



Tool Integration and Software as a Service

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Overview



Context: HOLISHIP

Hydrodynamic Tools

Example: ν -Shallo

Introduction

WebApp

Software as a Service

Conclusions & Outlook





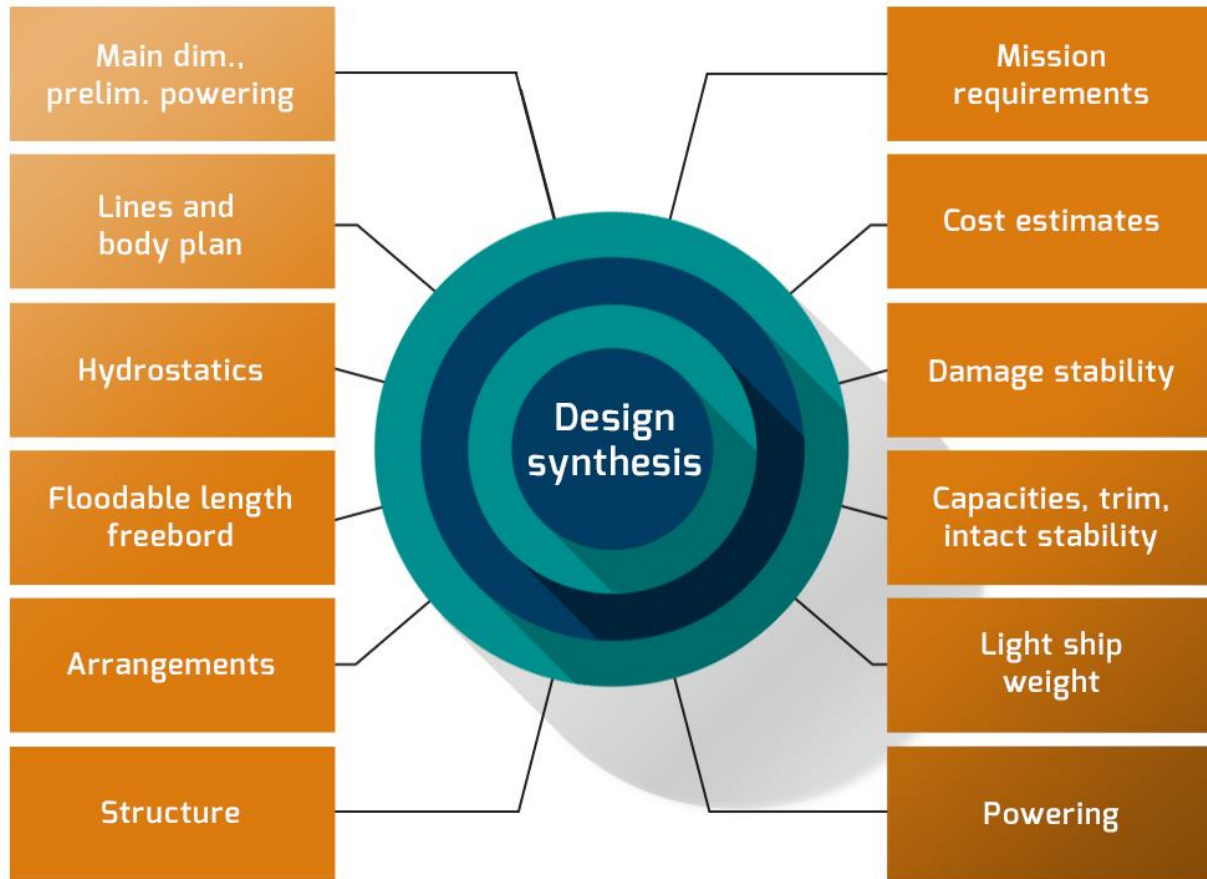
Context

- EU-funded project HOLISHIP (Holistic Optimisation of Ship Design and Operation for Life Cycle)
- Started in September 2016
- 38 partner organisations
- www.holiship.eu





HOLISHIP Approach



HOLISHIP Approach

- Many design tools from different disciplines
- Two platforms
 - Design: CAESES
 - Virtual Vessel Framework
- Tool suppliers will integrate their tools with support of platform providers
 - Advantage: integration can easily be updated (most tools under active development)
- Tool integrations will be demonstrated in a number of application cases





Hydrodynamic / Hydrostatic Tools

		index	Software Tool	Description	Partner		
Hydrodynamic Analysis Tools	RANS & URANS codes	1	StarCCM+	RANS code for calculating resistance, seakeeping and maneuvering	Tritec Marine		
		2	FreSCo+	RANSE Based CFD code for viscous flow simulations. Used to determine hull resistance and propulsion properties, behavior of ships in a seaway (ship motions and added resistance), maneuvering capabilities etc.	HSVA		
		3	ReFresco	RANS code for calculating ship resistance, flow around the hull and for determining maneuvering characteristics.	MARIN		
		4	Xnavis	Steady/Unsteady RANS based solver	CNR-INSEAN		
	Potential Flow Codes	Seakeeping	5	ANSYS AQWA	Potential theory based BEM solver for seakeeping calculations	Tritec Marine	
			6	NEWDRIFT	Potential flow 3D panel code for seakeeping, motions, loads and drift forces on ships and floating bodies in waves	NTUA	
			7	ShipX - Vessel Responses (VERES)	Potential, strip theory based tool. Calculates ship motions and global loads, including short term statistics, long term statistics and operability.	SINTEF	
			8	Aegir	Potential flow 3D Panel code (nonlinear/unsteady, time domain): seakeeping, added resistance, unsteady loads, 6DOF	CNR-INSEAN	
			9	HydroStar	Sea-keeping software based on Boundary Element Method (BEM), using linear and 2 nd order potential theory.	BV	
			Wave Resistance	10	v-SHALLO	Fully non-linear, free surface potential CFD code computing the inviscid flow around a ship hull at a free surface	HSVA
				11	WARP	Potential flow 3D Panel code to determine calm water resistance and loads. Steady, 2DOF	CNR-INSEAN

Table 1: List of Software Tools – Potential Flow & RANS

		index	Software Tool	Description	Partner
Hydrodynamic Analysis Tools	Other Tools for Hydro Analysis	12	MaxWave_Prop	Estimates the maximum wave height at which the ship is capable to navigate in head waves	Strathclyde
		13	MaxWave_Steer	Predicts the maximum wave head and the maximum available speed at which the ship is capable to maneuver in adverse sea conditions	Strathclyde
		14	Parametric Rolling	Tool developed within CAESES. Performs level 1 and level 2 checks for parametric roll failure mode, as described in SDC 2/WP.4 IMO guidelines	Strathclyde
		15	ShipX - Ship Speed and Powering	Calculation of calm water resistance and performance in addition to speed loss in waves. Utilizes empirical methods, residual resistance from database or model test or regression of resistance from SINTEF Ocean's database	SINTEF
		16	Wageningen B-series	Estimates the thrust and torque propeller characteristics using Wageningen B-series data (Matlab code)	Strathclyde
		17	Holtrop and Mennen's method	Utilizes empirical methods for resistance and propulsion prediction	Strathclyde
		18	XShip	XShip is an empirical maneuvering simulation tool.	MARIN
		CASD Tools	19	NAPA	Naval Architecture Package suitable amongst others for stability calculation (intact and damage)
	20		NAPA macros	NAPA macros for intact and damaged stability calculations	NTUA
	Supplementary Tools	21	HEXPRESS	Hexahedral volume mesh generation tool	HSVA
		22	CAESES Connector tool for StarCCM+	CAESES Connector tool for StarCCM+	Strathclyde

