

# SHIPMA

## SHIP-MAnoeuvring Numerical Model

# (the soul of SHIPMA)





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# SHIPMA - Index

## Intro

What is SHIPMA?

For what is SHIPMA?

Working with SHIPMA

Challenges

## Improvements





# What is SHIPMA?

## SHIP MAnoeuvring

#### Numerical Model

DI

RE

Deterministic

To simulate the manoeuvring behaviour of vessels in ports and fairways.

The application of SHIPMA is primarily in port and fairway design, referring to both approach channels and inland waterways. FEASIBILITY of Manoeuvers.

**Fast-Time Simulation** 

**Fast-Track Simulation** 

Autopilot Model



# How does SHIPMA work?

#### Flowchart: mathematical manoeuvring model











#### Flowchart: mathematical manoeuvring model











Flowchart: mathematical manoeuvring model





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Desired track Desired velocity or rpm Desired course offset

#### ... ARE NOT...

• "a priori" inputs (one exception)

#### ... ARE ...

• Parameters for optimization

REQUIRE ...
Interactive process to find the "best" manoeuvre



## **Track Optimization - One exception**

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- Upgrading of Nautical Channels
- Constant speed navigation
- No manoeuvring areas (stop, turning)
- No berthing/unberthing (no approach)
- Testing new bends layout with crossing waves, winds and currents
- Feasibilty study
- Manoeuvers consisting in:
  - Constant setting order
  - Imposed track
  - Power burst (if required)
  - No tug assitance (escort)
- Comparing weather conditions to set operational limits



# For what is SHIPMA?

## SHIP MAnoeuvring studies







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## SHIP MAnoeuvring studies

#### **SHIPMA**

- A tool to evaluate cases/alternatives using simulation of ship manoeuvres
- Entrance and exit of ports, passage of bridges, passage of channels, entrance of locks, offshore operations

#### **Purpose of SHIPMA**

- To evaluate the feasibility of manoeuvres under specific environmental conditions;
- Determine the consequences for the dimensions of infrastructure;
- Determine the consequences for the vessel's equipment (e.g. thrusters) or assistance (e.g. tugs).

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## SHIP MAnoeuvring studies

- First stages of the Project
- Conceptual Design
- Selection of Alternatives
- Basic Design (Pre-FEED // FEED)
- Previous design checking
- Feasibility studies
- Advanced Design
- Layout/Dredging optimization
- Human factor consideration for operational stage

But NOT always

## SHIP MAnoeuvring studies





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## Fast-Time vs Real-Time

#### Deterministic vs Probabilistic

#### Ship Feasibility vs Human Safety

## SHIPMA versus simulator

#### Advantages:

- All physics incorporated
- Runs can be reproduced and are comparable
- Fast

#### Disadvantages:

- No human element
- No multi ship situations



Operator is only one person, learning and listening from the others



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## **Only Civil Engineering**

- Justification: only channel design, just tugs exercise, ...
- Is it realistic?
- Initial conditions (departure) determine the success of the manoeuver
- Is this manoeuver similar to the future real-life operations?





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## **Only Ship Behaviour**

- Do you understand the Project?
- Focus "only" in ship characteristics
- What's about other restrictions:
  - port infraestructura, AtoN
  - Dredging
  - Harbour rules
  - environmental issues?
- What's about pilot strategies, towing issues,...?
- What's about safety margins?

EXAMPLE: Sailing at 4 knots against another vessel. SHIPMA performs the simulation, stops and turns before Collision (even at enough distance) but... what can a pilot think about risky situation?

ALSO: 2D perspective is different than 3D. So safety "feeling" is so different





 $Y = Y_{uv}.V_{s}^{2}.\cos\beta.\sin\beta + Y_{v|v|}.V_{s}^{2}.\sin\beta|\sin\beta|$ = Y<sub>uv</sub>.uv + Y<sub>v|v|</sub>.v|v| N = N<sub>uv</sub>.uv + N<sub>v|v|</sub>.v|v| X = Y<sub>v|v|</sub>.v<sup>2</sup>.

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# **Only Nautical**

- No experience in:
  - Modelling
  - Analysis
  - Objective comparison
  - Understanding of the project





## SHIPMA Future Challenges

Nowadays, in the Middle East, a typical ToR (Terms of Reference) for a tender has the following reference:

The Desktop Navigation Study shall be undertaken adopting two-dimensional real time navigation software. For clarity, fast-time navigation software will not be accepted, and technical proposals which make use of fast-time navigation software will be disqualified.

### Why?

Possible answers:

- Competence has no Auto-pilot models. High influence in the area
- Nautical sector (Pilots, Captains) doesn't understand well the software (very engineering)
- No nautical aspects are considered in many studies (better practices)
- Lower prices of Real-Time simulation (Desktop simulators, 2D, ...)

## SHIPMA Future Improvements

Possible suggestions:

- Collision module (improve unberthing operations
- Independent propellers/rudders
- Post-processing (more friendly and flexible; combining different tracks)
- More flexibility for usability of ship models (SCAMCO?)



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