

EUROPEAN* USERS' MEETING²⁰¹⁷





EUROPEAN* USERS' MEETING²⁰¹⁷















CAESES® – Current developments and perspectives

Stefan Harries

Potsdam, September 28, 2017



Content

- Recent and current R&D
- CAESES 5.0
- Appification and WebApps
- Sneak preview: Interactive shape variation



Recent and current R&D (highlights)

- PerSee
 - Hydrodynamic design of ships in sea-states
- No-Welle and FormPro
 - Parametric adjoint optimization
- HYKOPS [03 SX 401 K]
 - Appificiation
 - Geometric modeling
- HOLISHIP
 - Holistic design and process integration (platform)
 - Wrapping of functionality (dominos)
- GAMMA-1 [03 ET 1469 D]
 - Parameter reduction
 (Karhunen-Loève expansion)
 - Ease-of-use and GUI

Acknowledgement

Parts of the work presented here were realized within projects funded by the Federal Ministry of Economics and Technology (BMWi) on the orders of the German Bundestag and PtJ as the conducting agency.

Parts of the work were funded by the European Commission within the HORIZON 2020 Transport Programme.

> Funded by the European Union





Bundesministeriun für Wirtschaft und Technologie

Parametric adjoint optimization

- Results from adjoint CFD computation specify areas of the geometry that have the biggest impact on the objective
- Connecting to information about parameter influence on shape leads to sensitivities for all design parameters

240 180 120 60 -60 -120 -120 -180 -240 -300

		Sensitivity	Variation Delta
	width_mid	-41.2465	3.99853
	path_midfactorZ	1388.89	0.0208482
	path_startTension	562.865	0.0419241
	height_startTension	3119.02	0.242158
	path_midfactorY	233.01	0.0402543
	width_endTension	115.733	0.587913
		-619.726	0.0205169
	width_midPos		0.522516
	th_endTension	807.585	

adjoint shape sensitivity

design velocity

produc

Parametric adjoint optimization



 Using the gradient information from the adjoint CFD leads to a much faster convergence towards a local optimum

optimized

Parametric adjoint optimization









surfSens -2000,0 -1200,0 -400,00 400,00 1200,0 2000,0



-2000,0 -1200,0 -400,00 1200,0 2000,0 Improvement of resistance 1.9% R_T for constant displacement

Karhunen-Loève Expansion (KLE)

- Aims
 - Check quality of a parametric model
 - If needed and possible reduce number of free variables (further)
- Principle components analysis
 - A large number of statistical variable are being replaced by an approximation with a reduced number of linear combinations of orthogonal basis functions
 - Decorrelation of data (as far as possible)





Source: Lindsay I. Smith (2002) A Tutorial on Principal Components Analysis

Karhunen-Loève Expansion (KLE)

- Inlet geometry with 7 free variables
- Variability achieved

r 🔁

 – 1. "super parameter" 	65,78%
 – 1. + 2. "super parameter" 	92,59%
- 1. + 2. + 3. parameter	97,49%
- 1. + 2. + 3. + 4. parameter	98,98%
- 1. + 2. + 3. + 4. + 5.	99,44%





10



Available integrations









- Wrap functionality to make it more easily accessible
- Provide wrapped tools that can be flexibly combined within comprehensive projects

Compute resistance and flow field for hull form and operating conditions via a WebApp







CAESES as a platform (and "operating system")



CAESES 5.0

- Parallelized
 - CAESES 5.0 exploits all cores of multi-core machines (while 4.x uses only one core)
 - Speeds up project loading and model update (depending on the project, up to a linear scaling with regards to number of cores)
- New rendering engine
 - Handling of larger objects
 - Better user experience
 - Nicer pictures
- Base for appification

Speed up in CAESES 5.0

- Parametric CAESES model of a container vessel
- Good scaling on multiple CPUs







Speed up in CAESES 5.0

- Turbine example modeled in CAESES
- Scaling depends on hierarchical model







Speed up in CAESES 5.0

- Complex model of a catamaran
- Created in 4.2 runs flawless in CAESES 5.0

Better performance already in serial mode Opening time reduced by 60%



Rendering engine

	CAESES 4.2	CAESES 5.0	CAESES 4.2	CAESES 5.0
million triangles	average FPS (on a standard GeForce GTX 750 Ti)		million tris	
0.8	15	124	11.7	96.13
2.9	6	90	15.6	258.7
6.2	2	49	13.0	300.0
11.1	1	32	14.4	356.9
17.8	1	24	8.9	420.5
35.6	0	12	n/a	441.9

FPS = frames per sec. (60 FPS for games, 25 for movies)

tris = triangles per sec.

Rendering engine 4.x



Rendering engine 5.0



Rendering engine 5.0



Rendering engine 4.x



Rendering engine 5.0



Rendering engine 5.0



Rendering engine 4.x



Rendering engine 5.0



Rendering engine 5.0



Appification



INTERESTED?

YOUR APP

We can create your custom app on the basis of CAESES[®] that is absolutely easy to use and which runs in a browser. It can be hosted online, or by yourself without the need of Internet access.

ACT US







SHIP HULL

This is a ship hull model we have worked on within the R&D project HOLISHIP. Thanks also to our partners from CETENA. Includes typical parameters and a free geometry download at the end.

LIVE PREVIEW













Sneak preview: Interactive shape variation





Documentation and support

- YouTube
- Blog
- Forum
- Documentation browser
- Helpdesk



Thank you



www.CAESES.com