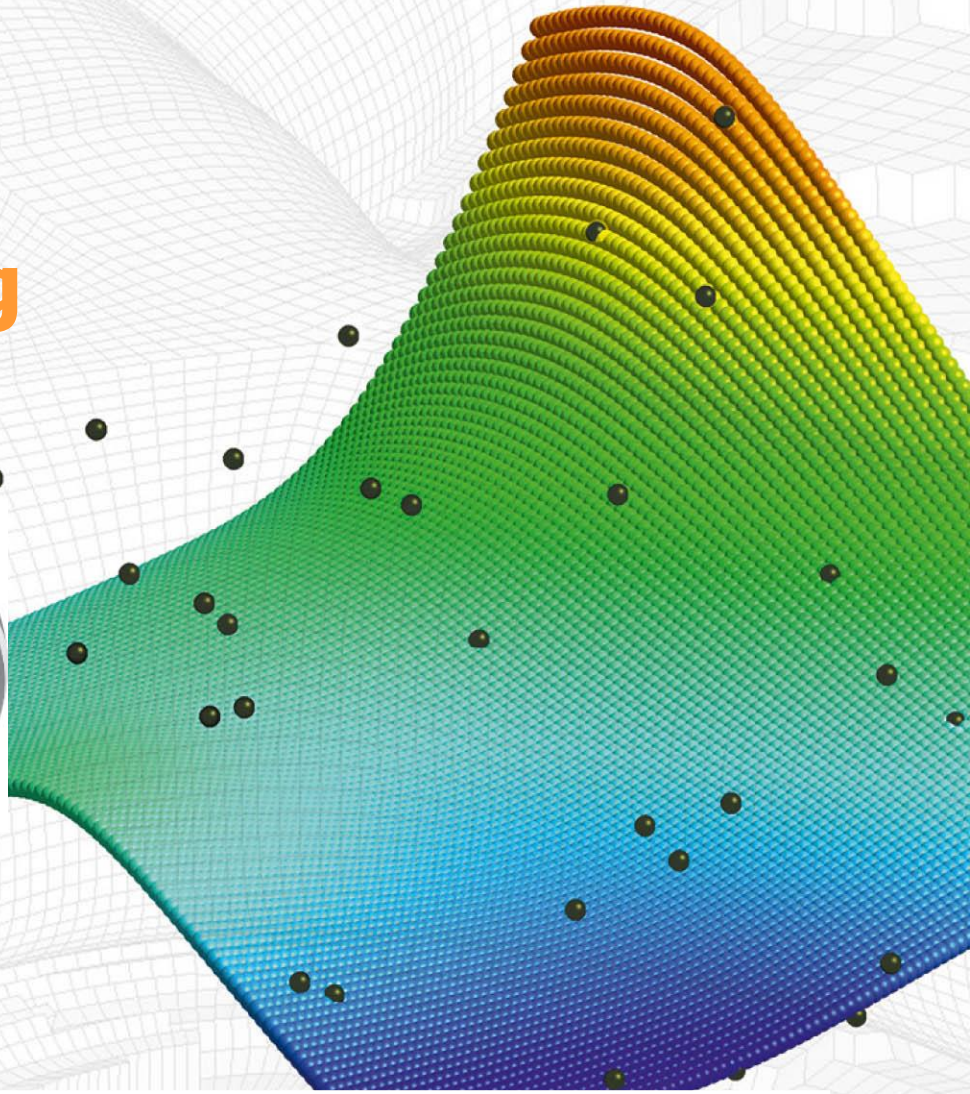
Introducing ANSYS optiSLang



Johannes Will

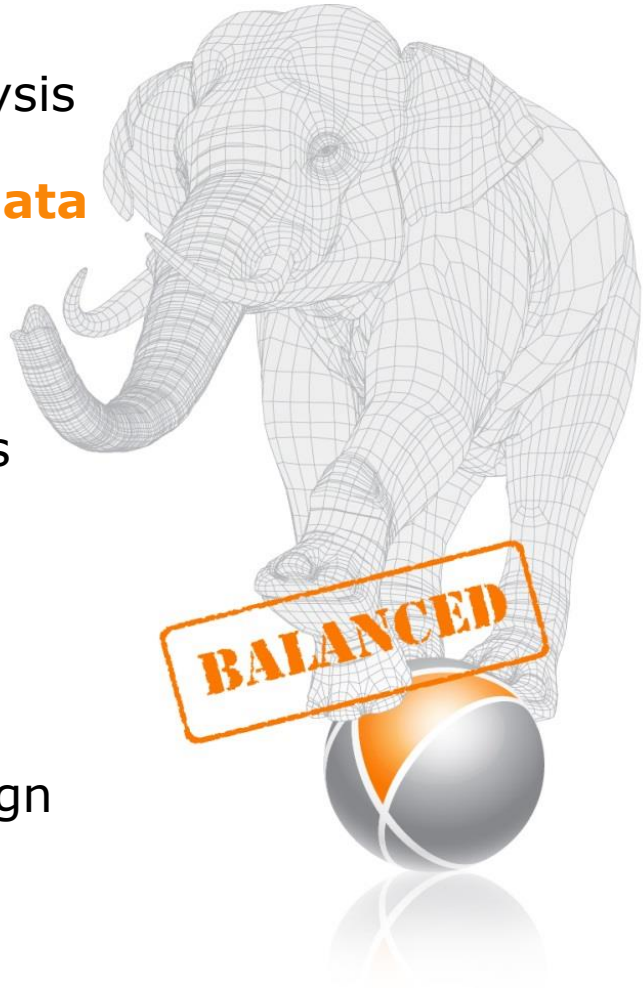
Dynardo GmbH

optiSLang

- is an general purpose tool for variation analysis

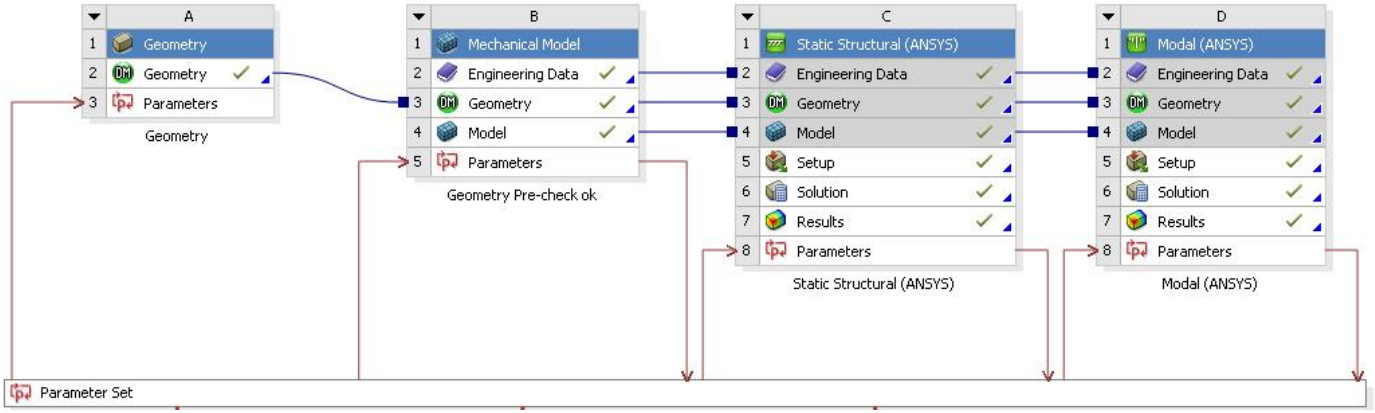
using CAE-based design points (and/or data points) for the purpose of

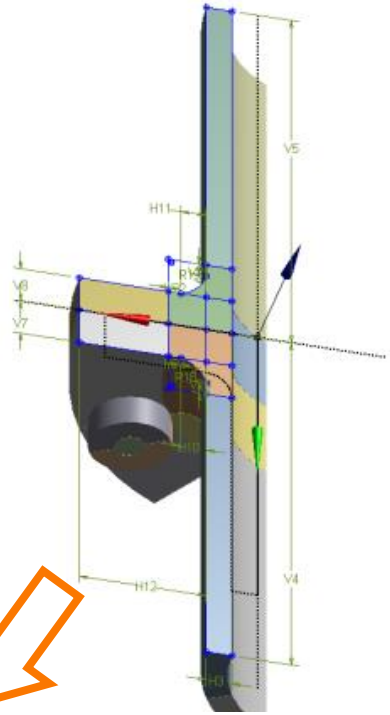
- sensitivity analysis
- calibration of virtual models to physical tests
- design/data exploration
- optimization of product performance
- quantification of product robustness and product reliability
- Robust Design Optimization (RDO) and Design for Six Sigma (DFSS)



