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LSE CFSPP

An ORCAN based application for sensor technology.

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Overview

1. Intended use of CFSPP at LSE
2. Requirements for CFSPP
3. The architecture of CFSPP
4. Implemented features and future enhancements

1. Intended use of CFSPP at LSE

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CFSP(ost)P(rocessor) is intended

- as a tool for visualization (most important features: isocontours or scalar mapping on deformed grids, vector glyphs)
- as a replacement for existing programs (Capapost & GMV)
- for the everyday use in the simulation and visualization cycle in combination with CFS++ (Coupled Field System in C++)
- as a learning tool in the practical excercises for the two courses *Computer Aided Engineering of Sensors and Actuators* (CAE) and *Numerical Simulation of Electromechanical Transducers* (NSEMT)

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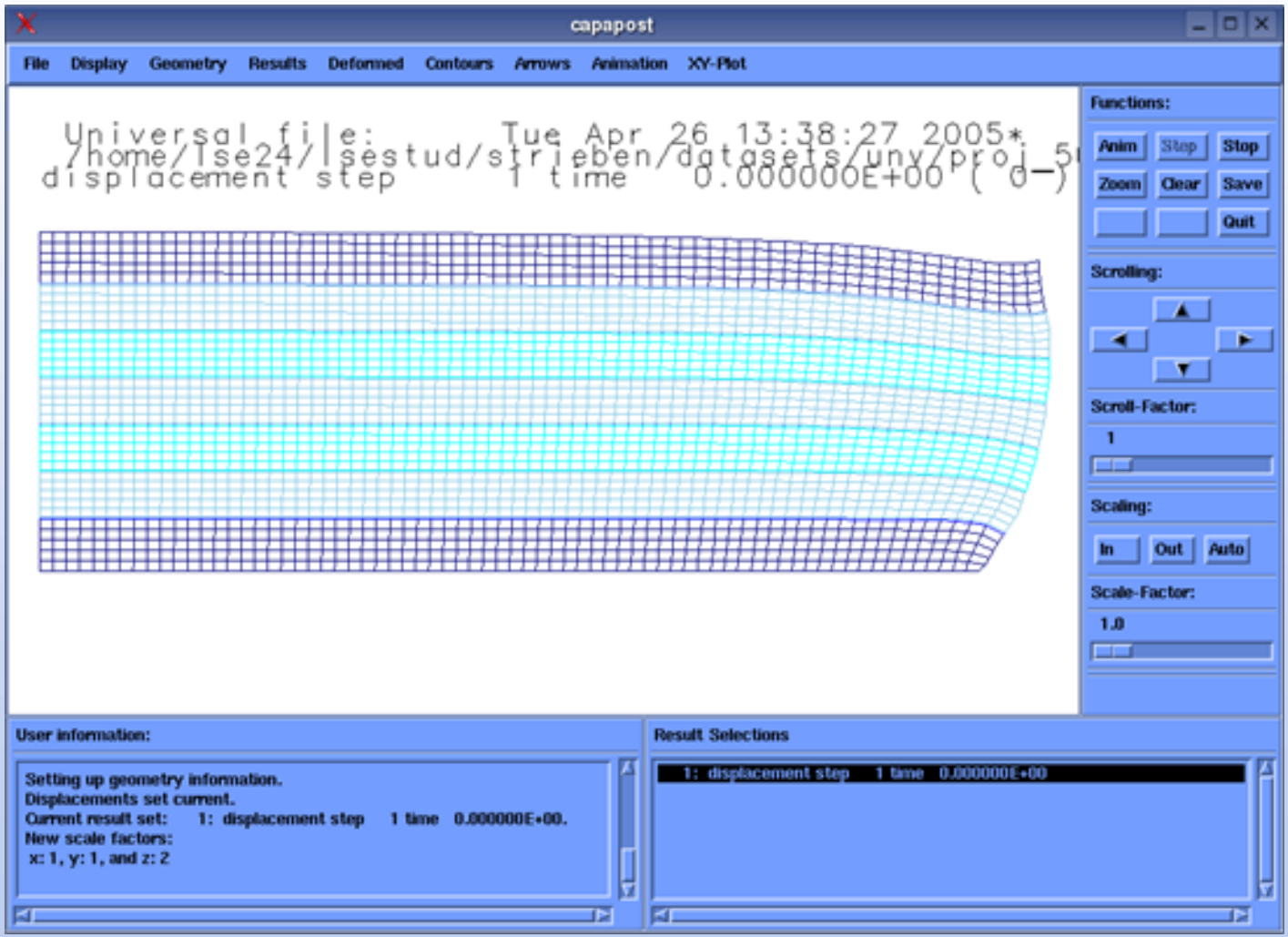
Capapost