Table 2: List of Software Tools – Other Tools





Hydrodynamic / Hydrostatic Tools

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	Wave Resistance					

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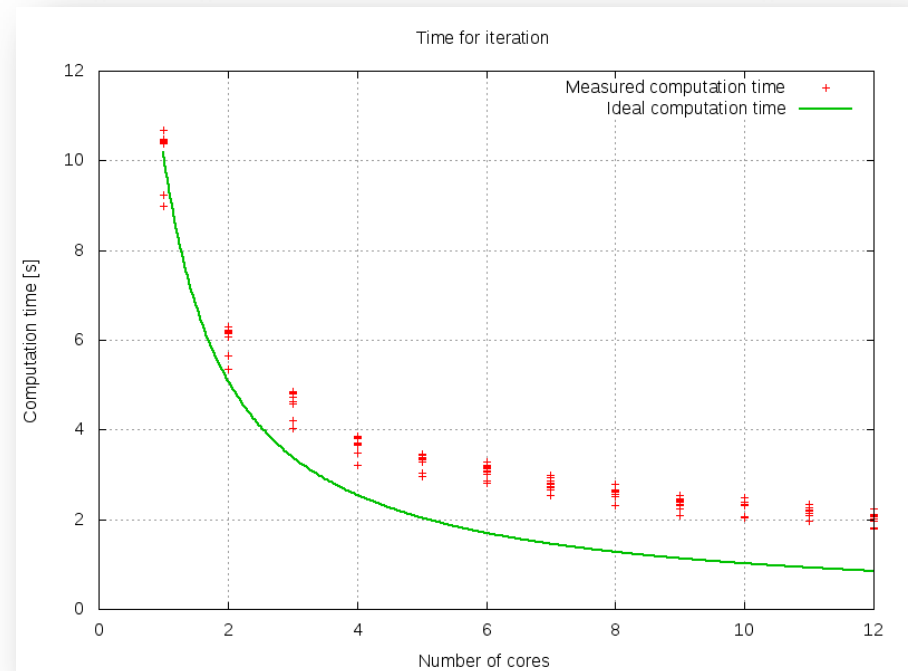
Table 2: List of Software Tools – Other Tools



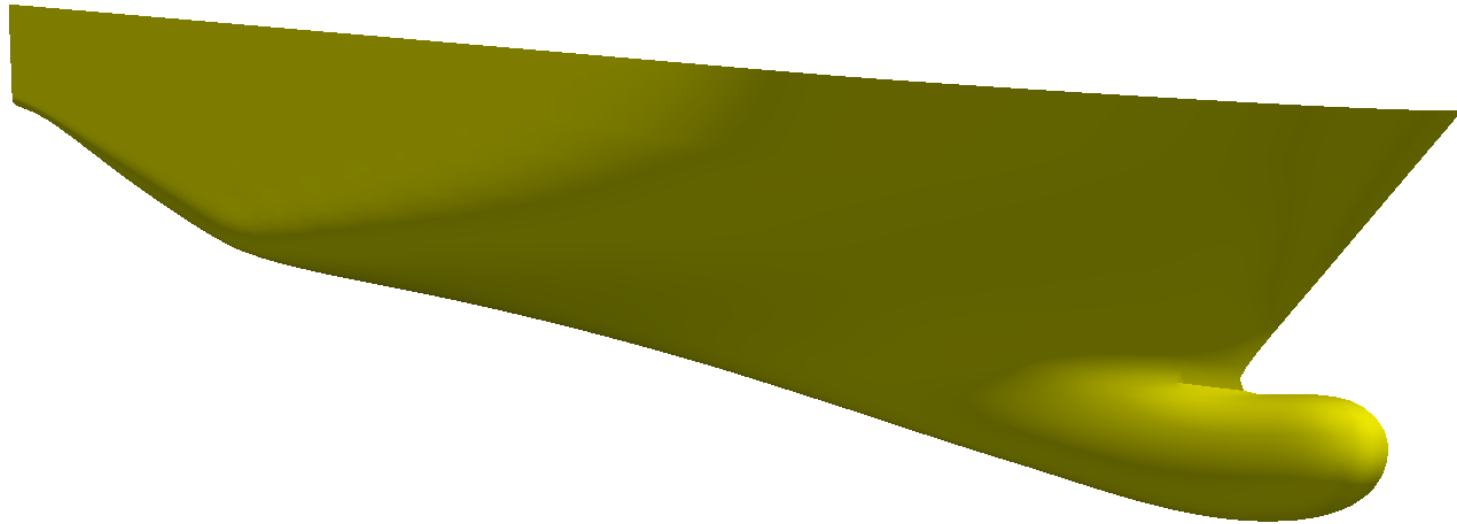
ν -Shallo: Introduction



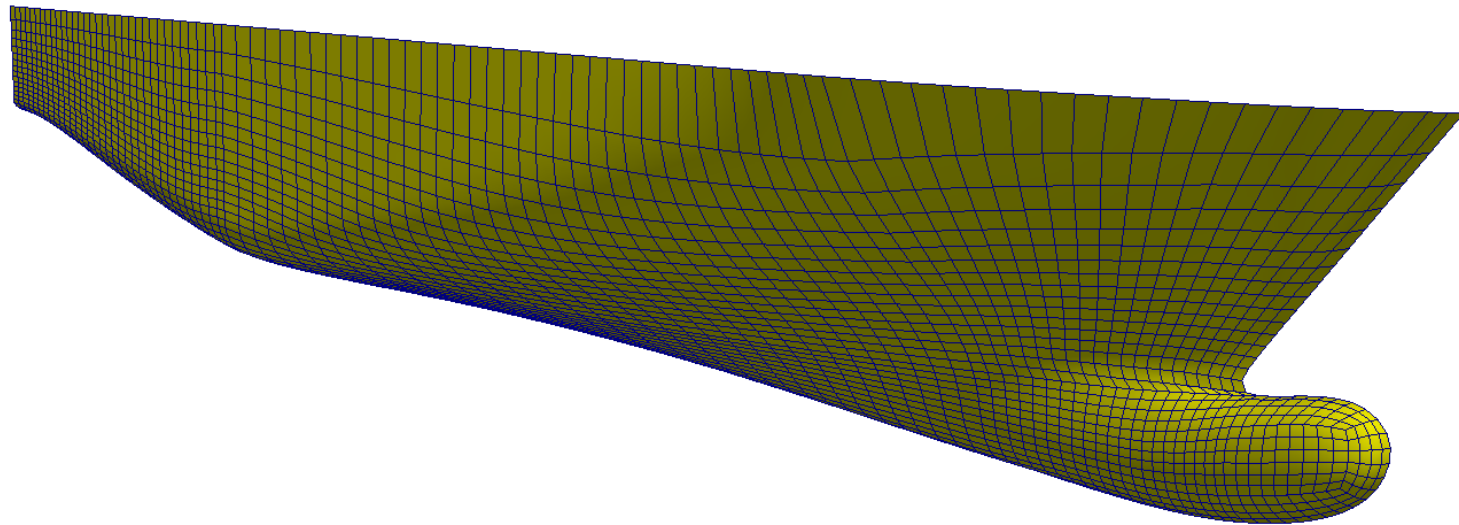
- Calm water resistance based on potential flow
- Nonlinear BC at water surface, requires iterative solution
- Resistance by pressure integration
- Shared-memory parallelisation (OpenMP)