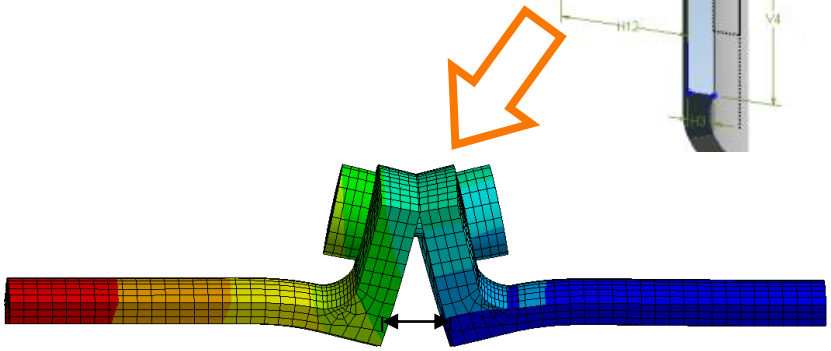
ANSYS Workbench

A Powerful Parametric Modeling Environment





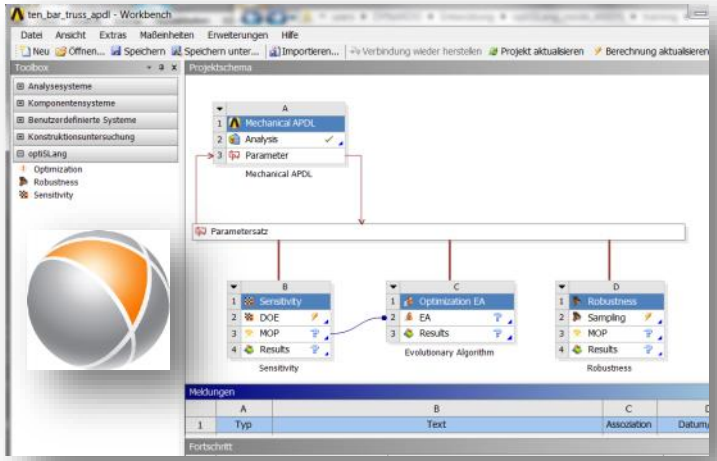
- Including process automation, third party CAE integration, bidirectional CAD interfaces, parallel computing
- Easy parametrization via parameter manager
- With this important technology ANSYS Workbench is ready to address RDO task‘s



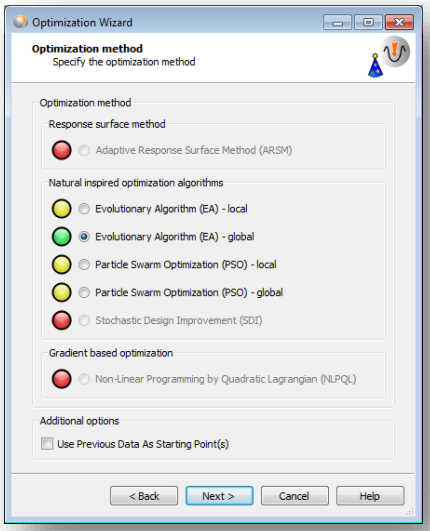
minimize

ANSYS optiSLang is easy to use

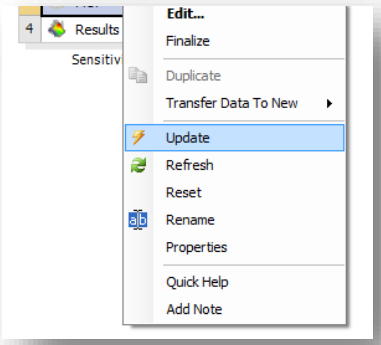
- Engineers and Designers should not have to choose from a list of detailed settings and complicated algorithms
- optiSLang's functionality is compressed to three wizards (sensitivity, optimization, robustness) with minimal user input
- Simply Drag and drop to add optiSLang, and push to solve….



Define the variation space ..



… follow the suggestion …



… Run

Customer benefits

✓ Understand your Design

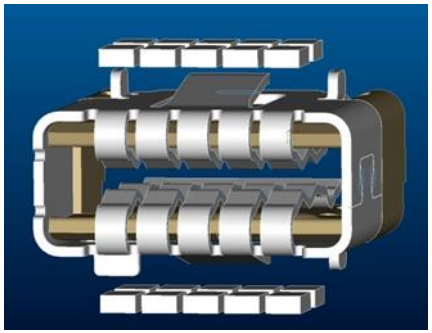
- CoP/MOP technology for engineers and designers to get a maximum understanding of the relations of parameterized properties with a minimum number of FE-calculations

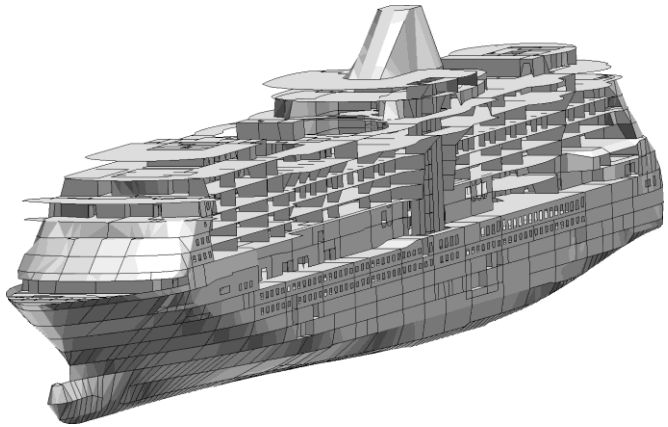
✓ Improve your Design

- Easy and safe to use optimization workflow provides insight and suggests optimization strategy

✓ Check and Proof Robustness of your Designs

- Easy and safe to use robustness workflow for 2-,3- or even a 6-sigma design





Signal processing inside ANSYS Workbench

- ANSYS optiSLang ETK module

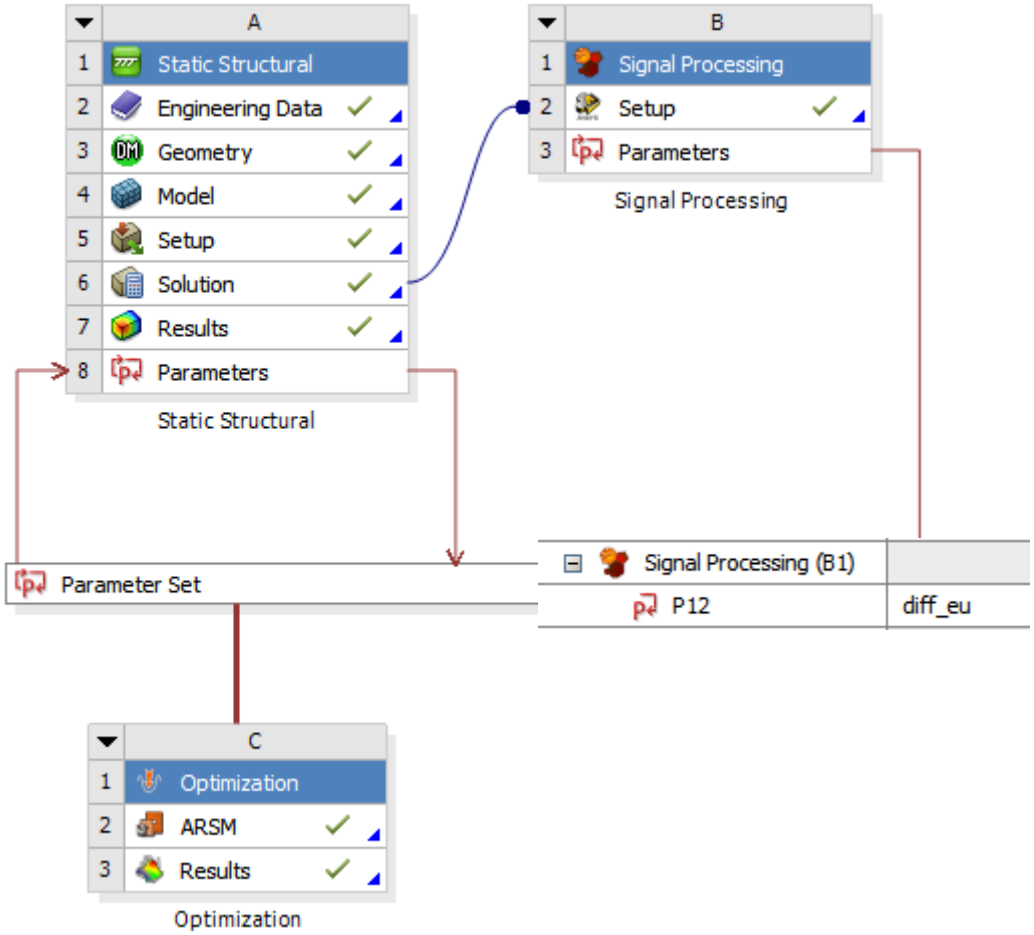
Access output parameters which are not "built-in" Workbench – e.g. arbitrary data in text or .rst files

- Nonscalar Data

Use functionality of Extraction nodes inside ANSYS Workbench to work with data which is not supported via ANSYS, i.e. vectors, signals, matrices

