dynardo
dynamic software & engineering

Integration of SimulationX® into optiSLang®

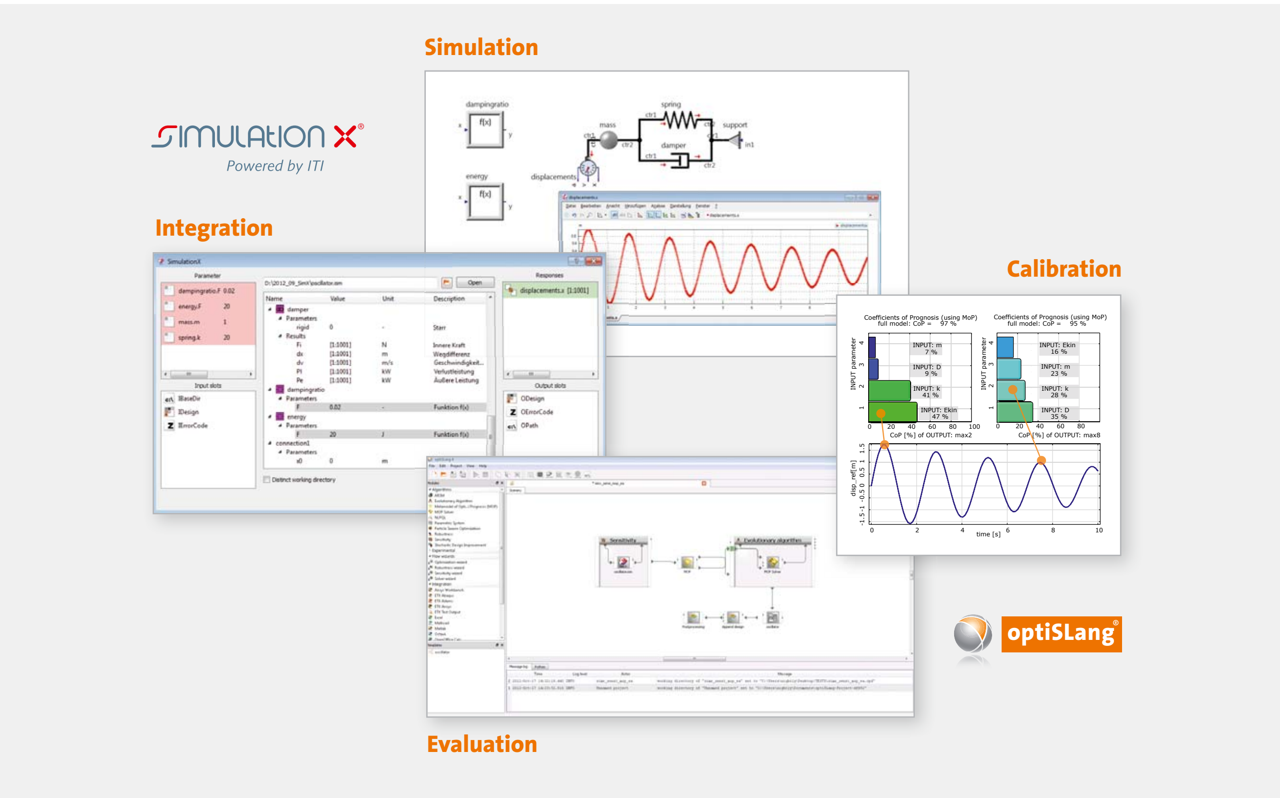
Sensitivity analysis, optimization and calibration using optiSLang® and SimulationX®

optiSLang®

In version 4, the algorithmic base of optiSLang has been completely restructured to a C++ library. As a consequence, all algorithms of optimization, stochastic analysis and metamodeling can now be approached via Python interfaces from optiSLang's GUI or any third party application. The software structure supports the integration of external CAE processes as well as the transfer of optiSLang methodology into third party parametric modeling environments. Thus, optiSLang will be ready for challenges of automated CAE simulation and process integration in the future.

SimulationX®

SimulationX is a standard software for evaluating the component interaction of all technical systems. It is a universal CAE tool for modeling, simulation and analyzing of physical effects – with ready-to-use model libraries for 1D mechanics, 3D multibody systems, power transmission, hydraulics, pneumatics, thermodynamics, electrics, electrical drives, magnetics as well as controls – post processing included. The tool is unique in terms of library integration, modeling comfort and flexibility. It has been developed as a CAE application with an up-to-date user front-end.