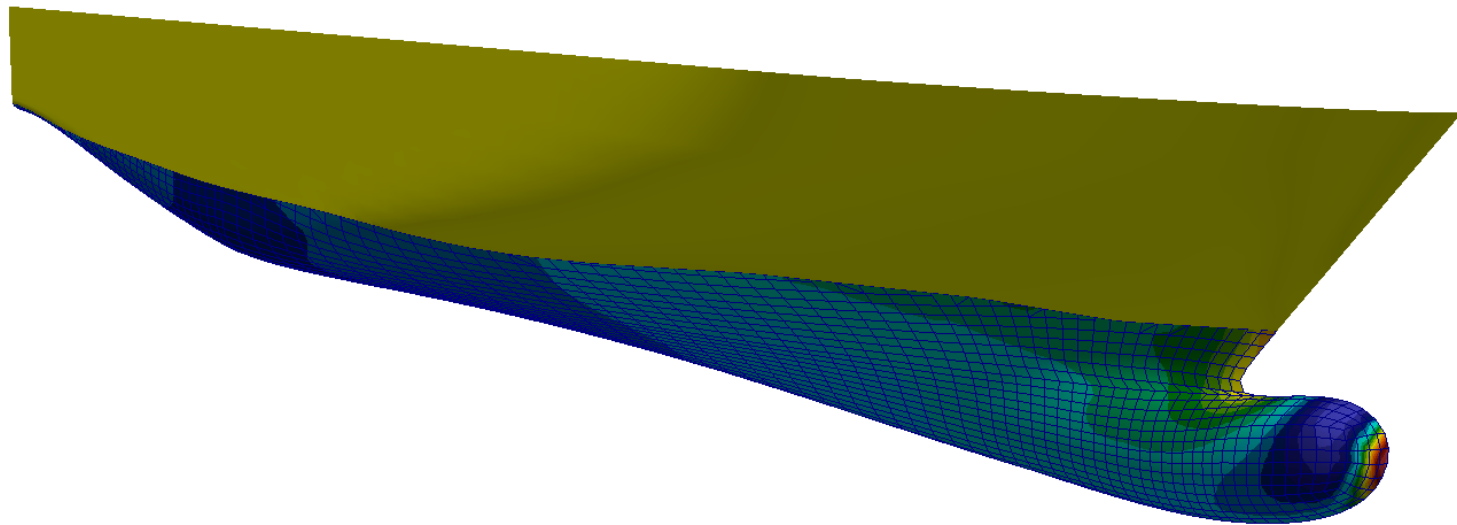
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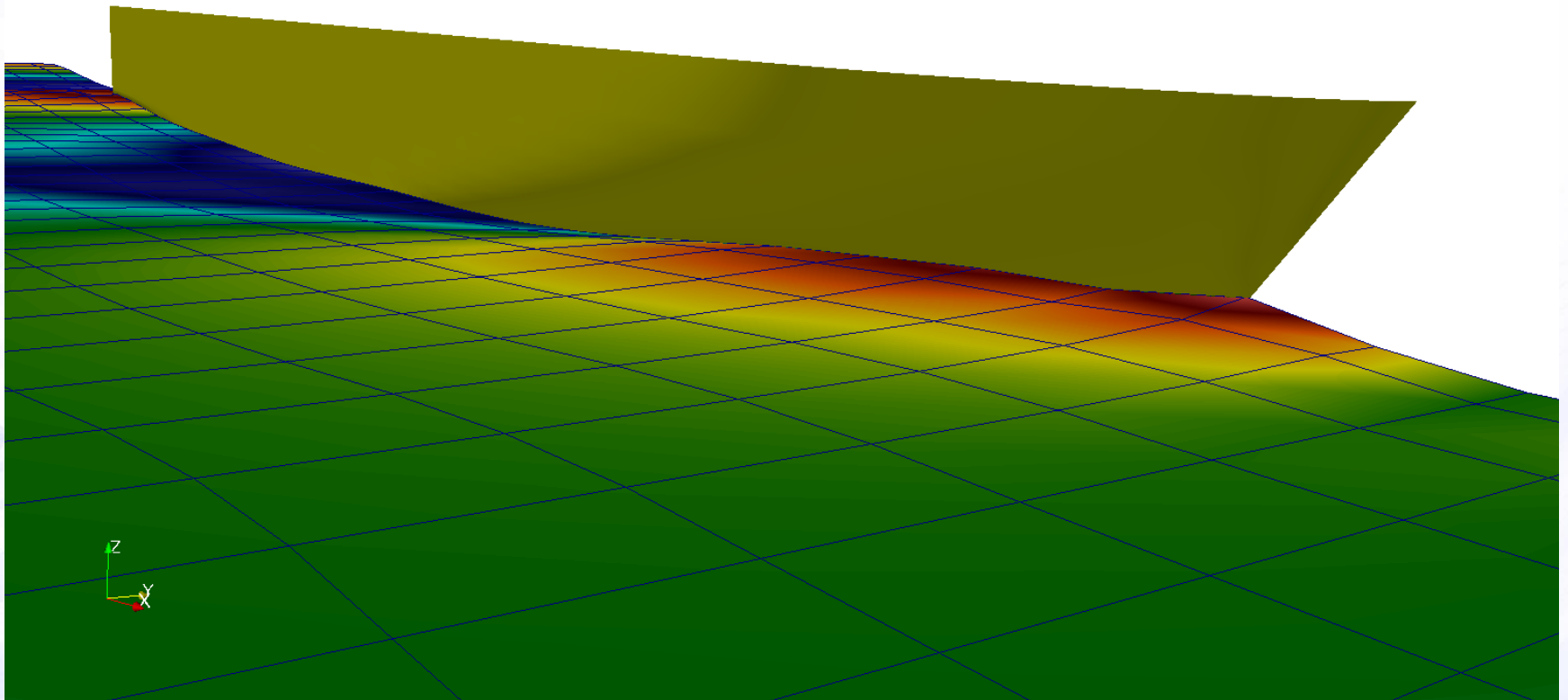
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