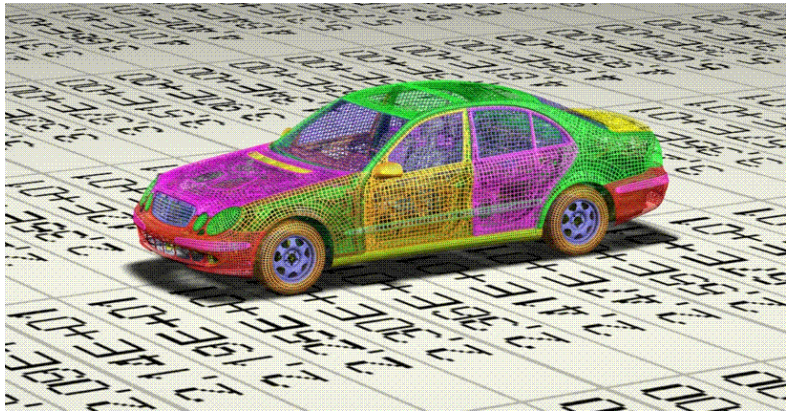
- Register response values

Use powerful optiSLang calculator functionality to derive scalar values and register them in Workbench Parameter Set



optiSLang's minimalist philosophy

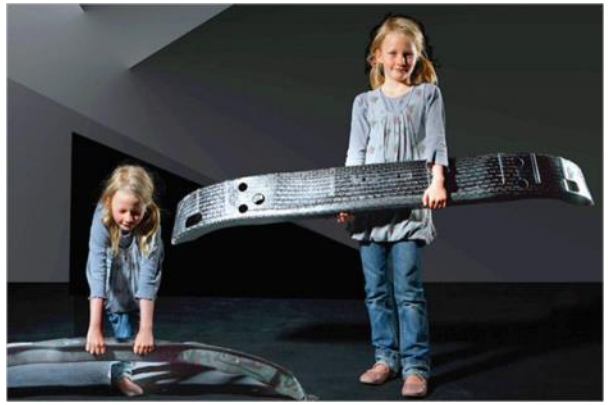
- Minimal user input
- CoP/MOP technology reduces to important parameter and the number of necessary calculations
- Algorithms are still working efficiently even with noisy results or when some designs are failing



Daimler: Dr. Idrisi:
„we successfully performed light weight structure optimization having up to 2000 design variables"

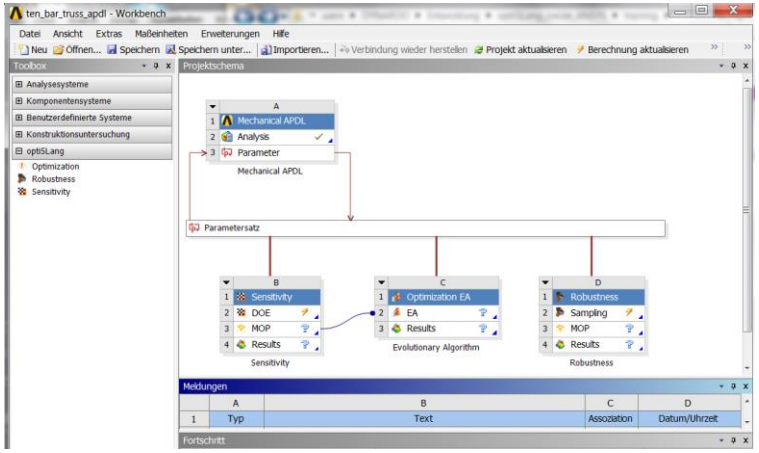
In-built mechanisms insure robust workflow

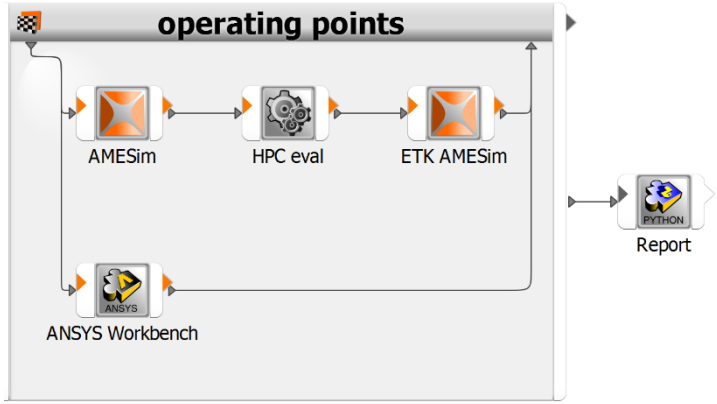
- Continue crashed/interrupted session
- Recalculate failed design
- Unique technology continues up to 50% of design failure rate



ANSYS optiSLang

- The **"all you need"** solution for customer which have ANSYS in house
- optiSLang integrated in ANSYS Workbench
  - very easy to use!
  - All methodology is available with 3 wizzard based workflows
- optiSLang GUI mode which supports integration of ANSYS and any 3rd party code
  - Easy to use process integration and automation capabilities
  - Easy to use workflow building capabilities
- Serves all ANSYS tools and HPC/Cloud components!





ANSYS optiSLang

- ANSYS optiSLang is the **successor** of "optiSLang for ANSYS" including "optiSLang inside ANSYS"
  - not a "new" product
  - no upgrade necessary

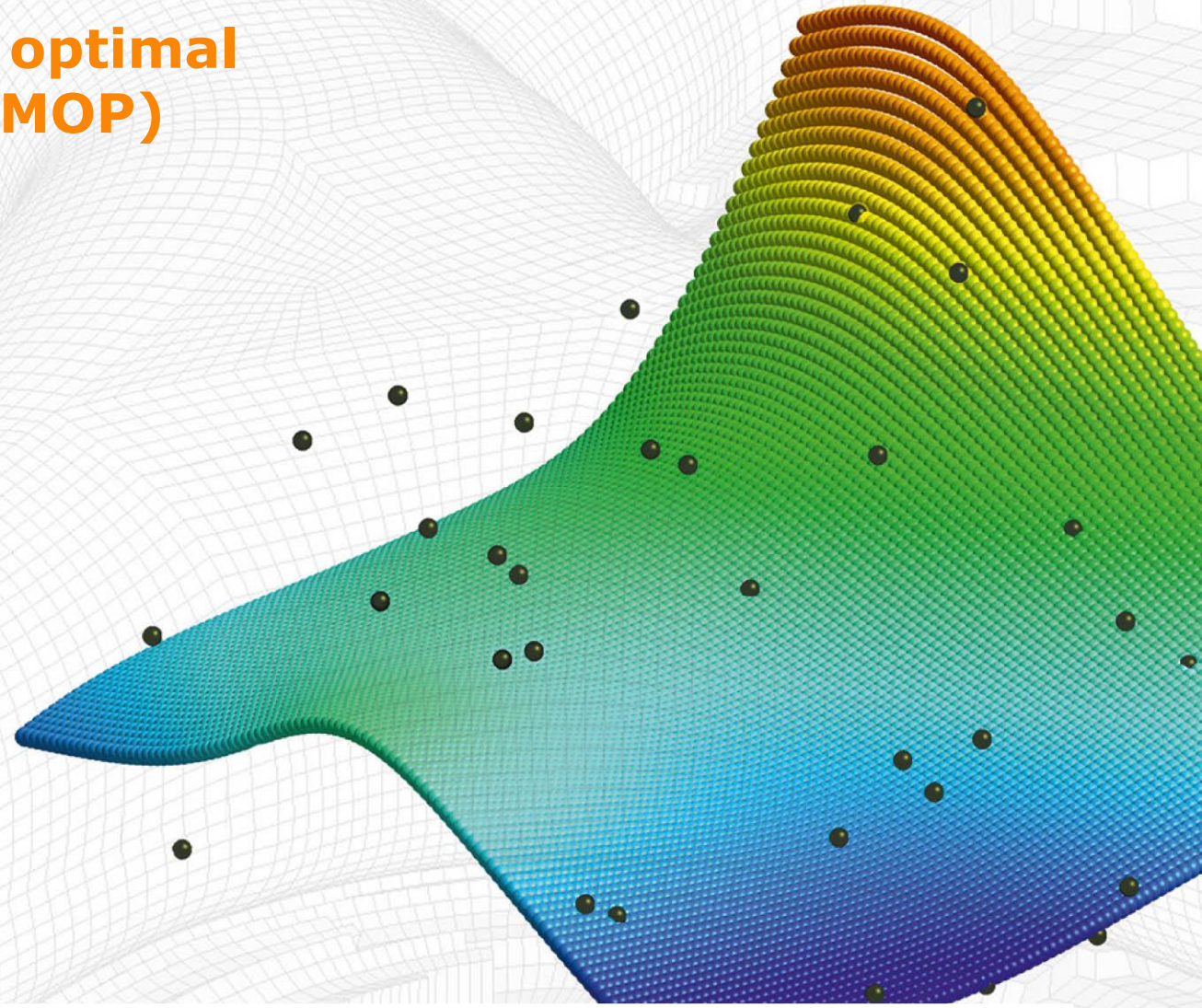
- **world wide distribution via ANSYS sales channels & Dynardo**
  - will give dynardo the opportunity to invest majority of software income for future development

- **Dynardo continues as an independent software company**
- **optiSLang continues as stand alone product**

- other dynardo products
  - Statistic on Structure (SoS)

- optiSLang extensions
  - Extraction Tool Kit (ETK)
  - optiSLang customization
  - optiSLang SPDM

