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SOFTWARE MYNTS OPTIMIZES TRANSPORT NETWORKS FOR ELECTRICITY, GAS AND WATER

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MYNTS

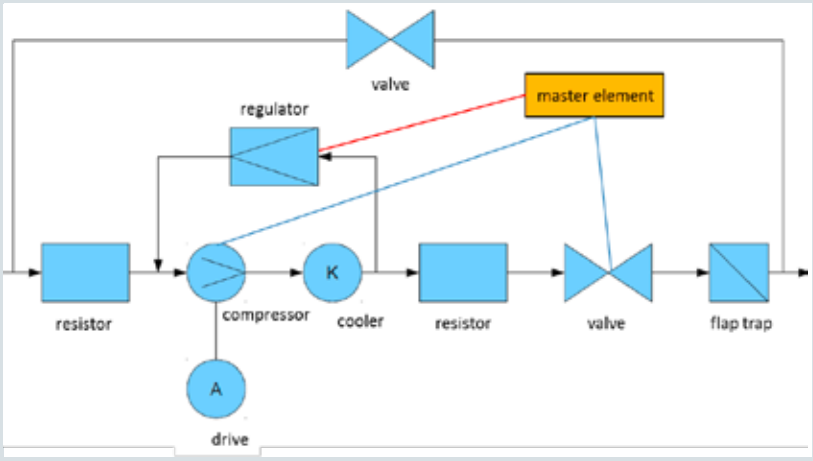
Efficient transport networks are of utmost importance for developed countries. Examples for such networks are infrastructure for the transport of gas, electricity, or water. Studies suggest that 3% of the total electricity production in the USA are used by the water industry. Up to 90% of this electrical energy is consumed by pumps. This means, that even small improvements in pump efficiency will result in significant reductions of energy consumption and costs.

In order to enable and increase the use of renewable energy, the German government supports the modernization and building of thousands of kilometers of new electricity networks. Such smart grids will be complex networks that need new strategies of management and optimization.

To meet this demand of the market, Fraunhofer SCAI has developed a software called MYNTS (Multiphysical Network Simulator). MYNTS is build on the fact that networks – either they are used for the transport of water, gas and electricity or as well electrical circuits inside technical devices – can be modeled in a very similar fashion as systems of differential-algebraic equations. Their numerical simulation can be performed based on the same numerical kernels! Resulting from the Fraunhofer MAVO HIESPANA and other projects, the software supports different applications ("one for all").

Flexible planning of gas, power and water grids

Because each field of application has its unique features, specialized versions of the software are available for various purposes. With MYNTS-Gas for simulation of gas transport systems, for example, a user can



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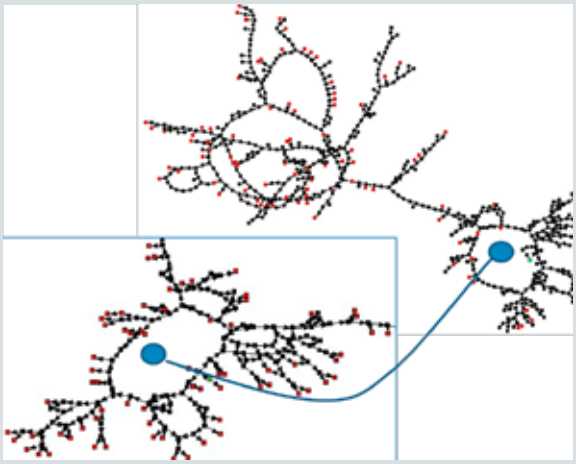

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1 *Schematic representation of a compressor station as a subnet for »MYNTS-Gas« with master element.*

2 *Graphical visualization of two networks, which are matched by net'O'graph ("graph matching").*

set up and control his or her own subnetworks with master element for modeling and controlling compressor stations (see Figure 1) or mixing chambers, for instance. In order to accelerate simulation computations, the software runs on computers with multiple processors.

This software is also of interest for smart grids, construction of which over the next few years is being promoted by the German government. Intelligent networking and controlling of electricity producers, storage facilities, electricity consumers and network resources within supply networks are considered to be among the greatest economic and environmental technology challenges.

For example: if bulk consumers could be controlled more efficiently, and power supply adjusted to match demand at different times, then consumption peaks could be capped, and the consumption of electric energy equalized to supply.

Such bulk consumers include water companies. One study shows that in industrialized nations, roughly three percent of the total electrical power consumed is used by water companies – specifically for pumps. Intelligent control of the network would have major economic potential: even minor incremental savings make a major contribution that benefits the environment.

MYNTS is continuously developed together with the group of Prof. Dr. Caren Tischendorf (University of Cologne / Humboldt University of Berlin).

In combination with net'O'graph and DesParO (see below), graph analysis, statistical analysis and optimization tasks are supported. net'O'graph is a novel software library with drivers for analysis and manipulation of networks and graphs. Features include graph reduction, graph matching (see Figure 2), input-output analysis and network decomposition, layout.

Software	Tasks	Special Functions	Availability
MYNTS → *www.scai.fraunhofer.de/mynts*	*Simulation and visualization*	*User-programmable subnetworks, user-defined elements, open modeling, Python API, steady-state as well as time-dependent computations, efficient math kernels exploiting multiple cores*	*MYNTS-Gas: Windows, Linux* *MYNTS-Circuit: Linux, further on request* *MYNTS-Water: for research purposes* *MYNTS-Electricity: under development*
net'O'graph → *www.scai.fraunhofer.de/netograph*	*Network and graph analysis, matching, layout*	*Extensive C++-library for analysis and manipulation, support for different formats; efficient routines for large networks*	*Windows (32-/64-bit), further on request*
DesParO → *www.scai.fraunhofer.de/desparo*	*Metamodeling, parametric analysis and optimization*	*Efficient interpolation by means of response surfaces with adaptive model building, Pareto optimization, extensive statistical analyses, Python API*	*Windows and Linux (32-/64-bit)*