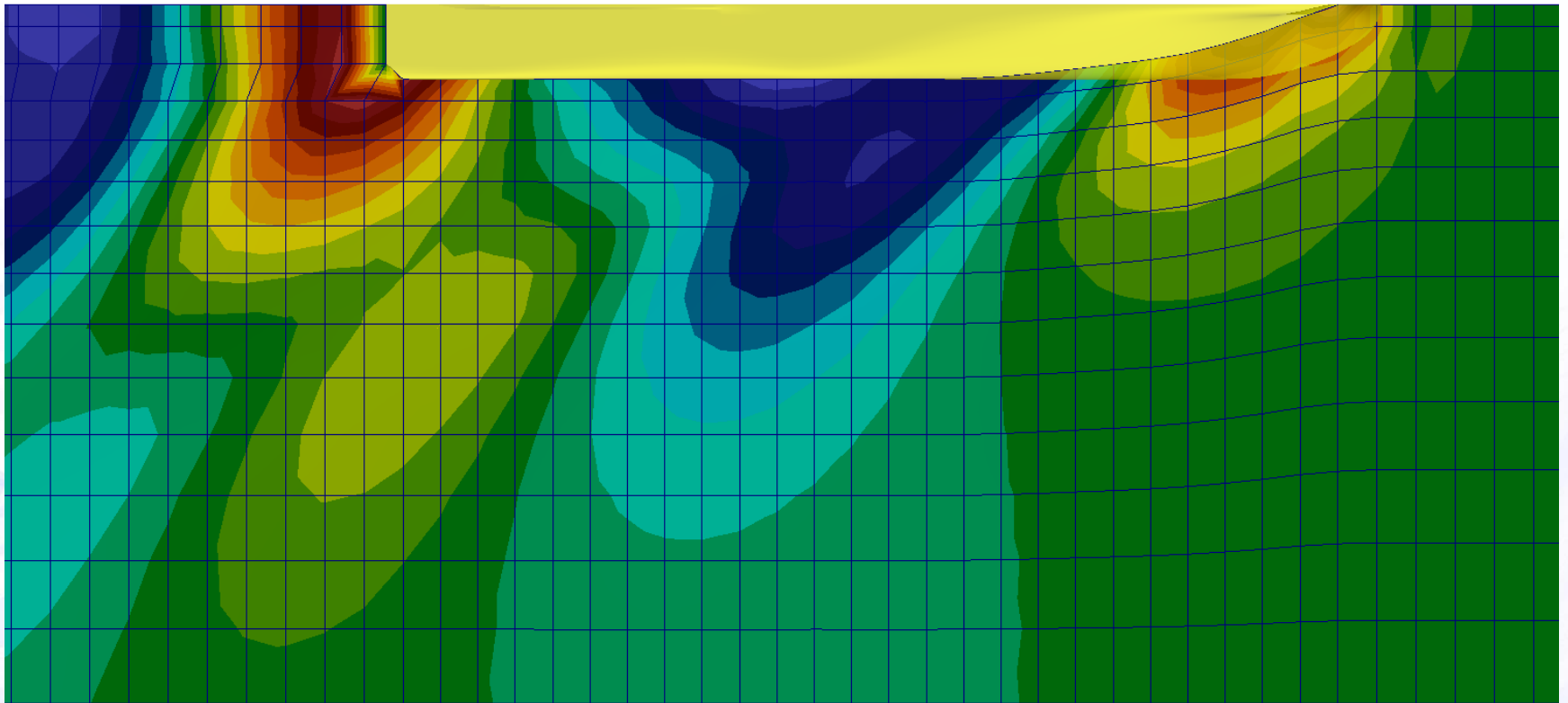
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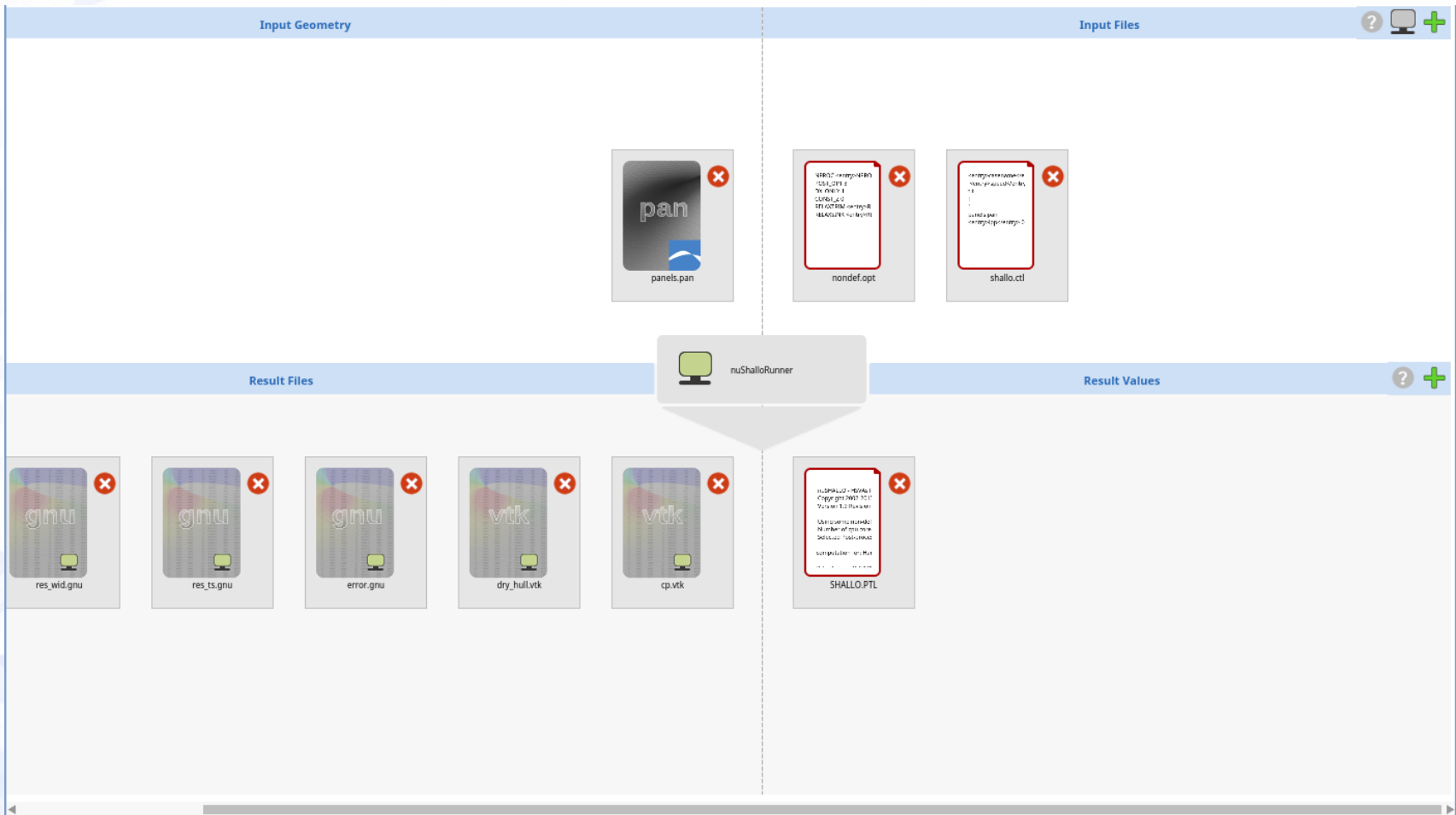