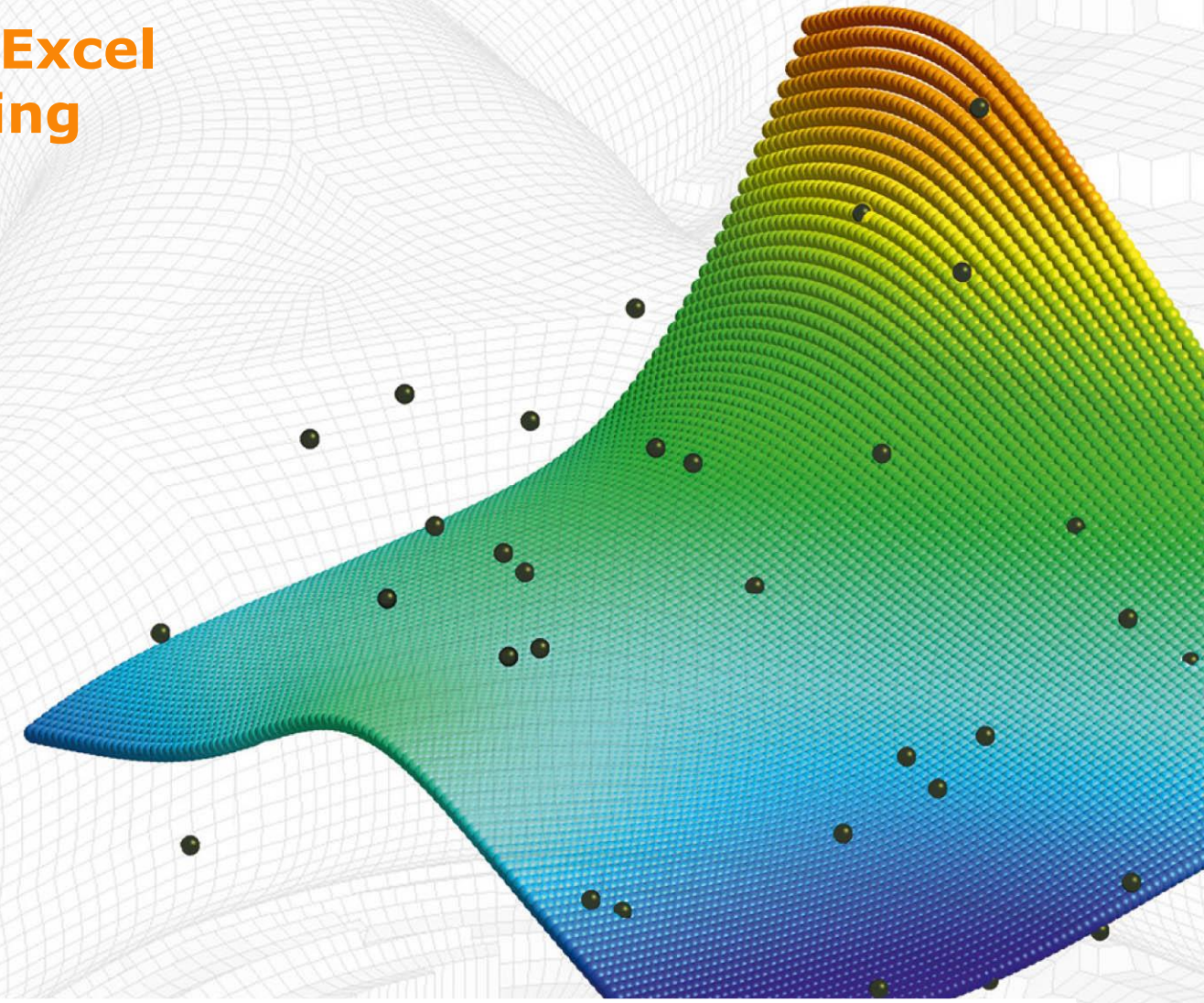
Metamodel of optimal Prognosis (MOP)



Use of optiSLang's MOP

- MOP is one of the most important innovations of dynardo
- MOP is very important
  - to connect CAE to management
  - to connect CAE to system simulation
  - to introduce CAE into products
  - To connect CAE to IoT/digital twins
- With introduction of **ANSYS optiSLang** we decided to not ask for MOP solver licenses outside optiSLang anymore
  - MOP's can be used unlimited outside optiSLang
  - We will extend MOP export to industry standards (FMU,..)

optiSLang Excel interfacing

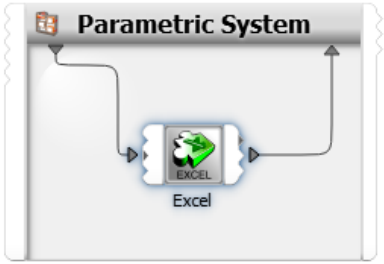


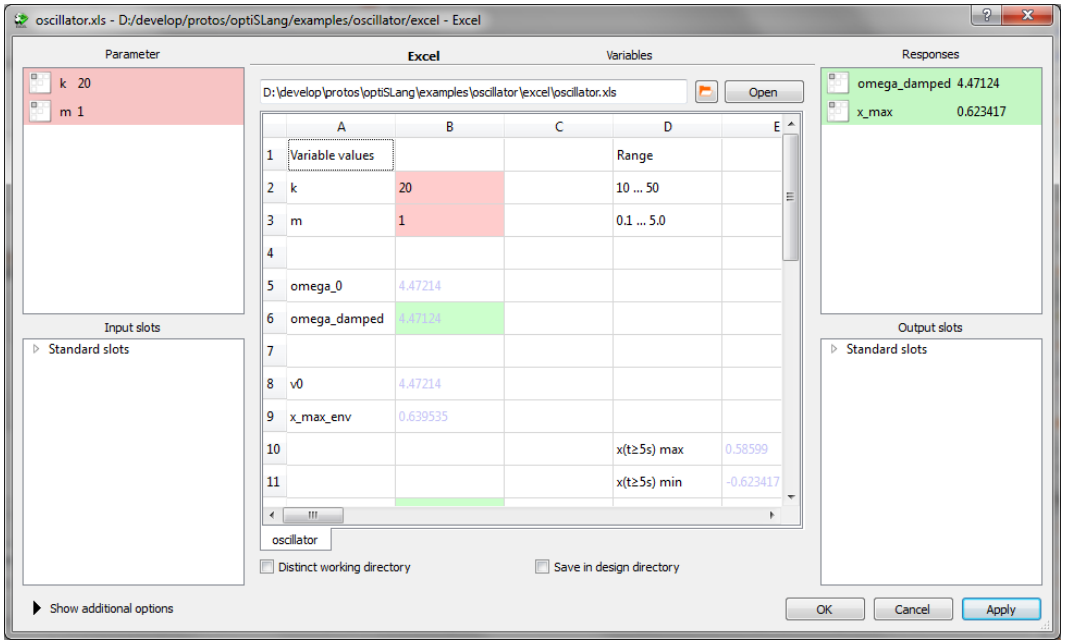
Excel Interface

Excel – COM Interface

- Get/set parameter
  - From/to cell
- Get responses
  - From cells
- (Test) run macros

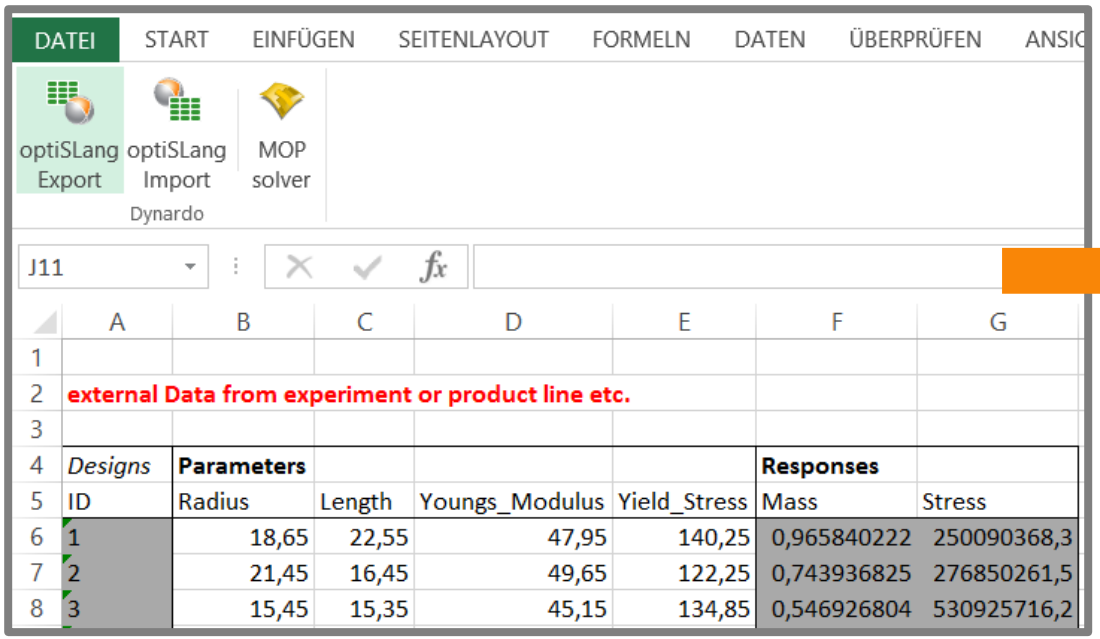
- Windows only
- Serial



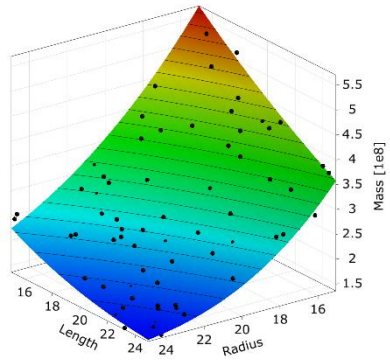


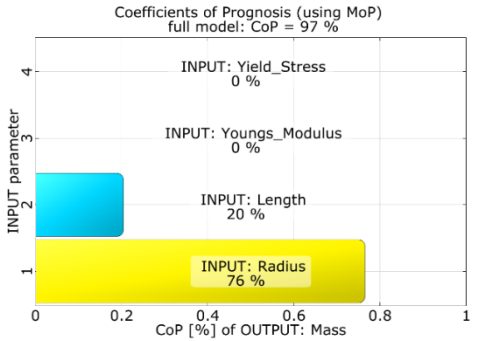
Excel Add-In

- Export your data in optiSLang database for statistical post-processing and MOP generation in optiSLang
- Import design point sets into Excel