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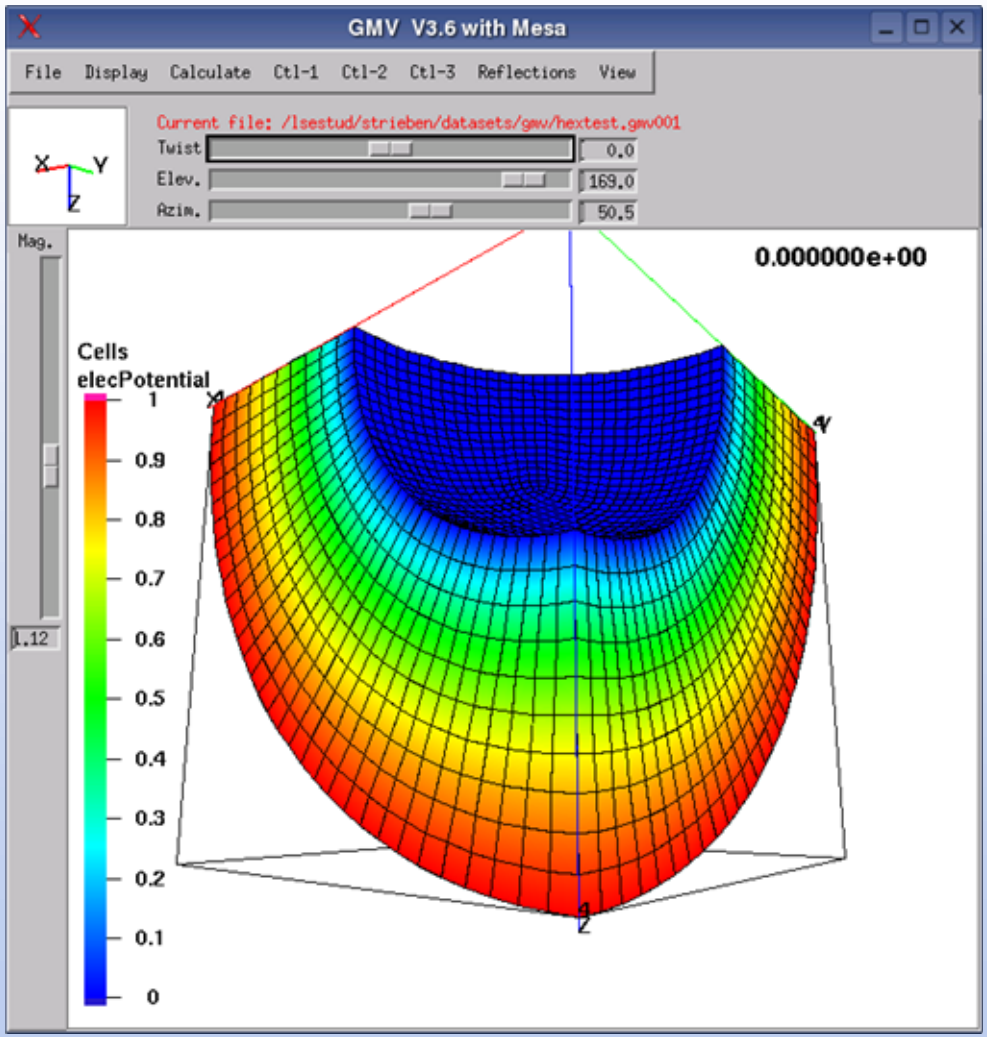
General Mesh Viewer



