the table below.

Table 1. The Experimental Results

No		Variation of Angle				
		22°	**24°**	**26°**	**28°**	**30°**
1	Q (W)	2.053	2.053	2.053	2.053	2.053
2	T (N.m)	6404.06	6404.06	6404.06	6404.06	6404.06
3	J	0.018	0.012	0.0102	0.006	0.0045
4	PD (W)	470.2	470.2	470.2	470.2	470.2
5	Ps (W)	729	729	729	729	729
6	PT (W)	1601.01	1139.92	902.97	531.53	403.45
7	KT	0.69	0.69	0.69	0.69	0.69
8	KQ	0.39	0.39	0.39	0.39	0.39
9	Va (M/s)	0.25	0.178	0.141	0.083	0.063
10	η_o	0.16	0.11	0.09	0.053	0.04

Based on the experimental results data, the results can be noted that the best water flow velocity is at an angle of 22 ° with a value of 0.25 m/s the time gained by 1.26 seconds with a distance of 0.5 m, and minimum results found in a 30 ° angle to the value of the speed of 0.063 m/s time taken 4.9 seconds from a distance of 0.5 m ball release.

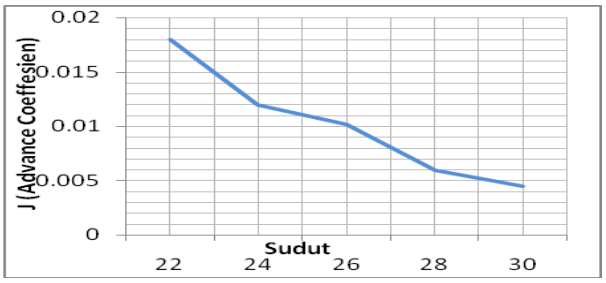

Figure 3 Graph of advance coefficient

Figure 3 shows the comparison chart between angle and advance coefficient. The angle of 22 ° give the highest advance coefficient. The angle of 22 ° give the greater of velocity water, its around 0:25 m/s.

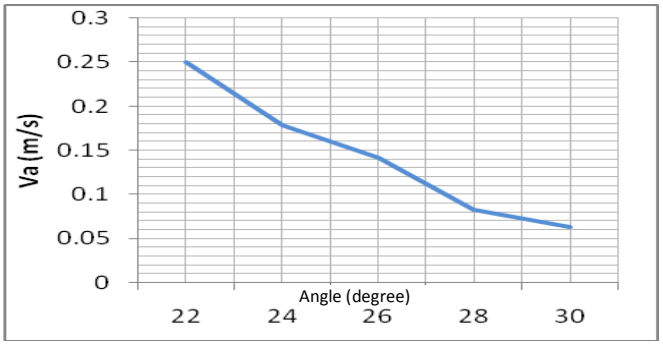

Figure 4 Graph of flow velocity

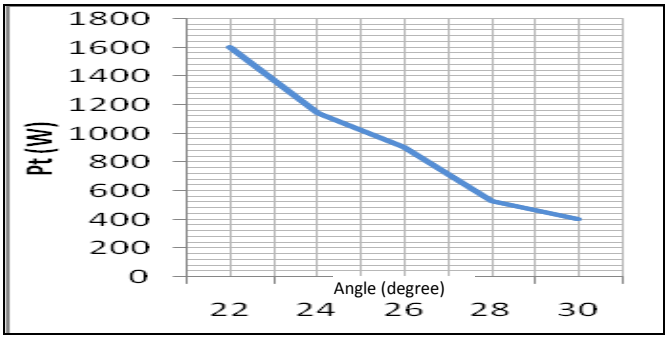

Figure 5 Graph of Power Trust

The result of power trust is shown in the figure 5. The power maximum is given by angle of 22, this phenomenon effect of in high value of advance coefficient and water velocity.

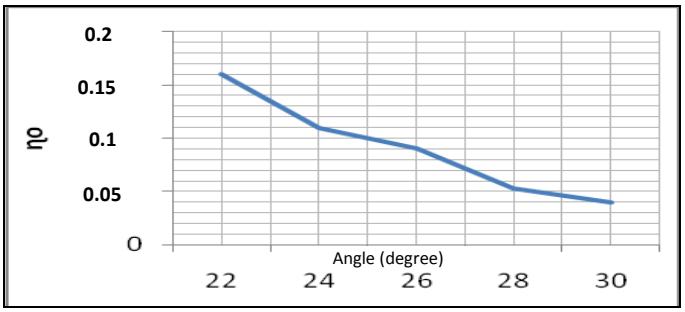

Figure 6 Graph of the propeller efficiency

The experiment shows clearly that the angle of propeller shaft will affect to the performance of ship propulsion.

CONCLUSION

The experimental of effect shaft angle propeller was done. The optimum efficiency of advance coefficient, flow velocity and efficiency open water was shows optimum value at angle of 22 ° where a water flow rate of 0.25 m/s, power of 1601.01 W and η_O is 0.16, respectively.

REFERENCES

Achmad S., (1999). Study on Propeller Efficiency Fishing Vessel 150GT using Turbo Pascal. Bachelor Final Project. Universitas Dharma Persada. Jakarta.

Carlton, J.S. (1994), Marine Propellers and Propulsion, Butterworth-Heinemann Ltd, Oxford,

Howard I Chapeller, (1971). Boat Building; a complete Handbook of wooden Boat construction, George Allen and Unwin. London.

J.D.K. Wilson, (1999). Fuel and Financial Saving for Operator of Small Fishing Vessels. Food and Agriculture Org. ISBN 9251042233, 9789251042236. USA

Kleppes Kristoffer, (2015). Empirical prediction of resistance of fishing vessels. Master Thesis in Marine Technology. Norwegian University of Science and Technology. Norway.

Mahardjo W., (1989). Efisiensi propeller kapal kayu tradisional di pantai utara pulau jawa. Institut Teknologi Sepuluh November. Surabaya.

S.V. Aa Harvald, (1983). Resistance and Propulsion of ships, John willry & Sons. New York..

Suryo adji, (2006). Pengenalan Sistem Propulsi. ITS Surabaya.

W.P.A. Van Lammeren, J.D. Van Mannen, M.W.C Oosteverld, (Nov 1969). The Wagening B-Screw Series, SNAME – New York.

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