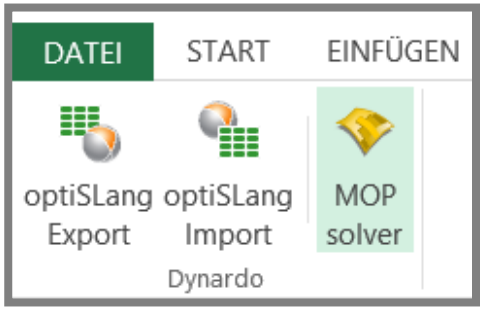
	A	B	C	D	E	F	G
1							
2	external Data from experiment or product line etc.						
3							
4	*Designs*	**Parameters**				**Responses**	
5	ID	Radius	Length	Youngs_Modulus	Yield_Stress	Mass	Stress
6	1	18,65	22,55	47,95	140,25	0,965840222	250090368,3
7	2	21,45	16,45	49,65	122,25	0,743936825	276850261,5
8	3	15,45	15,35	45,15	134,85	0,546926804	530925716,2





MOP-Solver in Excel

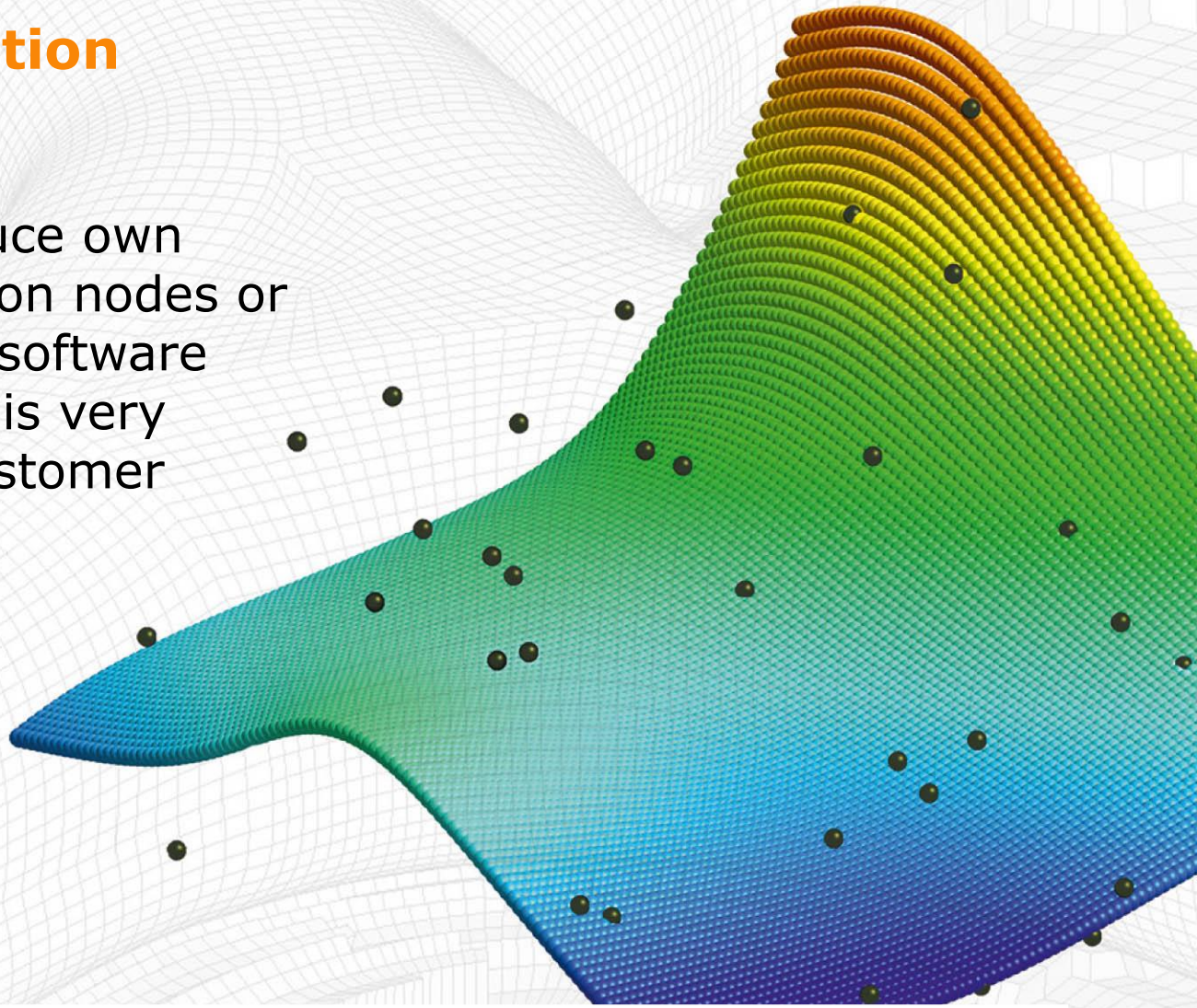
- Access to MOP's directly in Excel



	A	B	C	D	E	F	G
1	**optiSLang MOP solver version 5.0.0**						
2	Meta model database was imported from:						
3	C:\Users\MOP (1).omdb						
4	Load time: 00:00:00.1427614						
5		DS_Thickness	DS_Depth	DS_LowerRadius	DS_Angle	Full model	
6	Equivalent_Stress_Maximum	77,48%	21,02%	2,00%		99,54%	
7	Geometry_Mass	22,46%	64,84%	7,17%	2,38%	98,12%	
8							
9		**Parameters**				**Responses**	
10	Lower Bound	15,05	15,05	45,05	120,15		
11	Upper Bound	24,95	24,95	54,95	149,85		
12	ID	DS_Thickness	DS_Depth	DS_LowerRadius	DS_Angle	Geometry_Mass	Equivalent_Stress_Maximum
13	0	18,65	22,55	47,95	140,25	0,975084996	249025106,7
14	1	aaa	bbb	ccc	ddd	???	???
15							

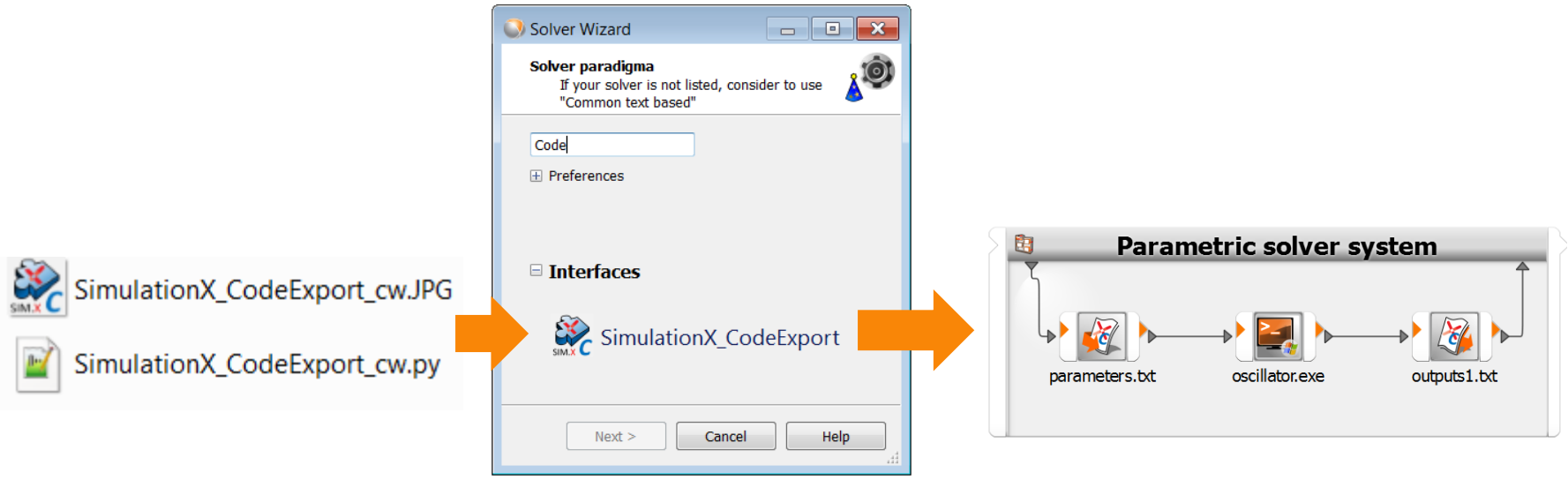
Customization

Being able to introduce own algorithms, integration nodes or to use optiSLang as software integration platform is very important for our customer



optiSLang's Customization Extension

- We decided to change licensing from "use" to "create" extensions
  - License will only necessary when extension will be published as software plugins in optiSLang (Integration nodes, customer algorithms, modified Wizards, ..)
  - Use of software plugins does not require a customization license