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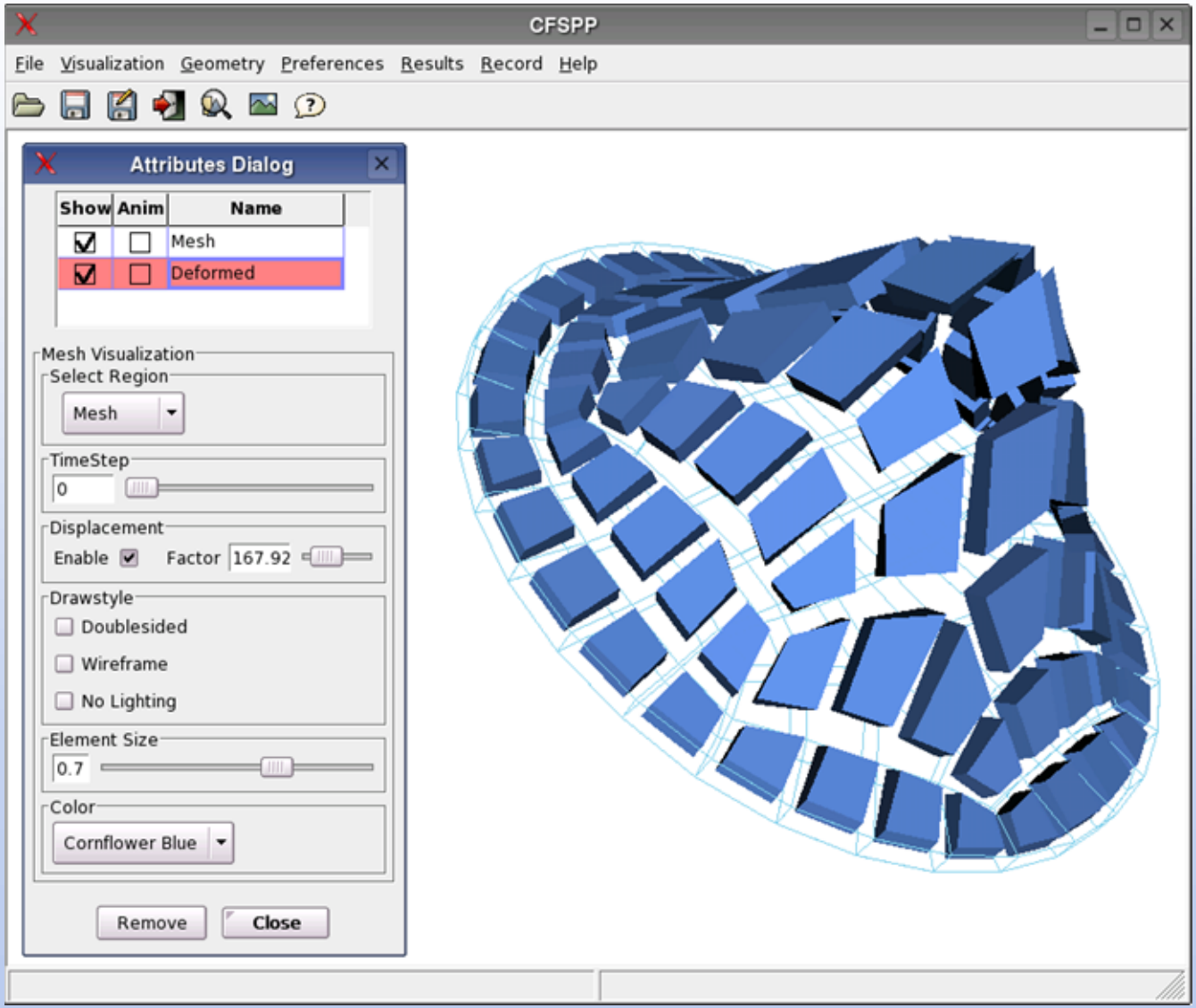
CFSPP



