An Interactive Environment for Simulation and Visualization

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Problem

Scientific computing researchers are confronted with the challenge of devising and running simulations for increasingly complex problems in areas such computational fluid dynamics, image processing, computational mechanics, or any other numerical simulation domain in general.

The researcher usually needs to cover the following tasks:

- simulation construction out of existing software components such as algorithms, data structures, visualization, and more
- simulation steering, by changing process parameters
- data exploration, by monitoring numerical or visual output
- process modelling, by devising new algorithms and data structures

The problem we address is the limitation of current scientific computing software tools. Most such tools have one or more drawbacks:

- separate tools for simulation and data visualization
- no interactive imulation steering or data exploration available
- difficult or impossible to extend or customize existing simulation software
- difficult or impossible to integrate several existing software environments to produce the desired simulation tool
- existing tools are often hard to use by non software experts

Solution

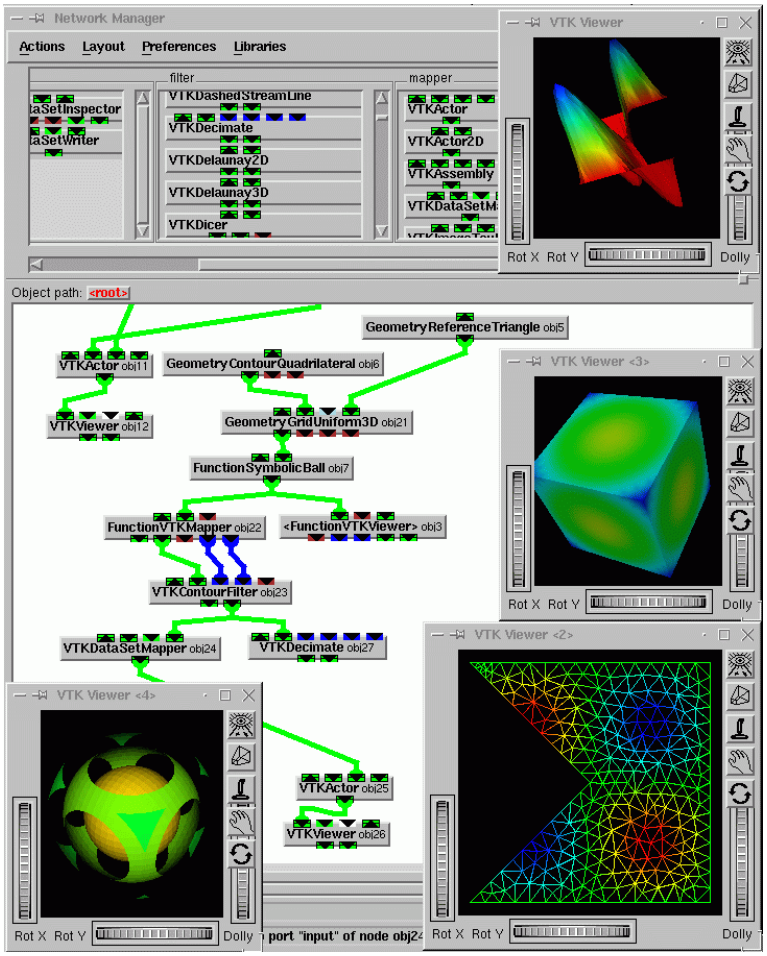
The solution we propose is **VISSION: Visualization and Simulation with Object Oriented Networks.** The VISSION system offers a new way to scientific computing, data exploration, analysis and presentation for the computational researcher.

Application construction: the researcher can construct applications in a matter of minutes by combining computations and visualization easily in an interactive visual application editor, similar to Matlab's Simulink or AVS's network editor.

Application use: applications can be run and monitored numerically or visually in an interactive manner. Parameters of all computational modules can be modified on the fly to control the process evolution or select the desired postprocessing operation.

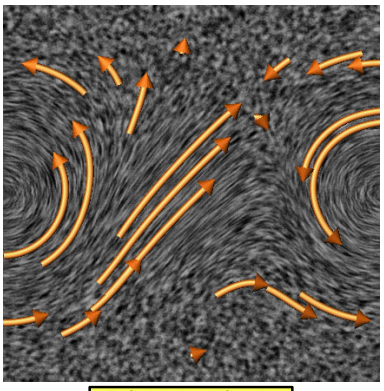
Application development: VISSION is not limited to a single application domain. Existing code can be easily integrated as new modules. The modules get automatically constructed GUIs and can be immediately connected to a dataflow network. VISSION avails now of the following module libraries:

VTK:	scientific visualization, data processing	~400 modules
Numlab:	scientific computations (FEM,FDM)	~50 modules
VEX:	vector field simplification	~20 modules
XFF:	global illumination simulation	~20 modules

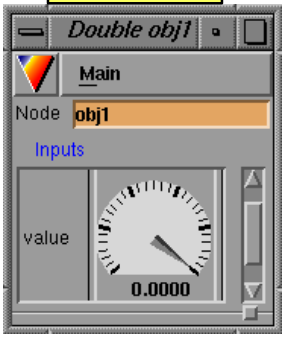


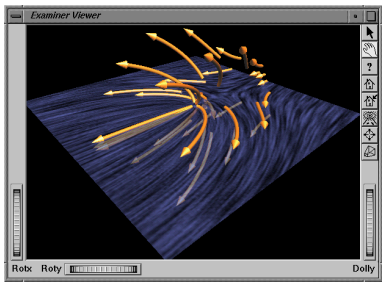
Network Editor with several simulations

Module interfaces



2D field simplification





3D field simplification