ν -Shallo: Integration

- Input
 - Representation of geometry: panelisation
 - Two ASCII files for case setup
- Output
 - ASCII files reporting resistance, trim and sinkage
 - VTK files
 - Wave elevation
 - Pressure distribution / velocities on the hull



ν -Shallo: Integration

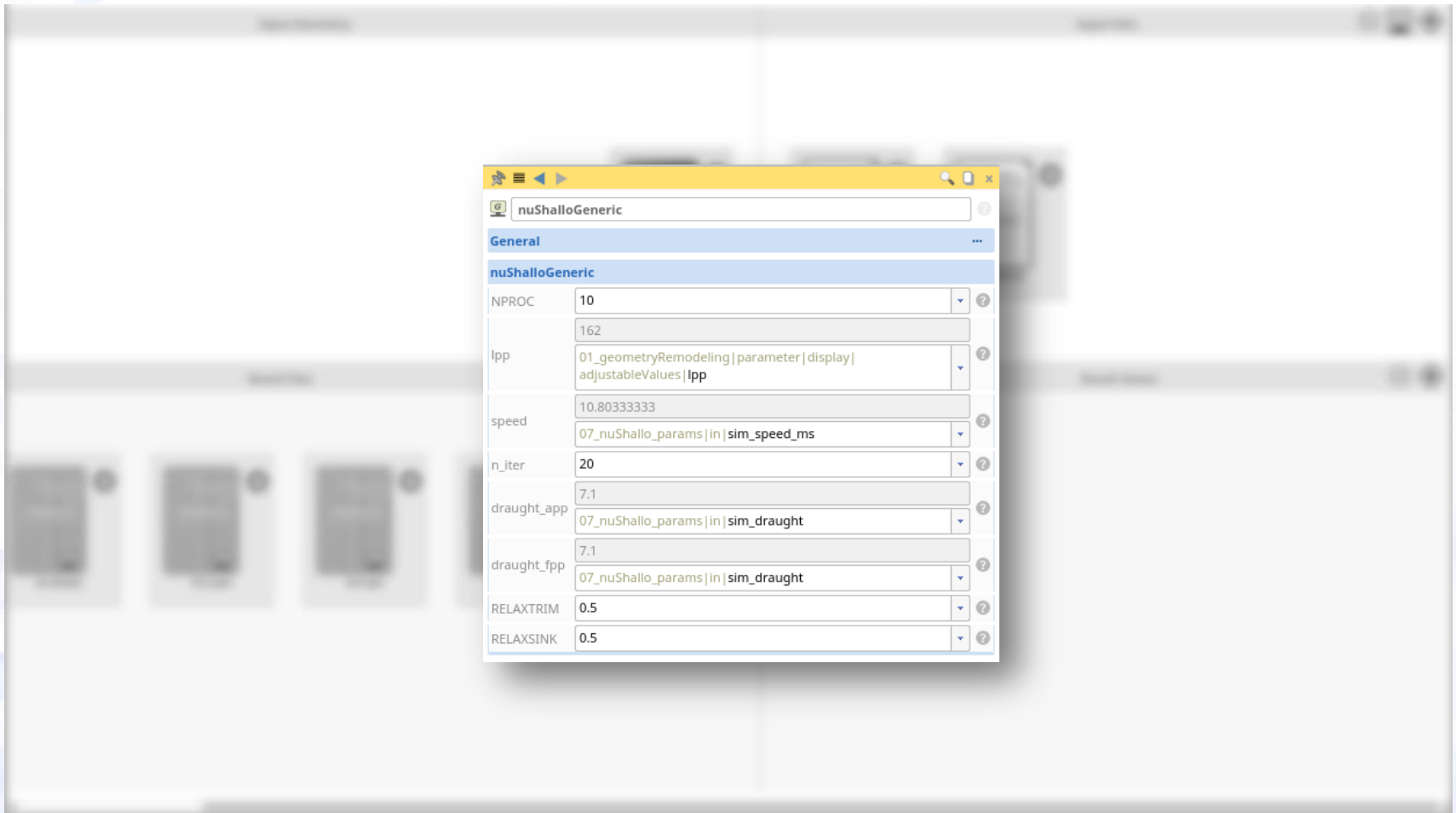




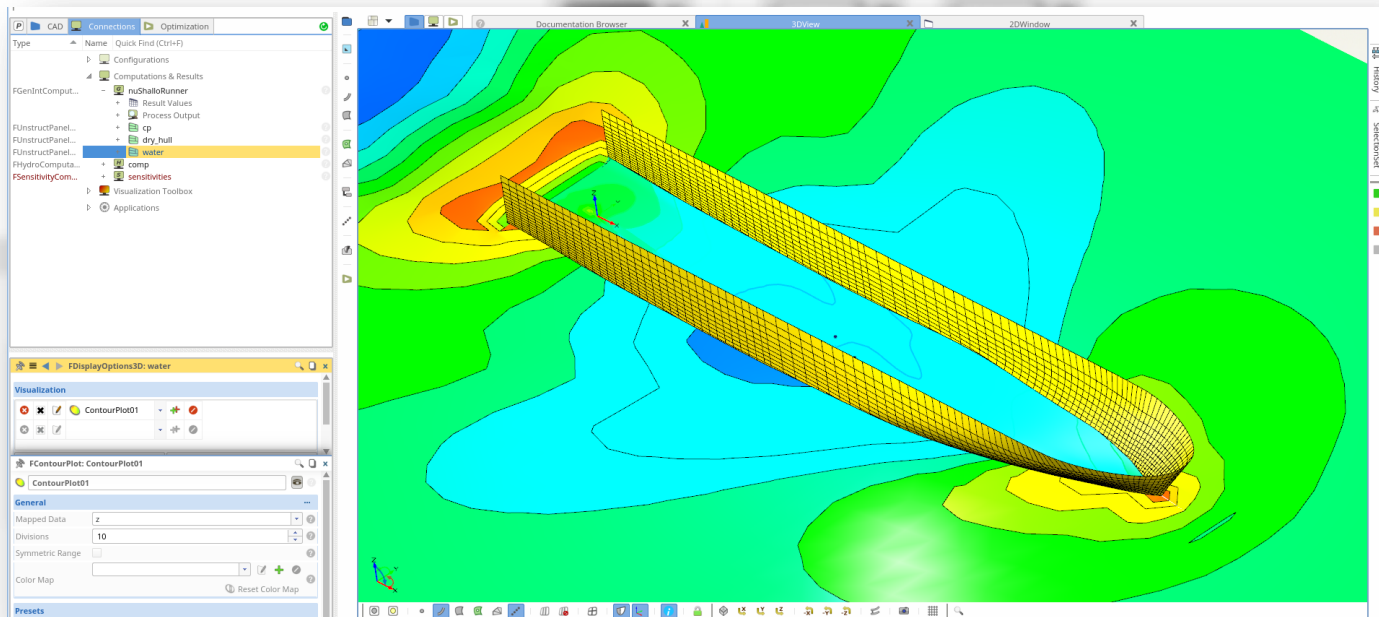
ν -Shallo: Integration



ν -Shallo: Integration



ν -Shallo: Integration



ν -Shallo: Integration



General

Template Name: SHALLO.PTL
Subfolder:

