

ARITRA

QUESTION 2

ME22B171

REPORT

The problem statement requires,

- Research about the KCS and Otter Catamaran
- Create URDF models for both vessels
- Implement ROS2 topics for controlling the vessels
- Visualize the URDF models in RVIZ2 for both vessels
- Create a ROS2 launch file that sets up the simulation environment with both vessels

Research:

1. KRISO Container Ship

- a. The ship is a concept vessel designed at the Korea Research Institute of Ships and Ocean Engineering (KRISO). The KCS was conceived to provide data for both explication of flow physics and CFD validation for a modern container ship with bulb bow and stern. It was originally called MOERI container ship. No full-scale ship exists.
- b. Dimensions:

Main particulars		Full scale
Length between perpendiculars	L_{PP} (m)	230.0
Length of waterline	L_{WL} (m)	232.5
Maximum beam of waterline	B_{WL} (m)	32.2
Depth	D (m)	19.0
Draft	T (m)	10.8
Displacement volume	∇ (m^3)	52030
Wetted surface area w/o rudder	S_W (m^2)	9424
Wetted surface area of rudder	S_R (m^2)	115.0

c. Specifications:

Block coefficient (CB)	$\nabla / (L_{PP} B_{WL} T)$	0.6505
Midship section coefficient (CM)		0.9849
LCB (% L_{PP}), fwd+		-1.48
Vertical Center of Gravity (from keel)	KG (m)	
Metacentric height	GM (m)	
Moment of Inertia	K_{xx}/B	0.40
Moment of Inertia	K_{yy}/L_{PP} , K_{zz}/L_{PP}	0.250
Propeller center, long. location (from FP)	x/L_{PP}	0.9825
Propeller center, vert. location (below WL)	$-z/L_{PP}$	0.02913
Propeller rotation direction (view from stern)		clockwise

2. Otter Katamaran

- a. THE OTTER UNCREWED SURFACE VESSEL (USV) is designed by 'Maritime Robotics' for autonomous operations. Its hull shape is inspired from catamaran.
- b. Dimensions:

Feature	Description
Dimensions (LxWxH)	2000 mm x 1080 mm x 1065 mm
Draft*	320 mm
Hull material	High Density Polyethylene (HDPE)
Dry weight	62 kg

c. Specifications:

Battery type	4 x lithium-ion batteries
Weight with batteries	85 kg
Payload weight capacity	30 kg
Propulsion	2 x electric motors
Endurance*	20 h operation time at 2 kts
Top speed*	6 kts
Sea State (Beaufort Scale)*	2
Autonomous and remote-control	Maritime Robotics Autonomous Navigation System
Vehicle Control System	VCS Rugged Laptop and Android app
Standard situational awareness	Camera / AIS class B receiver
High-bandwidth communication	5GHz MIMO radio / Wifi

URDF Modeling:

1. KRISO Container Ship
 - a. URDF file is created by typing manually
 - b. base_link is taken dimensions from MOERI model ship
 - c. Rudder & propeller shape is taken appropriately
 - d. Joints are described accordingly
2. Otter catamaran
 - a. URDF file is created by typing manually
 - b. base_link is the top bar
 - c. Right & Left hull shape are taken appropriately
 - d. Propellers are attached & Lidar is attached to top bar
 - e. Joints are described accordingly
3. Default tutorial package “urdf_tutorial” which contains display.launch.py is used to run the above urdf files

ROS2 Control Setup:

1. KRISO Container Ship
 - a. Teleop_twist_keyboard is mapped to kcs_ctrl node from vessel_ctrl_setup package
 - b. kcs_ctrl converts Float64MultiArray to Float32MultiArray and publishes it
2. Otter Katamaran
 - a. Teleop_twist_keyboard is mapped to otter_ctrl node from vessel_ctrl_setup package
 - b. kcs_ctrl converts Float64MultiArray to Float32MultiArray and publishes it