



Integrated Model Based Design. Bridging the gap between 3D and 1D CFD

Mentor, A Siemens Business

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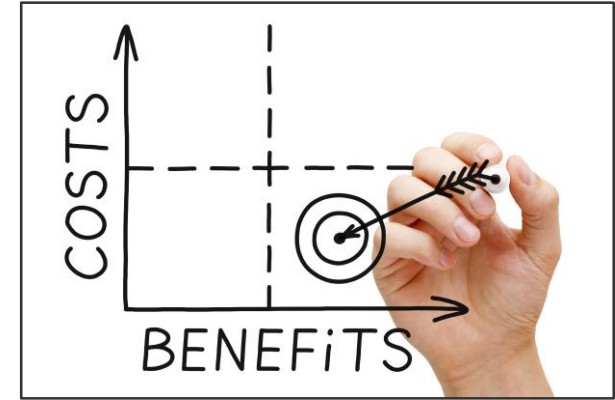
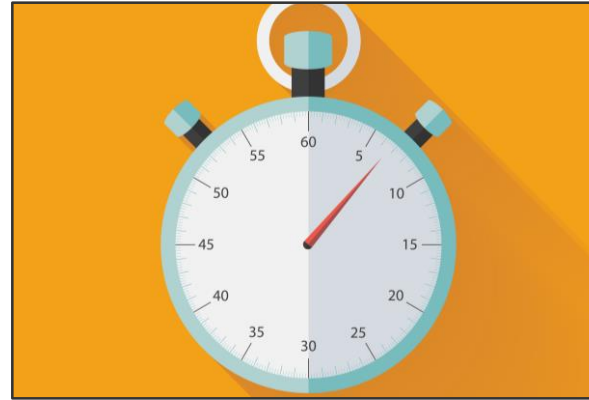
Why are you here in Berlin today?

1. Because I like the city
2. Because I want to know more about FloEFD
3. Because I know that fluid behavior is important to understand





Fluids Behavior is important to Understand



Avoid failures and
ensure safety

Optimize performances

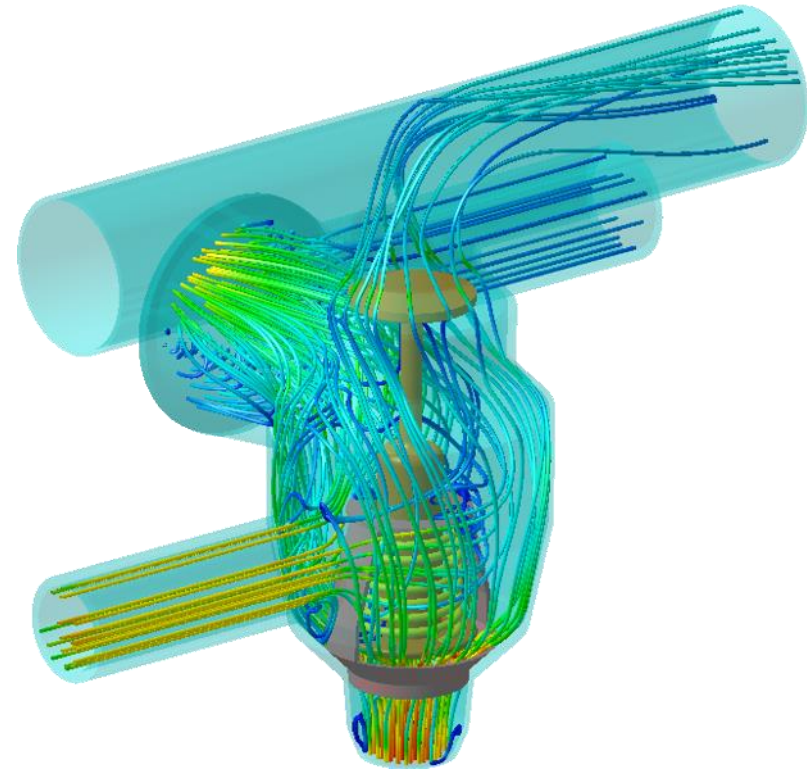
Reduce
Time-To-Market

Save money



3D Computational Fluid Dynamics

- Solves the full set of Navier-Stokes equations on a 3D computational mesh
- Model complex geometry
- Based on 3D CAD geometry
- Provides detailed information on fluid behavior
- Can provide good accuracy
- Significantly faster than physical test