Benefit of Integration

optiSLang 4 offers a wide range of direct integration nodes. These can be immediately called up or run inside optiSLang. Compared to calling up an external CAE process, this makes design evaluation much faster. In the case of SimulationX, the direct interface allows an easy and user-friendly parameter and response definition. Using this object architecture, the SimulationX model components, including their properties, can be quickly accessed in the parametrization process of optiSLang. During the optimization or calibration analysis, the specified properties will be modified directly in the SimulationX model according to the defined ranges and the response values calculated for each design.

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Coefficient of Prognosis (CoP) and Metamodel of Optimal Prognosis (MOP)

Today, users have access to very powerful parametric modeling environments. As a consequence, the number of optimization parameters has increased. The traditional DOE and Response Surface procedure involves a high amount of manual customisation. The user has to reduce the set of variables and choose an appropriate DOE and regression function. Finally, the accuracy of the resulting Response Surface Model has to be tested. Dynardo developed a methodology that supports an automated variable reduction with a reliable quantification of parameter importance. The CoP allows you to filter the relevant input parameters. According to the prognosis capability of the resulting values, optimal meta-models will be selected. These Metamodels of Optimal Prognosis (MOP) represent the most important correlations between parameter input variation and output results.

Using the Metamodel of Optimal Prognosis (MoP), the sensitivity of different signal properties can be evaluated. Furthermore, an MOP-based optimization can be used to obtain an initial estimation of the optimal parameters. For the final optimization procedure, several algorithms are available in optiSLang. A Best-Practice-Management automatically selects the appropriate optimization algorithms, such as gradient methods, genetic algorithms, evolutionary strategies or Adaptive Response Surface Methods.

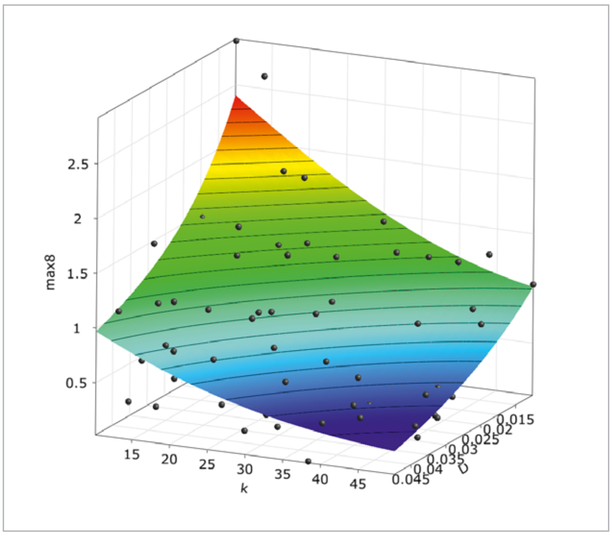

Figure 2: Response surface of the Metamodel of Optimal Prognosis

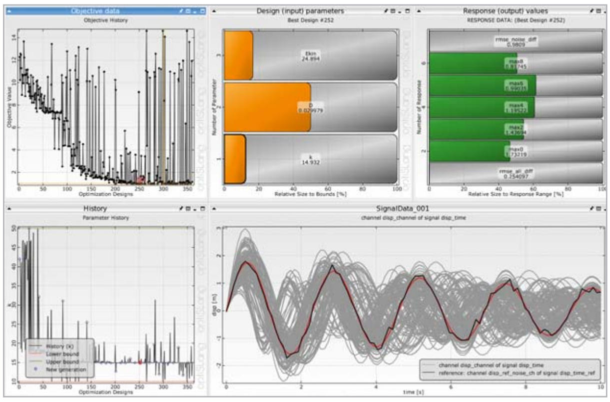

Figure 3: optiSLang signal post processing during the calibration process of a damped oscillator using evolutionary algorithms

Visualization

Figure 3 shows the convergence of an evolutionary algorithm for the calibration of a simple damped oscillator. In the optiSLang post processing, the reference, e.g. from measurements, can be visualized in comparison to the numerical solution of each single optimization design. This illustrates the optimization procedure and contributes to the understanding of the result values.

optiSLang® SIMULATION X® Powered by ITI

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