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Disadvantages of the existing programs:

1. Capapost

- uses deprecated libraries
- does not support 3D geometries
- user interaction not intuitive
- does only support view of deformed mesh but not fields on the mesh

2. **G**eneral **M**esh **V**iewer

- does indeed include support for 3D geometries but lacks support for deformed grids
- complex user interface

1. Intended use of CFSPP at LSE

Some preliminary developments that influenced CFSPP

- it was initially intended to use the library gridlib should for visualization
- in the course of my bachelor thesis a socket interface for incremental transfer of simulation results between CFS++ and gridlib has been developed (Gridlib Socket Interface)
- this interface served as a basis of our binary file format GSI
- but: the further development of gridlib was cancelled because of it‘s complexity
- thus the choice was made for ORCAN which is developed in the same SFB

2. Requirements for CFSPP

- CFSPP should be a tool for visualization and not simulation
- as little overhead as possible should be introduced by components specialized for other purposes

→ the component VtkUGridVolMesh was kindly provided by the ORCAN Team. VtkUGridVolMesh just wraps a VtkUnstructured Grid in an ORCAN VolMesh component

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- it should be possible to visualize results for certain predefined parts, so called regions, of the grid

→ the grid has to be subdivided according to some element attribute.

2. Requirements for CFSPP

- many different visualizations should be manageable and viewable in a scene

→ a special interface LSEMultiVisInterface has been developed for adding, renaming, deleting visualizations. It also includes functions like positioning the camera and so on.

2. Requirements for CFSPP

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- visualization of results on deformed geometries.
- readers for our two most important data formats UNV (IDEAS universal file) and GSI (Gridlib Socket Interface)
- reader for the XML simulation description files for additional infos

2. Requirements for CFSPP

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- support for time dependent results.
- disadvantage of standard ORCAN interfaces: only support for results on elements, nodes or faces.
- 200 result data sets (one for each timestep) on a grid but just a single result type!

→ development of the grid interface LSETimeRegionMeshInterface. The readers feed the interface with infos about timesteps and the visualization can use these infos