Simulation Product Data Management (SPDM)

SPDM is very important for our customer

optiSLang was selected by customers to serve SPDM

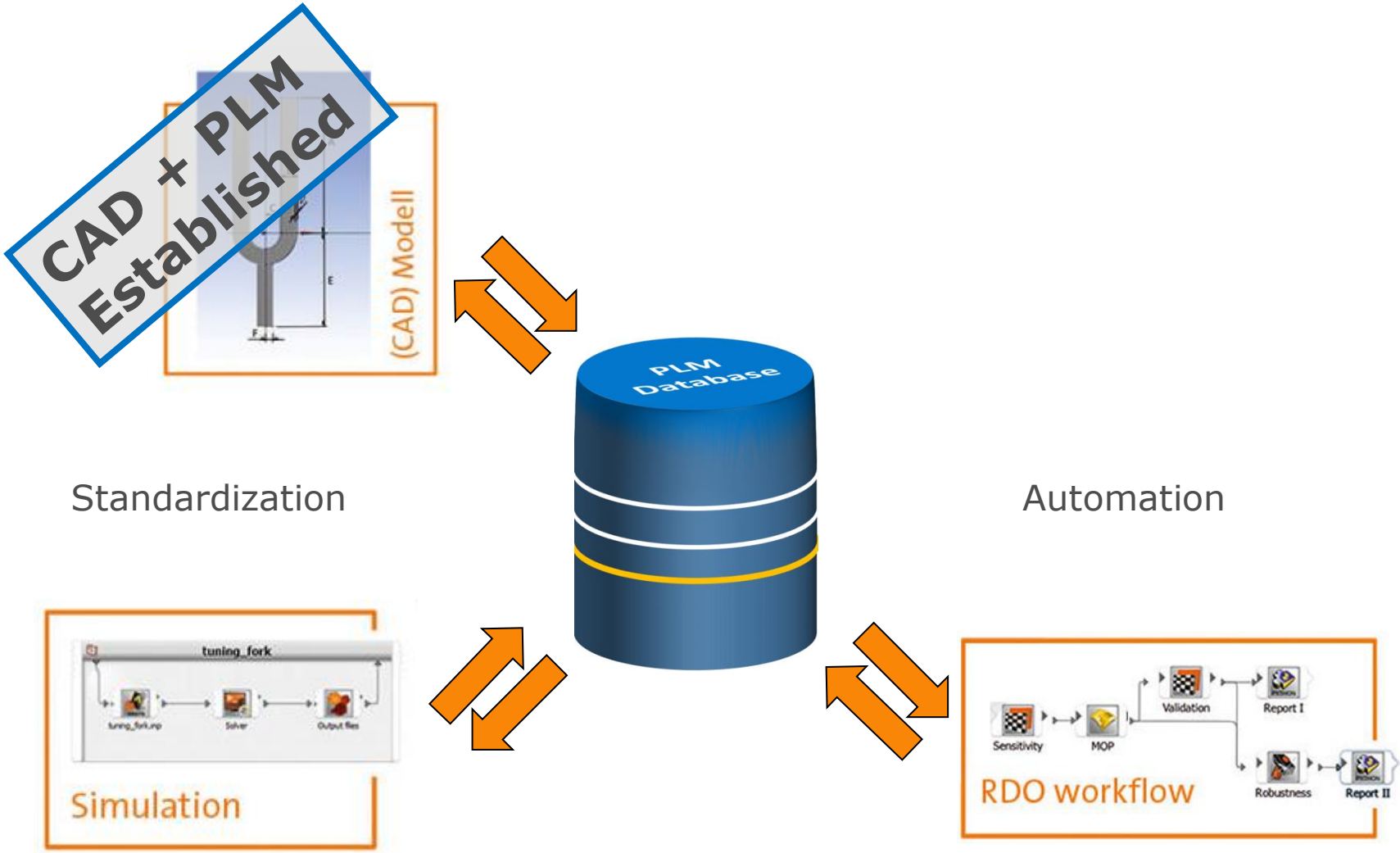
optiSLang's SPDM Extension

SPDM = optiSLang (SPM) + Database (PDM)

Part of optiSLang:

- Simulation Process Management
  - Integrate and automate processes, generate product related workflow templates, publish CAX-workflows
- Connection to Process Data Management
  - Share data with **P**rocess **D**ata **M**anagement (PDM) System

Usergroup – Simulation or Workflow Engineer

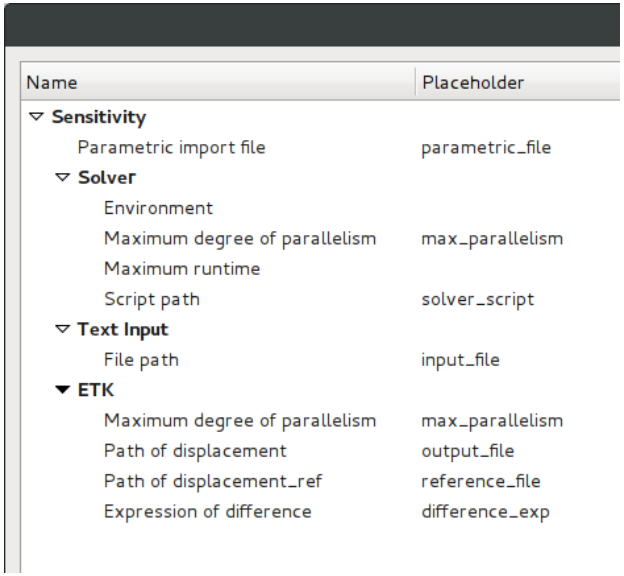


Usergroup - Simulation or Workflow Engineer

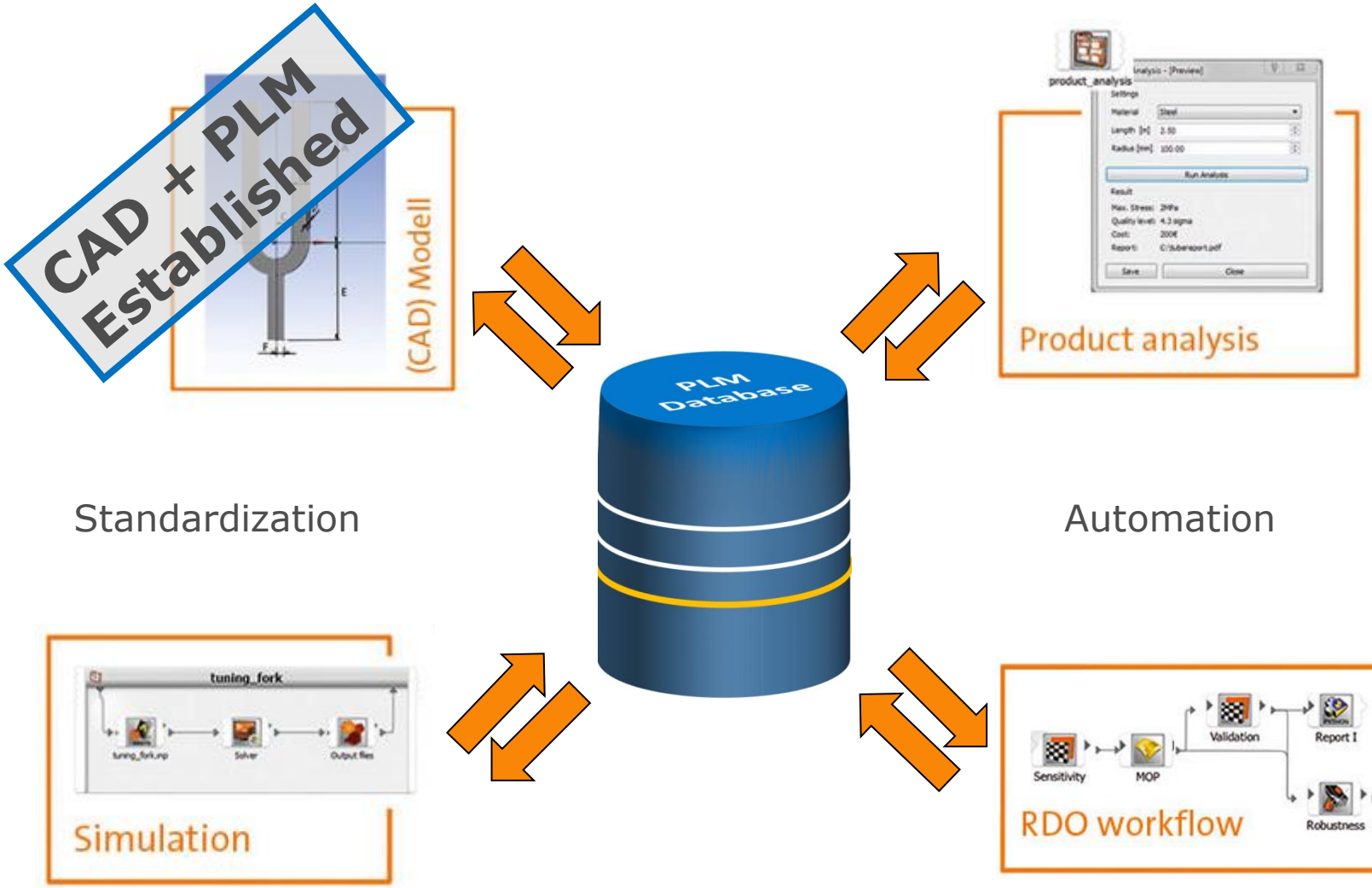
Task: Create a project workflow template and define project parameter (Placeholder) and rights to see & change