Column Separator

Find numbers:
Custom:

Values

Name: nuShallo_CR
Type: FDouble
Line: 0
Column: 0
Anchor String: CR:
Occurrence: Last
Average:

Results Preview

	Value	Type	
nuShallo_CF_ITTC	0.00146984	FDouble	<input checked="" type="checkbox"/>
nuShallo_k_Friction	0.0902166	FDouble	<input checked="" type="checkbox"/>
nuShallo_CVD	0.000175724	FDouble	<input checked="" type="checkbox"/>
nuShallo_CT	0.00229012	FDouble	<input checked="" type="checkbox"/>
nuShallo_CR	0.000820282	FDouble	<input checked="" type="checkbox"/>
nuShallo_Rt	599.138	FDouble	<input checked="" type="checkbox"/>
nuShallo_Rr	214.601	FDouble	<input checked="" type="checkbox"/>
nuShallo_max_zeta	1.93697	FDouble	<input checked="" type="checkbox"/>

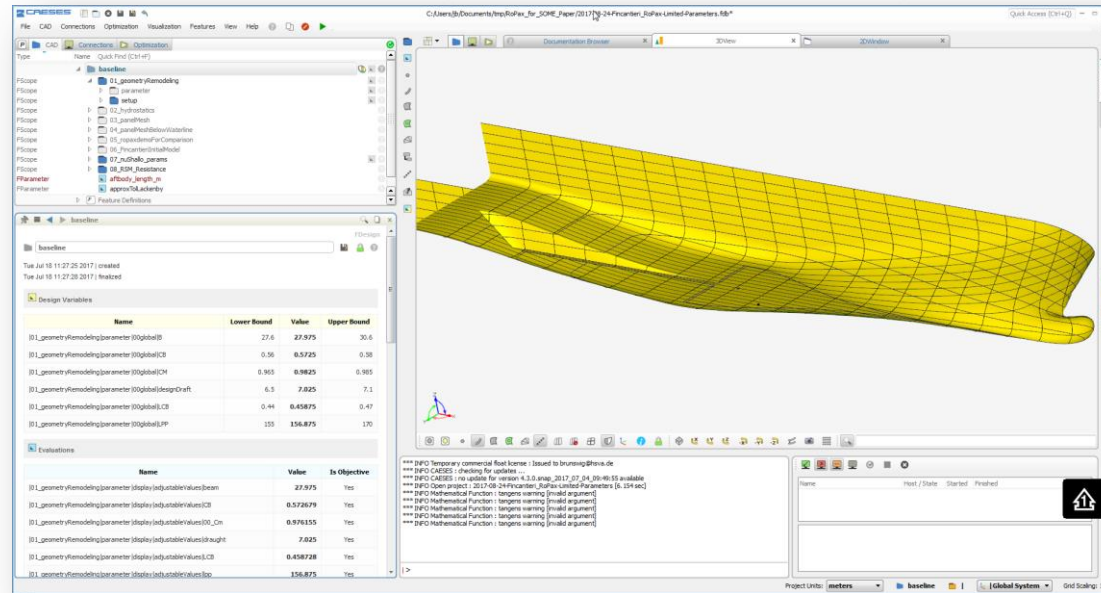
File

```
299 Total Force vect. : -65.33 -83851.61 -143406.02 197305.36 -10914326.00
300 Friction form factor: 0.09
301 Visc. press. Force: -22.43 21.12 29.93 39.99 82.99 -138.
302 >>----- New Step -----
303 >> Max. error: 0.102341E-01 at point (1,x,y)3166 -13.2755 2.2900
304 cw: 5.11926773E-04
305 CF_ITTC: 1.46984053E-03
306 k_Friction: 9.02278423E-02
307 CVD 1.75782043E-04
308 CT: 2.29016994E-03
309 CR: 8.20329296E-04
310 Rt: 599.150085
311 Rr: 214.613068
312 max Zeta: 1.93583488
313 at (x,y): 150.267593 2.24538302
314 delta_t = -2.40903137E-06 total sinkage: 6.66136742E-02
315 delta_psi= 3.00771603E-07 total trim: 4.00162721E-03
316 TAP= 10.6666136 TFP= 11.2816620
317
318 > Iteration 10 *****
319
320 actual Wetted surface (m^2) : 2867.79834
321 Total number of panels on body: 1924
322 Total number of collocation points on water surface: 1262
323 Total number of collocation points on transom: 0
324 Location of hull sources determined!
325 Arrays for system of equation allocated, total number of unknowns: 3186
326 Coefficients for free surface boundary condition ready!
327 Coefficients for body boundary condition ready!
328 Velocities computed!
329
330 Total Force vect. : -65.33 -83851.60 -143406.11 197305.00 -10914349.00
331 Friction form factor: 0.09
332 Visc. press. Force: -22.43 21.12 29.89 40.06 83.15 -138.
333 >>----- New Step -----
334 >> Max. error: 0.102456E-01 at point (1,x,y)3166 -13.2755 2.2900
335 cw: 5.11954422E-04
336 CF_ITTC: 1.46984053E-03
337 k_Friction: 9.02166367E-02
338 CVD 1.75723791E-04
339 CT: 2.29012268E-03
340 CR: 8.20329296E-04
341 Rt: 599.437756
342 Rr: 214.609754
343 max Zeta: 1.93697262
344 at (x,y): 150.267593 2.24621844
345 delta_t = 2.78094449E-05 total sinkage: 6.66414872E-02
346 delta_psi= -2.27068597E-07 total trim: 4.00139997E-03
347 TAP= 10.6666412 TFP= 11.2816544
348 the crystal ball says: Done
349
```





RoPax WebApp: Model



- Based on a Fincantieri design
- Re-modelled using CAESES
- Most parameters are relative (factors)



RoPax WebApp: Demo



CAESES

GEOMETRY SETUP MAIN

GLOBAL

LPP [m] 179

MONITOR

LOA [m]	201.8
B [m]	30.33
T [m]	7.8
DISPLACEMENT [m ³]	24808.83
CB	0.585
XCB [m]	81.79
ZCB [m]	-3.26
KM [m]	17.02

MAIN

WIDTH FACTOR	1
TRANSOM OVERHANG FACTOR	1
RELATIVE MID LENGTH	0.011
RELATIVE AFT BODY LENGTH	0.456
HEIGHT FACTOR	1
DRAUGHT FACTOR	1

1 2 3 >

DE 300%

13:57



Benefits of Web Apps



- Provider:
 - Wrap complex functionality in simple interface
 - Demonstrate functionality of a tool or model
 - **Offer services efficiently (e.g. as pay-per-use)**
- User:
 - No software licenses required
 - No specialists required for standard simulations
- Customer:
 - More cost-efficient for low-volume applications



Software as a Service (SaaS)



- CFD Simulation(s)
 - Calm water resistance
 - Speed-power (incl. propulsion)
 - Seakeeping
 - Adjoint Analysis
- Optimisation
 - Single discipline, e.g. hydrodynamics
 - Multiple disciplines



