Abstract

The majority of captains are concerned about horizontal motions of a yacht at anchor, especially for new yacht designs. In a questionnaire 76% of the yacht captains indicated to encounter problems due to horizontal motions at anchor. The motion behaviour will become a problem in case guests are noted by and concerned about the motion amplitude. The objective of this research project is to give recommendations on yacht design parameters to reduce horizontal motions of motor yachts at anchor. Horizontal motions of a yacht at anchor are studied by a parameter sensitivity study performed on a mathematical model drawn up in MATLAB. This model simulates horizontal motions with three mean force components in time. First component is the excitation force only provided by wind, obtained from wind tunnel test results. Variation of superstructure location is applied by wind moment coefficient modification. The second component is the anchor restoring forces, obtained by a catenary description. The last component, hydrodynamic hull reaction forces are presented by a coefficient description obtained from SURSIM results. Variations of the hydrodynamic forces are simulated by implementation of an additional underwater wing. Variation of parameters within the mathematical model result in reduced horizontal motions with decreasing wind velocity, shortening anchor chain length, decreasing frontal and lateral area above water, far aft located centroid x position of lateral area above water, far forward located anchor fairlead location and additional hull damping far forward. Although the choice of design parameters can reduce horizontal motion amplitudes of yachts at anchor, this will not be sufficient to prevent possible issues. Furthermore, yacht design will be defined by requirements and aesthetics whereas practical importance of reducing horizontal motions at anchor is less considered. On the other hand, the implementation of thrust can result in stable horizontal motions behaviour and allowed to control heading. More research is required to determine how to use thrusters on yacht at anchor without issues of noise, vibrations and safety.