D. Dynamic Simulation

In the first step, the measured current value of the state of motion is filtered by Kalman filtering, and the optimal estimate value of the motion of semi-platform is achieved. Next, compared with the set target value the state deviation can be known with position and heading angle deviation are imputed to the PID controller timely. The thrust instruction sent to the thrust allocation will be processed and each propeller to provide thrust. Finally, the effective thrust together with the environmental loads is imposed on the platform model. Doing the Loop until finished, the whole dynamic simulation platform movement and the thrust within the time history is done.

Environmental conditions: wind, waves and currents are in the same direction of 45 degree. The requirement of the simulation is shown as Table Ⅲ.

TABLE III. DYNAMIC SIMULATION PARAMETER

Item	***Setting Value***	***Item***	***Setting Value***
Control mode	PID+Kalman filter	The initial coordinates	X=0,Y=0, Ψ=0deg
Thrust allocation principles	Lower power	Initial velocity	Vx=0,Vy=0 VψΨ=0deg
Control point	center of gravity	Positioning target	X=0,Y=0, Ψ=0deg
Simulation time	2000s	Positioning accuracy	ΔX=0,ΔY=0, ΔΨ=0deg

The following is concluded from the results of simulation in full mode of operational condition presented in Fig 5 and Fig 6:

a) Platform can be maintained in operational condition - full mode of positioning, with the positioning accuracy to meet the requirements.

b) The power of the thruster is mostly on the level of 30-40% of the low power. The higher efficiency of the propeller means lower fuel consumption and makes the dynamic positioning system of the economy improved.

c) In actual operation, controlling the bow to make the environment more favorable can reduce the power consumption.

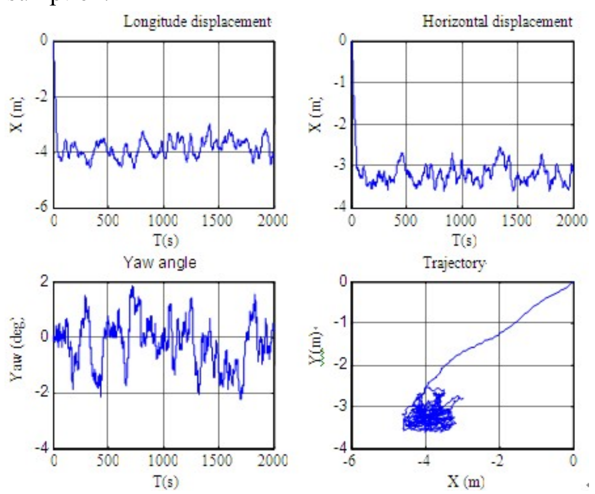

Figure 5. Horizontal movement of time trace and trajectory for the platform

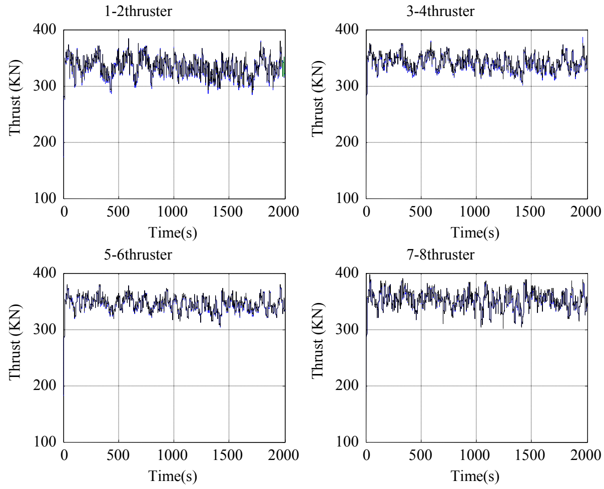

Figure 6. Time-history curve for the thrust of the thruster

V. CONCLUSION

A dynamic simulation is presented to perform DP of deepwater semi-submersible drilling platform equipped with 8 azimuthing thrusters. Mathematic model of low-frequency movement and environment load is created before the simulation. Simulation results show that:

The DP with PID controller and Kalman filter can fulfill the requirement and proves that the design is feasible. The power of the thruster can keep in acceptable range

The modular approach to the semi-submersible platform of the model for is practical. But to obtain accurate wind load, current load. The wind tunnel model test is needed. Only the operational condition and full mode is simulated. To do the further research, the failure mode is also needed to simulate.

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REFERENCES

[1] MJ Morgan, "Dynamic Positioning of Offshore Vessels,"pp. 195–210, 1984.

[2] ZHAO Zhigao, YANG Jianmin, WANG Lei. "The development and research method of dynamic positioning system,"The Ocean Engineering, 2002, 20(1), pp.91-97.

[3] A.Lough. Dynamic Positioning. Lioyd's Register Technical Association. 1985

[4] van Walree Ir F. " Wind and Current Loads on Semi-submersibles ,"MARIN: No.49817-5-SE, 1991

[5] van Walree Ir F, Willemsen. " Wind loads on offshore structures ,"Boss-88 Conference, Trondheim, 1988

[6] Dalzell, J.F. "Application of the Functional Polynomial Model to the Ship Added Resistance Problem,"11The Symposium on Naval Hydrodynamics , London, 1976

[7] Li Dianpu, "Ship motion modeling" Harbin Engineering University Press, Harbin 1999,pp. 1-90