SaaS: Challenges



Things that could go wrong



SaaS: Challenges



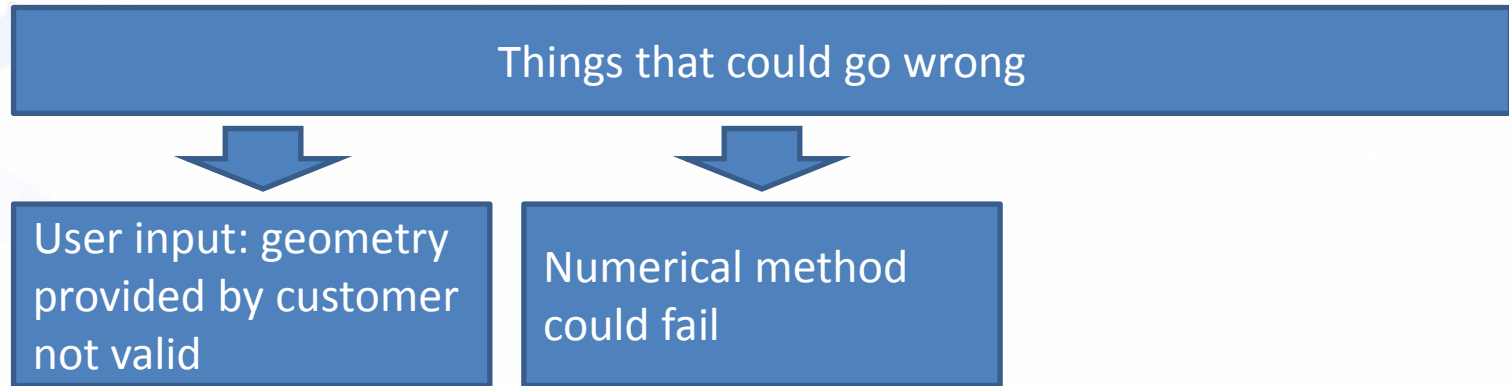
Things that could go wrong



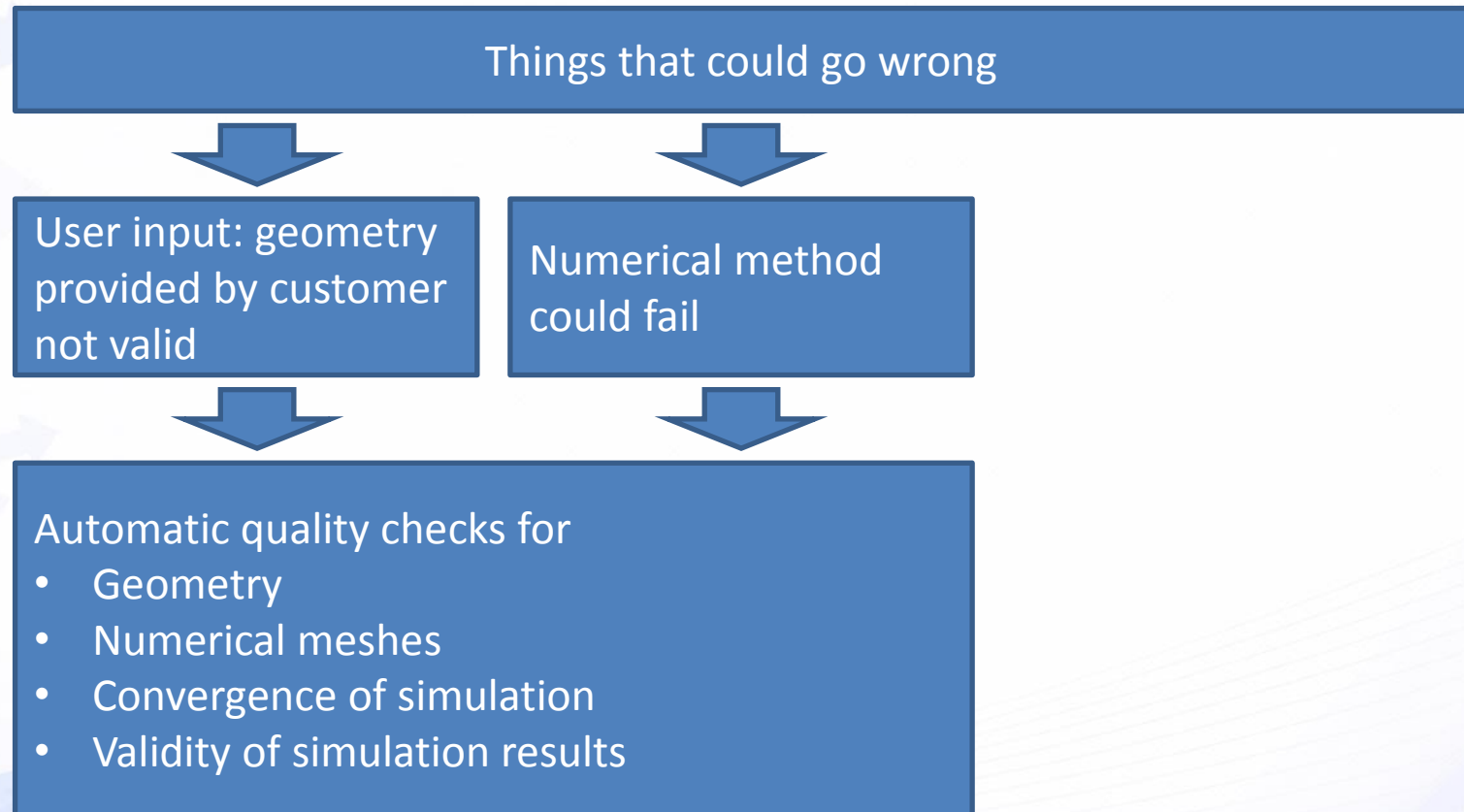
User input: geometry
provided by customer
not valid