3. The architecture of CFSPP

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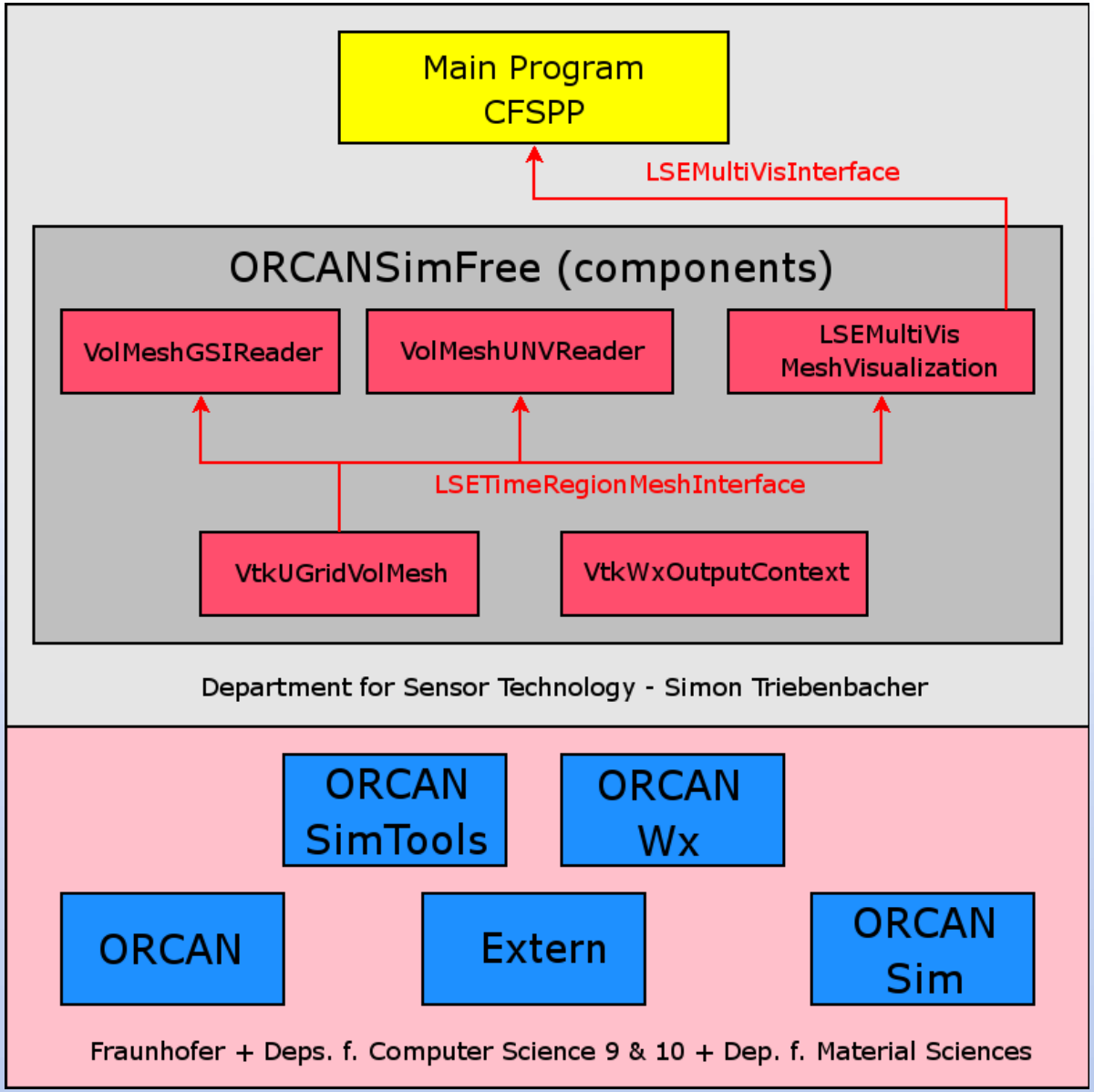

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VtkUGridVolMesh

- the component implements most standard ORCAN interfaces plus a new one:
- LSETimeRegionMeshInterface provides functions for:
- setting and getting infos about some special attributes (region and displacement)
- setting and getting infos about normal attributes:
- hierarchy: mesh → attribute → region → timesteps

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LSEMultiVisMeshVisualization

- uses the LSETimeRegionInterface to query the VolMesh for infos about the attributes
- has a vector of visualizations (derived from class VisBase)
- has a pointer to a vtkUnstructuredGrid which is initialized from a VolMesh when the main program calls SetInput()
- defines a new Interface LSEMultiVisInterface, which can be used by the main program to interact with the visualization