- Defines “project parameter”
  - Use Expressions and free variables to avoid redundancy
  - See e.g. variable “model”
- Defines what others see and can change
  - See column “minimum user level”

	Id	Minimum user level	Data type	Value
1	reference_files_dir	Computation Engineer	Path	${project_dir}/files
2	model	Computation Engineer	String	oscillator
3	parametric_filename	Flow Engineer	Path	${model}_parametric.csv
4	parametric_file	Flow Engineer	Path	${reference_files_dir}/${parametric_filename}
5	input_filename	Flow Engineer	Path	${model}.s
6	input_file	Flow Engineer	Path	${reference_files_dir}/${input_filename}
7	max_parallelism	Computation Engineer	Integer	100



Usergroup - Product Engineer



Usergroup - Product Engineer

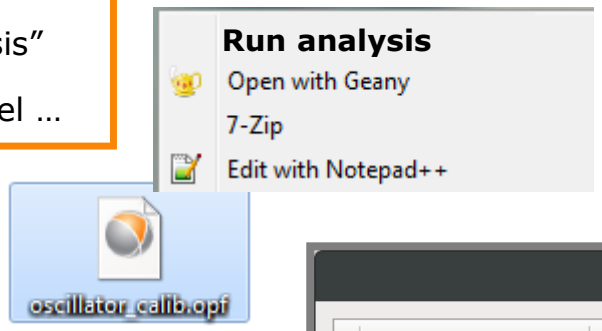
- Knowledge about constraints, requirements
- Only needs to specify or update project parameters
- Run the analysis (use project template)
- No need to care about optiSLang workflow template, CAD Model, …

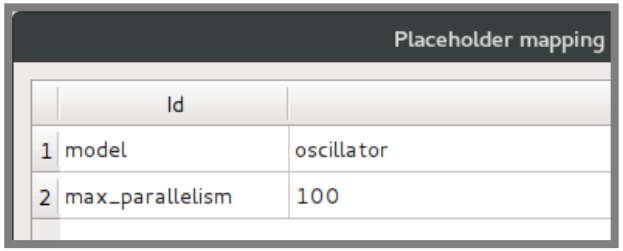
➔ Results can be automatically stored in PLM/PDM

Standardized process e.g.

- Start Windows Explorer
- Choose "Run analysis"

Or web-interface, Excel …





Interface PDM/PLM inside optiSLang

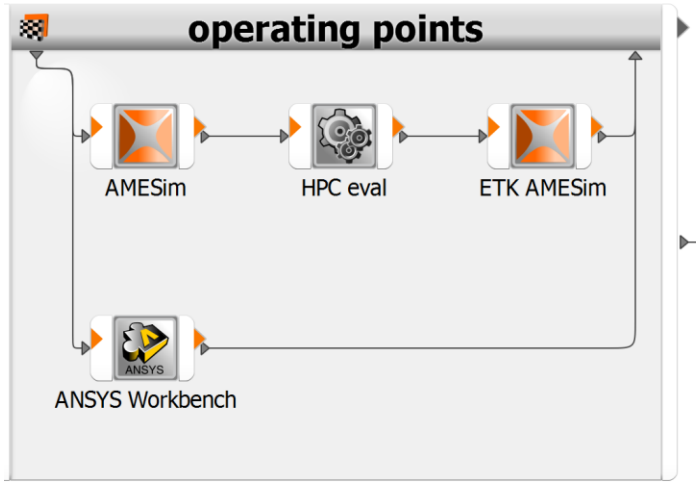
Product parameter

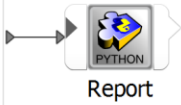
Name	Resolution	Range	
X1	Continuous	-3.14	3.14
X2	Continuous	-3.14	3.14
X3			