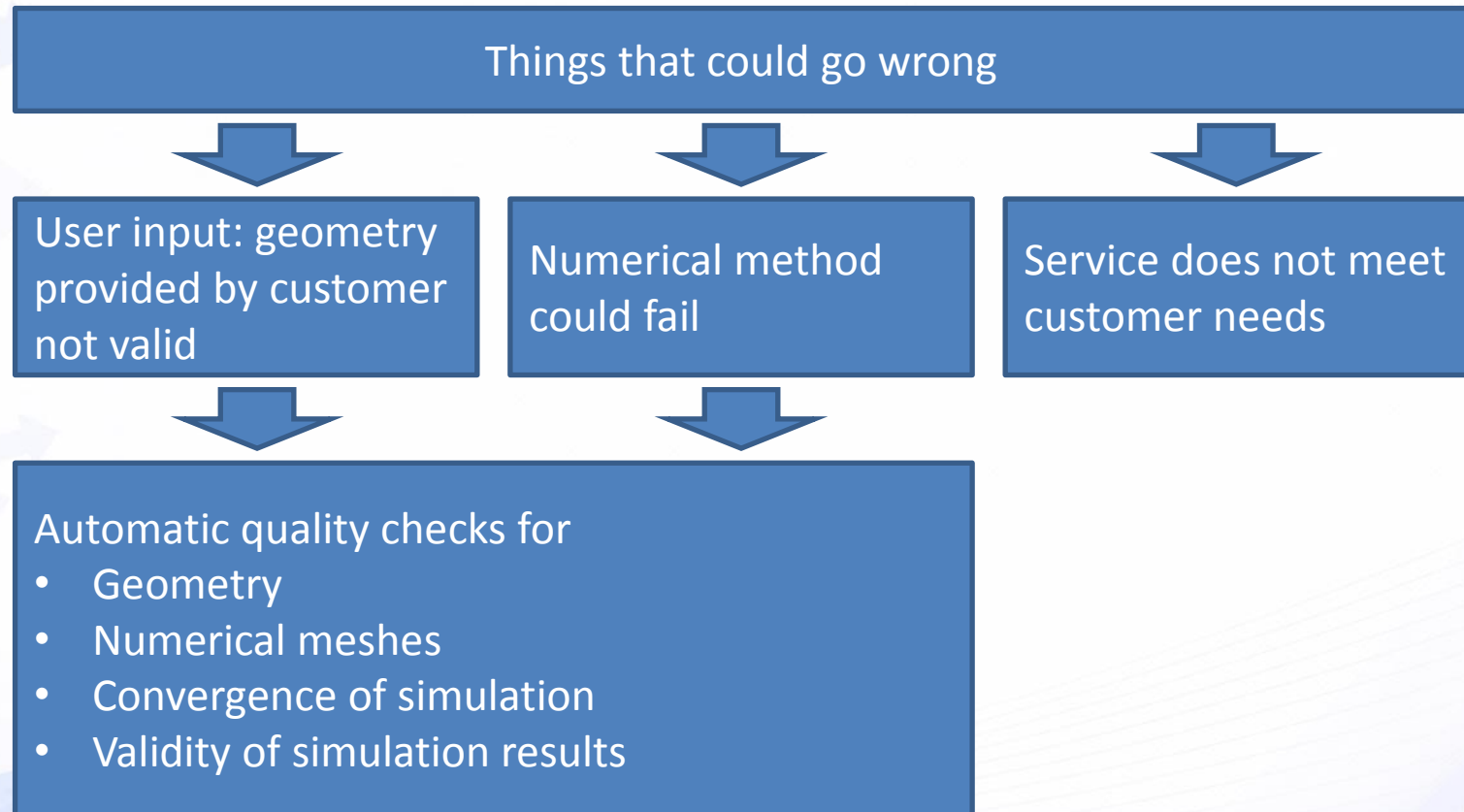
SaaS: Challenges



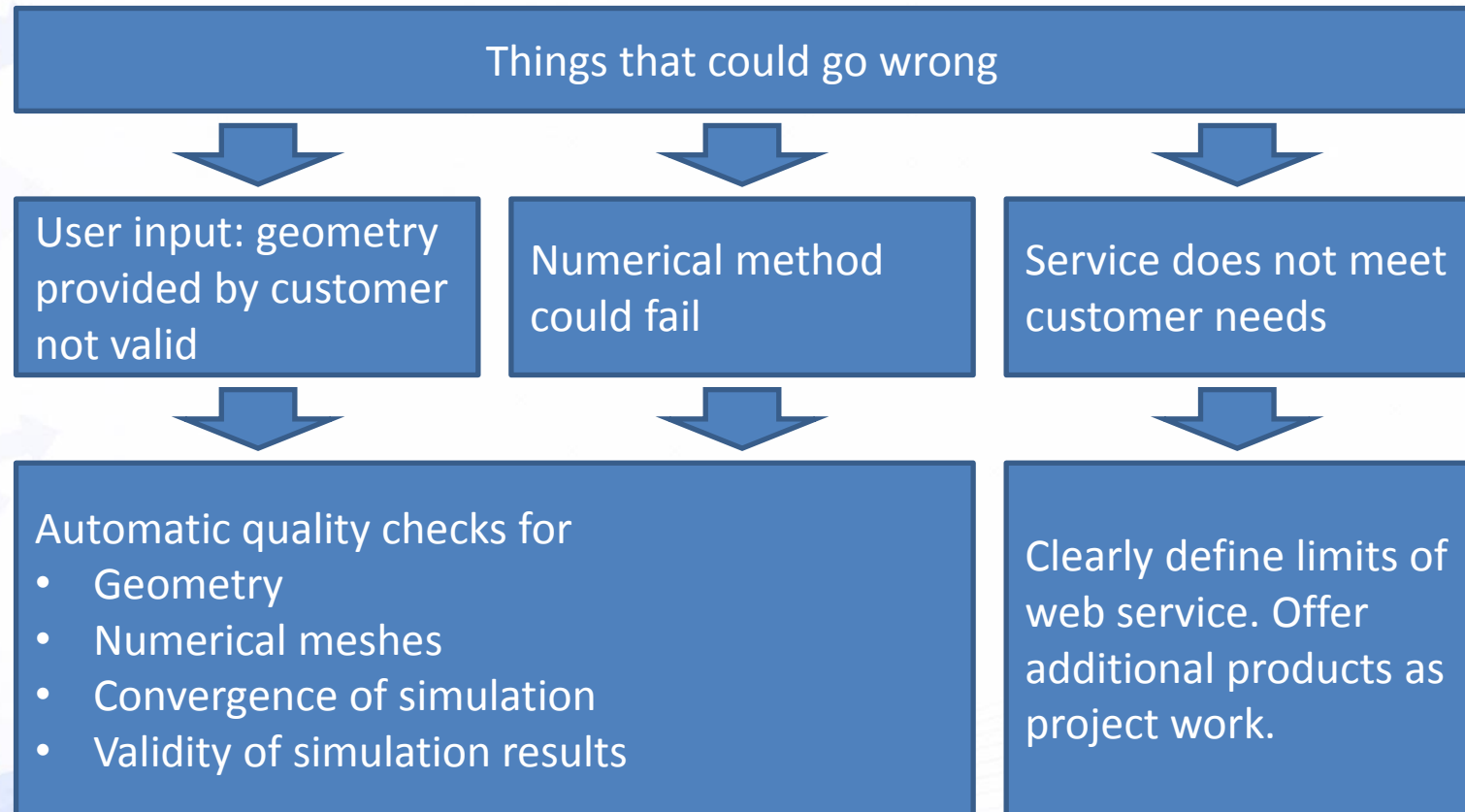
SaaS: Challenges



SaaS: Challenges



SaaS: Challenges





SaaS: Open Questions

- Are there serious legal issues?
- Who would do user management and shop setup?
- Could web services cannibalize classical project work?





Conclusions & Outlook

- ν -Shallo WebApp works as a demonstrator
- Integrated tools could be implemented as SaaS
- Next steps:
 - Work on process chains for viscous CFD applications
 - Develop and implement validity and quality checks
 - Integrate more tools
 - Further assessment of SaaS





Thank you for your attention!

Questions? Suggestions? Remarks?

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