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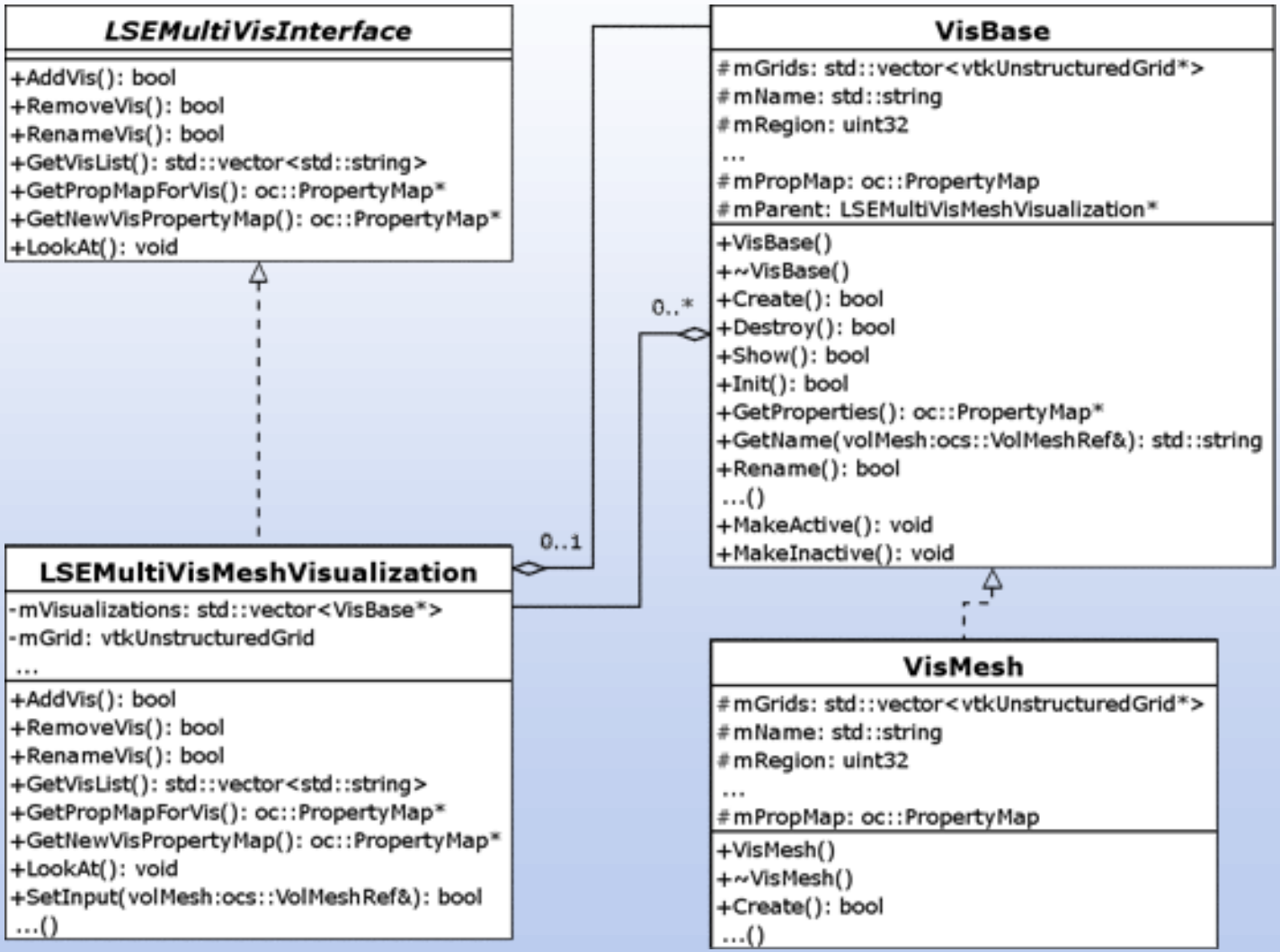
LSEMultiVisMeshVisualization



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Main Program

- provides the main user interface and functions for viewing help and managing global preferences
- has functions to load datasets and pass the resulting VolMesh to the visualization component
- can add, rename or delete visualizations via the LSEMultiVisInterface
- provides dialog templates into which the property maps of the visualizations are mapped via the automatic GUI generation mechanism

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Implemented Features

- mesh visualization for deformed geometries and selected regions
- scalar mapping for deformed geometries and selected regions
- LSETimeRegionMeshInterface for generic access to time-/frequency dependent data on grid
- GSI and enhanced UNV Readers with support for the new grid Interface
- LSEMultiVisInterface for the management of multiple visualizations

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Additional features of special interest to LSE

- support for animations of time-/frequency dependant data
- more visualization types → maybe transition to the new visualization component of the ORCAN team
- a reader for our brand new XML result data format is being developed at the moment as part of a bachelor thesis
- a major new feature would be the support of adaptive grids. CFS++ does support it whereas ORCAN does not provide this feature (at the moment!)

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Thank you for your attention!