Name	Left side expression	Criterion	Right side expression
Constraint	Y	≤	10

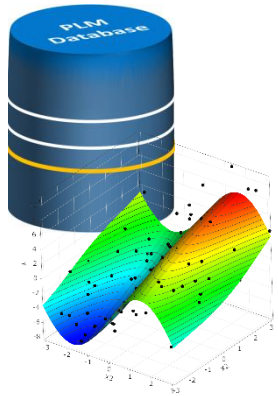
CAE Model

CAE Model



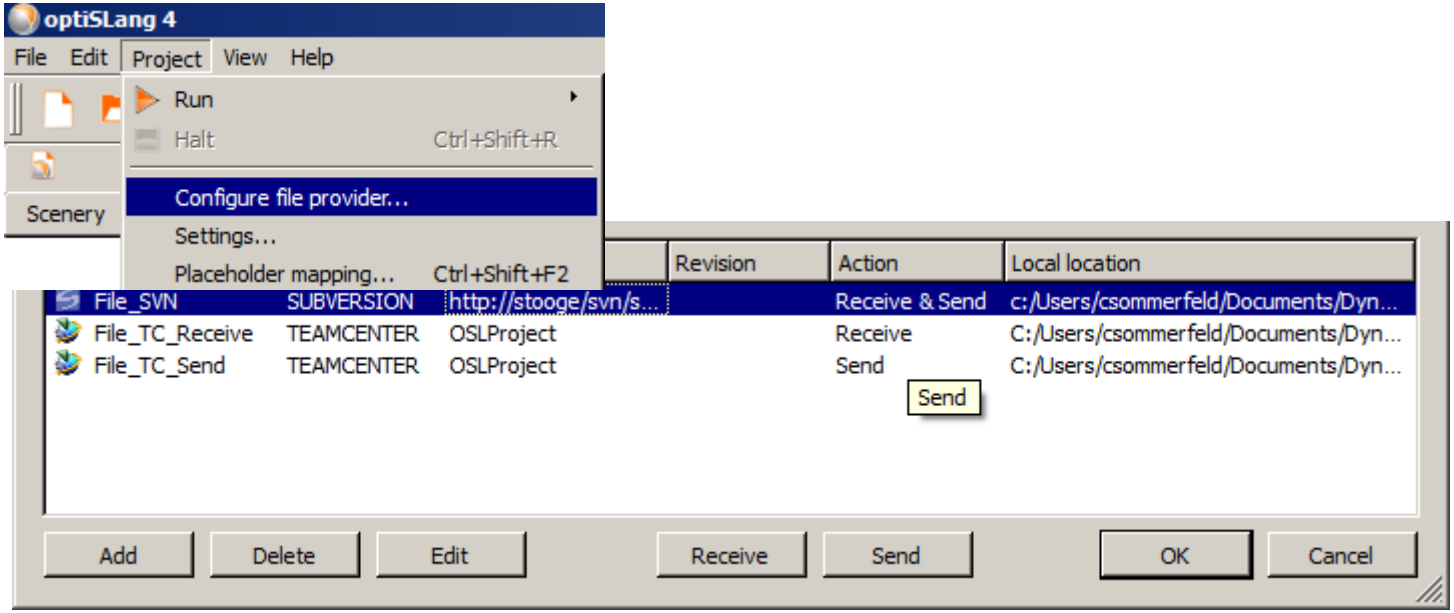


Results

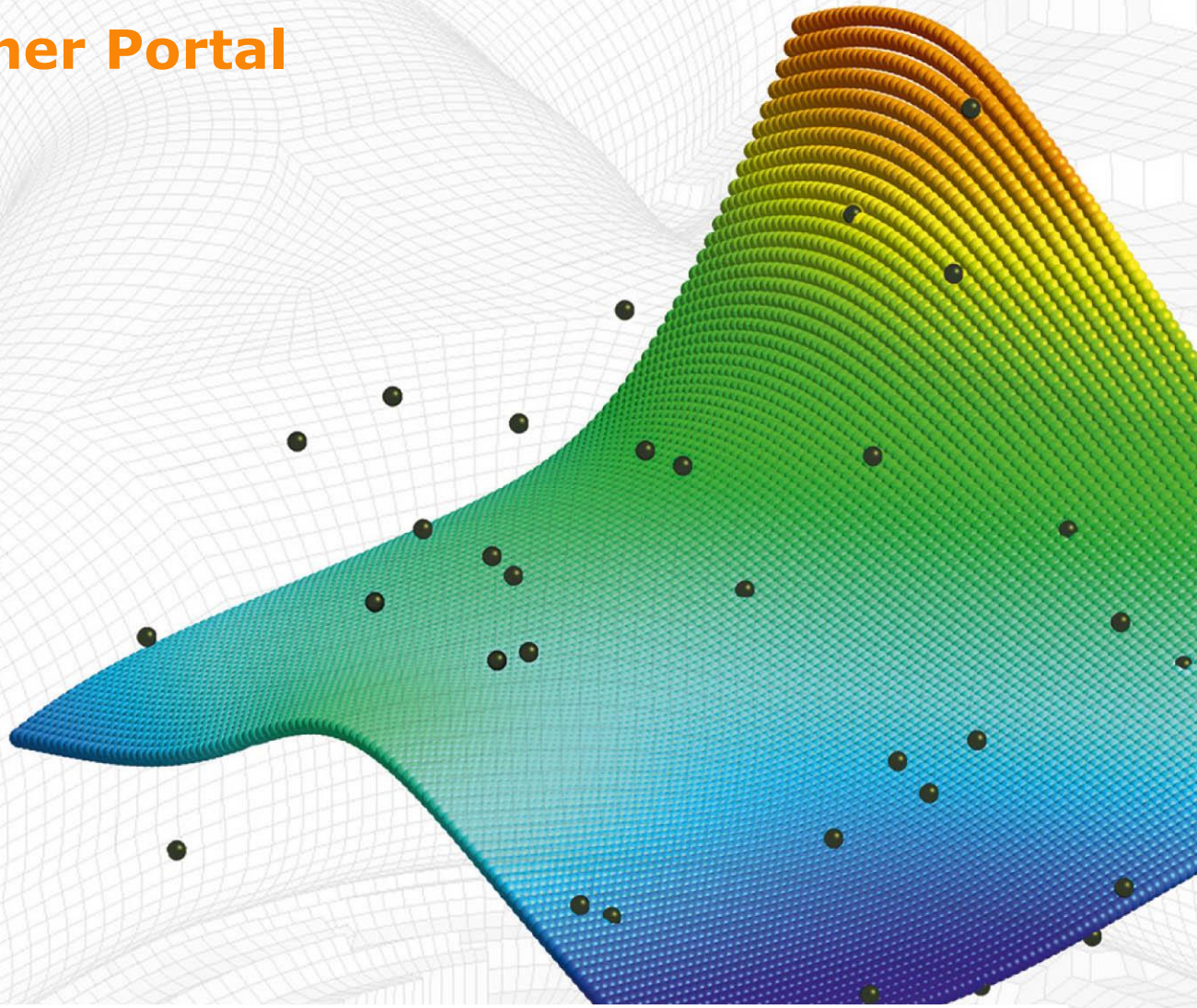


optiSLang's SPDM Extension

- License will be necessary to
  - have project parameter (placeholder) available
  - define what others see and can change (placeholder)
  - Interfacing with PLM software (Teamcenter, ANSYS EKM)

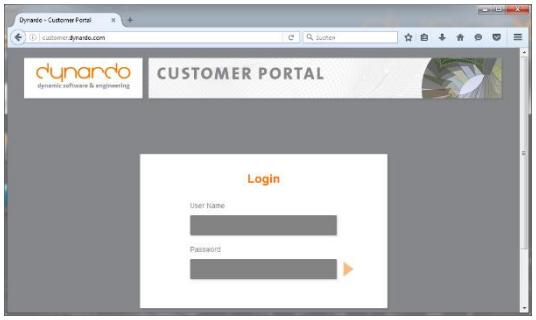


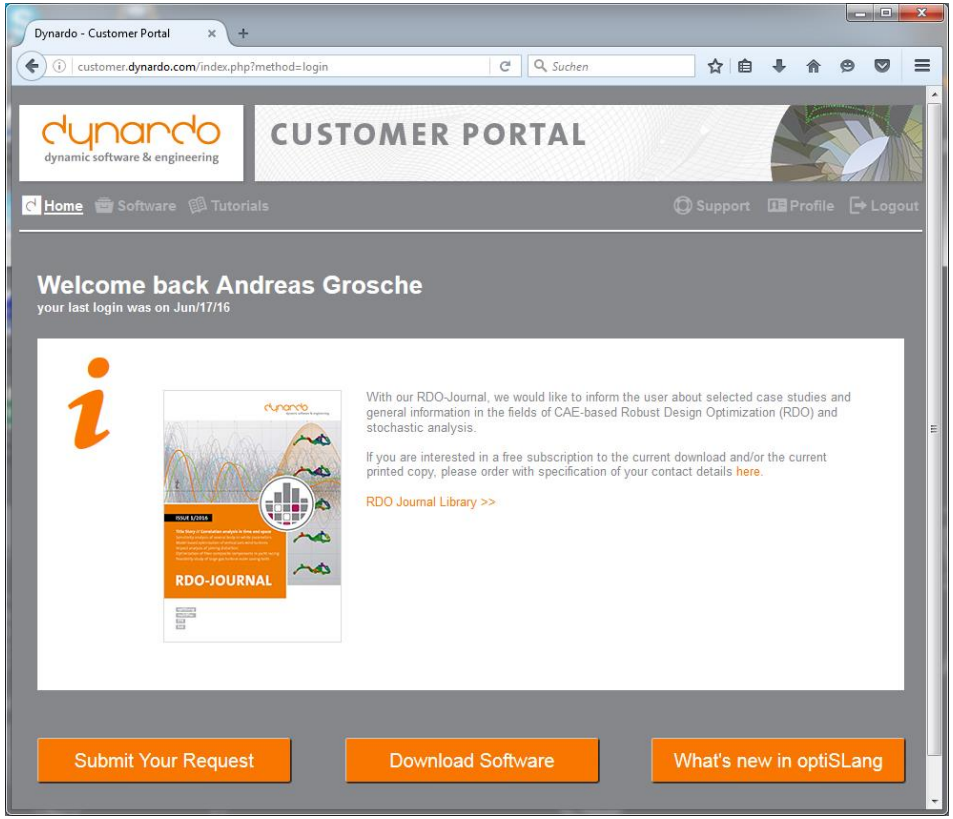
Dynardo Customer Portal



Dynardo's customer portal

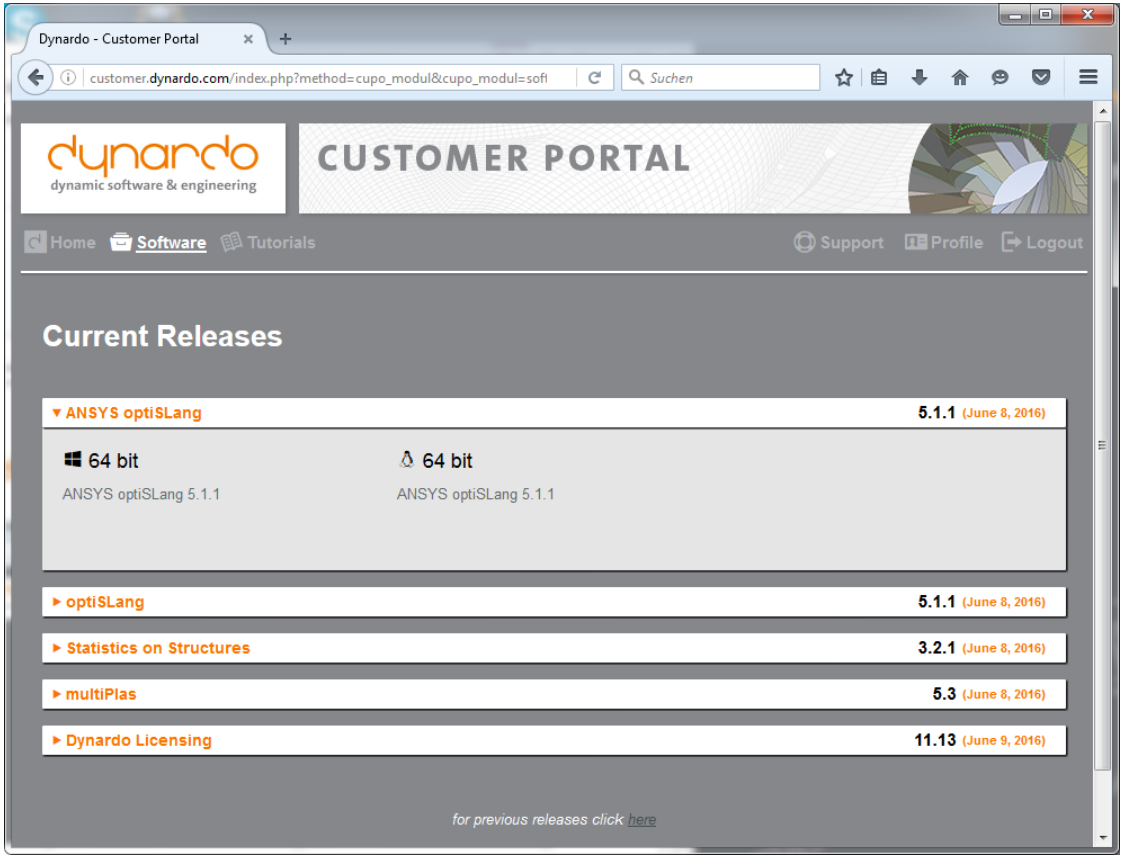
- Keys will be send in July 2016 to support coordinators
    - Submit support request
    - Download software
    - What's new link to homepage section





Dynardo's customer portal

- Future software downloads via Customer Portal only



Dynardo's customer portal

- Library of Tutorials available