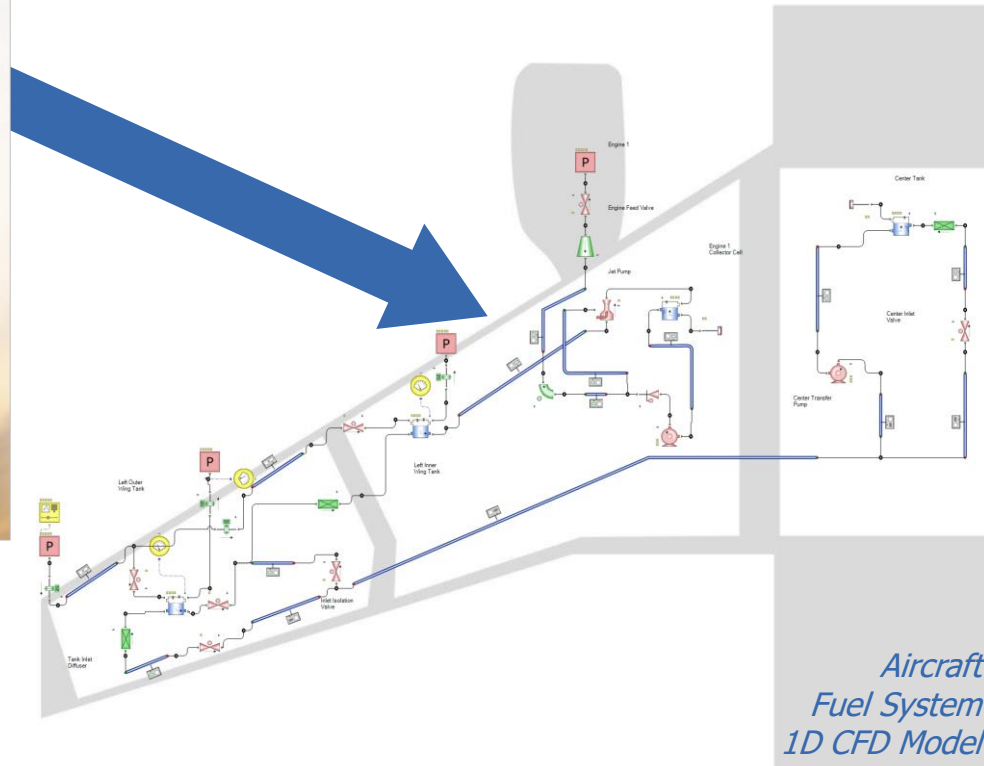
Components can be effectively studied with 3D CFD

Components are usually inserted into larger systems

Components influence each other performances

3D CFD study of the entire system is not effective or even impracticable

1D Computational Fluid Dynamics



Real-life systems
modelled
by means of Networks

Each system element
represented by a discrete
component

Performance based on
empirical data or
theoretical correlation



1D Computational Fluid Dynamics



Fast

- Run a large number of simulations in a short time



Flexible

- Model different system configurations
- Model different operating conditions
- Model transient scenarios
- Account for control systems
- Optimize the system



Accurate

- As long as single components are accurately characterized/modeled

The background of the image shows a complex industrial facility, likely a refinery or chemical plant, with a dense network of white pipes, metal scaffolding, and structural beams. Two men in dark blue work shirts and white hard hats are in the foreground. The man on the left is wearing safety glasses and large blue earmuffs. The man on the right is also wearing safety glasses and large black earmuffs, and has a yellow handheld device clipped to his shirt. They are both holding a long, thin wooden stick. Three speech bubbles are overlaid on the image, containing text about CFD modeling.

We need to model
this with 3D CFD!

No!
Let's use
1D CFD!

Why not using
1D and 3D CFD
together and get
the best of both
approaches?



Goal

Bring 3D CFD and 3D CAD into an Integrated Model Based Design enabled System Simulation Environment

Real-life systems
modelled
by means of Networks

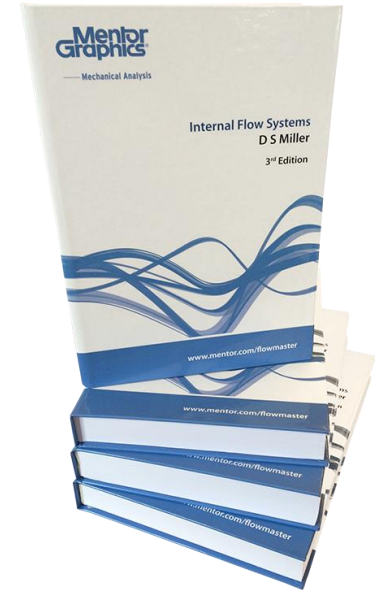
Performance based on
empirical data or
theoretical correlation

400+ empirical
components based on
DS Miller Data*

Each system element
represented by a discrete
component

Accuracy depends on
component
characterization/modeling

*A set of 3D loss
coefficient measured and
validated at BHRA test
laboratories



Complex non-standard components can be characterized/modelled with 3D CFD for improved accuracy

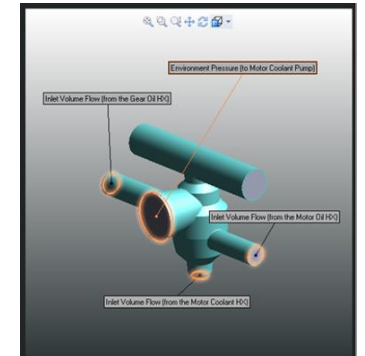
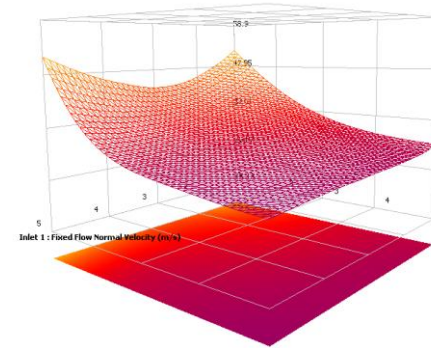
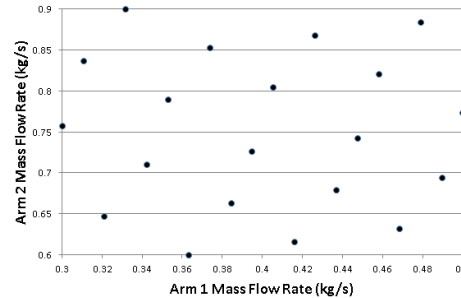
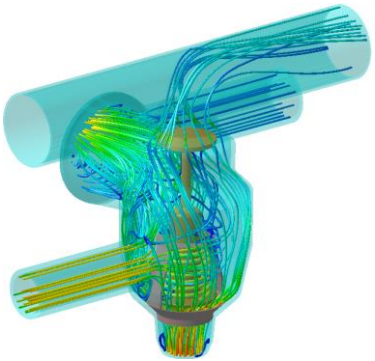
Networks can be created based on 3D CAD geometry to save time



SBC. Simulation Based Characterization

A methodology that enables a 3D part that is too **complex** to be represented using 1D CFD, to be **characterized** using **3D CFD**

Released @
FloMASTER V8



FloEFD
3D CFD Model



Design Of
Experiments
(DOE)



Response Surface
Model (RSM)



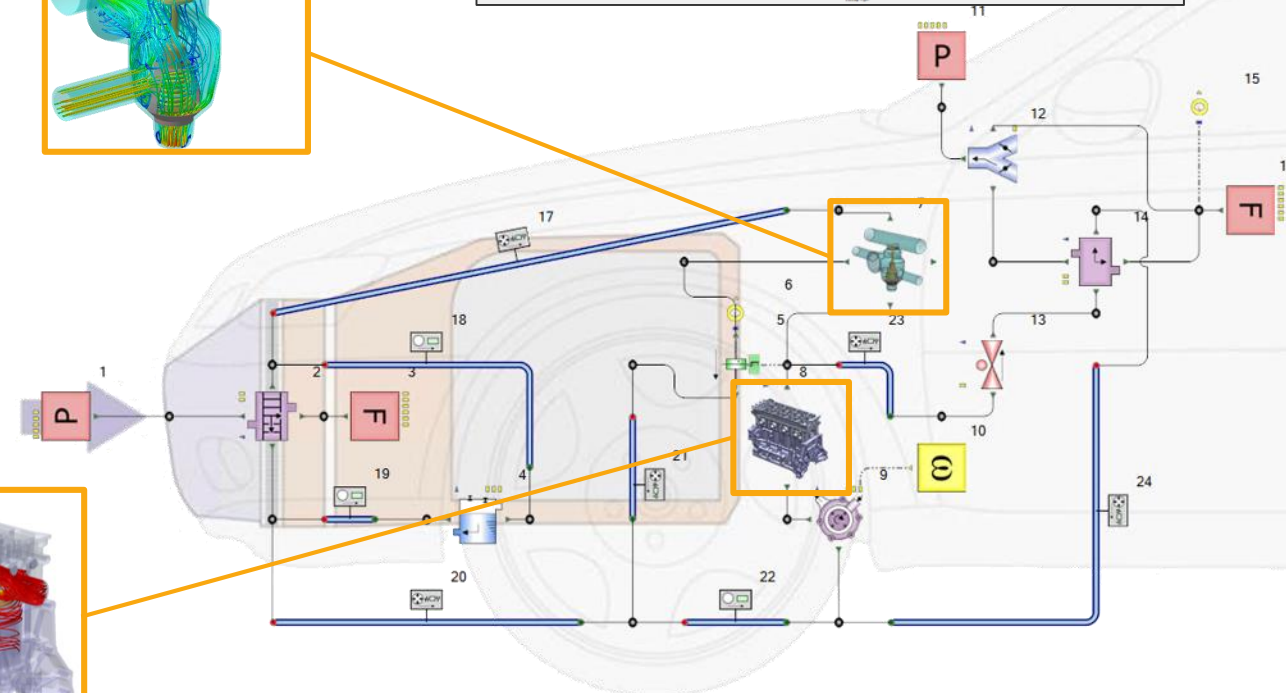
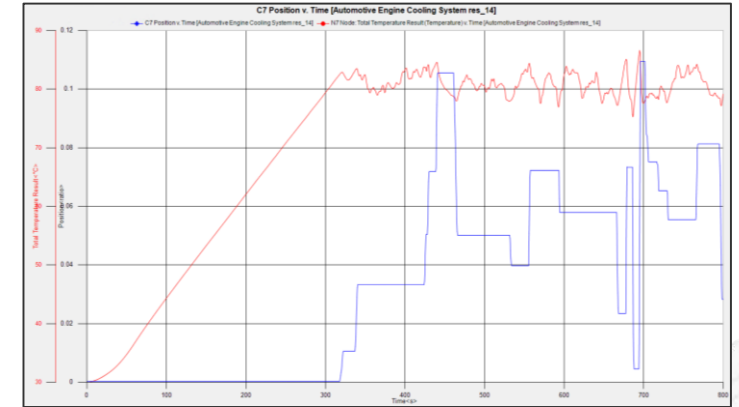
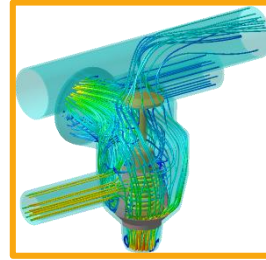
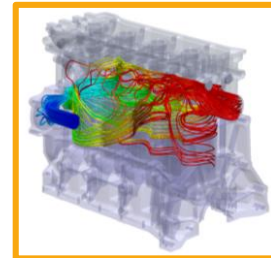
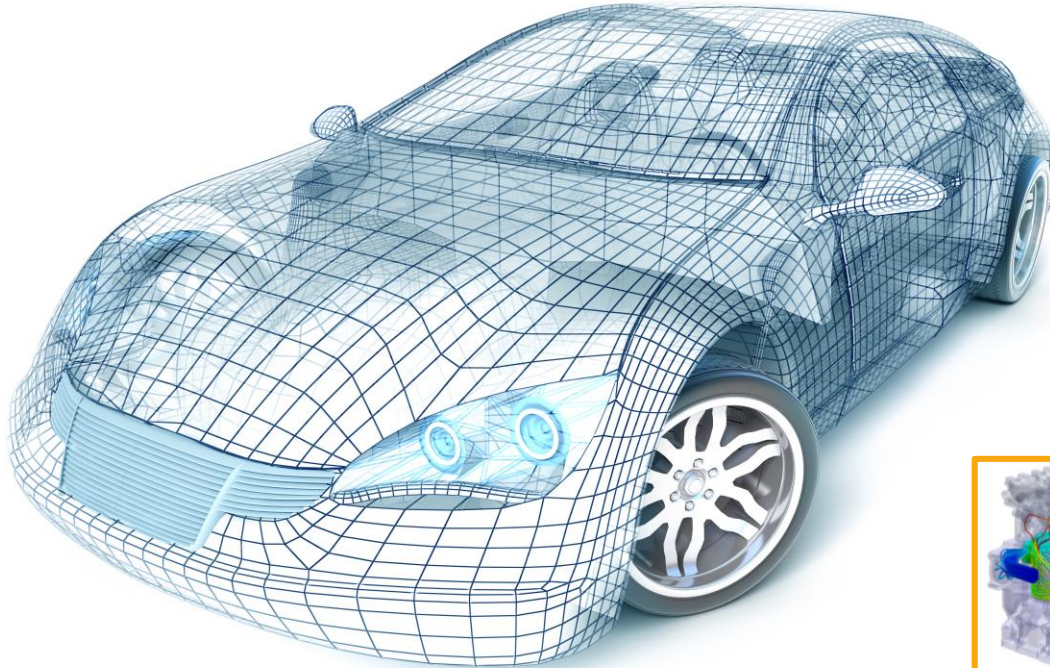
FloMASTER™
N-Arm
Component



Integrated Model Based Design

Bridges the gap between 3D and 1D CFD leveraging

- Accuracy of 3D CFD and 3D MCAD
- Flexibility and Speed of 1D CFD



HOEFD

Thank you!

