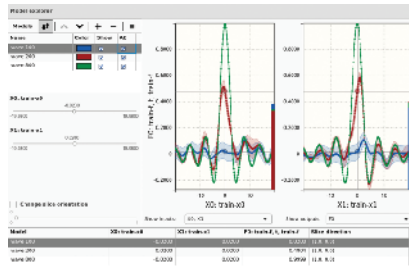# πpSeven

DESIGN SPACE EXPLORATION FOR EVERY EXPERTISE
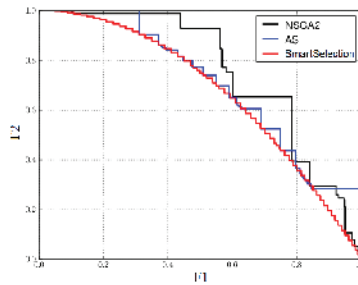
BY

DATADVANCE

WHY CHOOSE PSEVEN?

Complete Toolset for Design Space Exploration

Solve complex engineering problems with a full set of highly-interconnected tools for Design Space Exploration in an easy-to-use graphical user interface.

State-of-the-Art Algorithms

Significantly reduce design lead time and improve your product characteristics with automatic selection of advanced algorithms and techniques for Design Space Exploration.
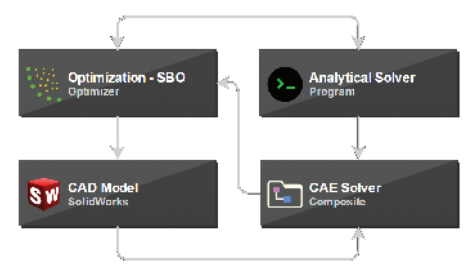
Powerful Workflow Engine

Formalize your product development processes and improve collaboration between different departments with the powerful workflow engine.

From a technical point of view

- Innovative intellectual data and model analysis techniques.
- Unique, fast and efficient algorithms for single-, multi-objective and robust optimization problems.
- Automatic selection of the most efficient algorithms for a given problem and data with SmartSelection.
- Fully scriptable with Python.

From a business point of view

- Improved collaboration between departments and engineers.
- Reduction of cost intensive physical and computational experiments.
- Reuse of already available in-house engineering data.
- Cloud-enabled architecture making capabilities accessible from web-browser.
- Unbeatable license price/product performance ratio.

Choose a solution that fits your product development process the best:

pSeven Workflow
- Workflow construction
- Workflow execution
- Post-processing capabilities

pSeven MDO
- pSeven Workflow
- Data & Model Analysis
- Design Optimization
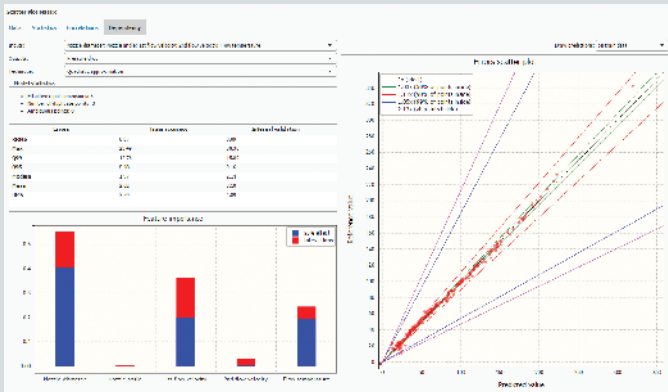- Predictive Modeling

pSeven Ultimate
- pSeven MDO
- Model Export
- Uncertainty Quantification
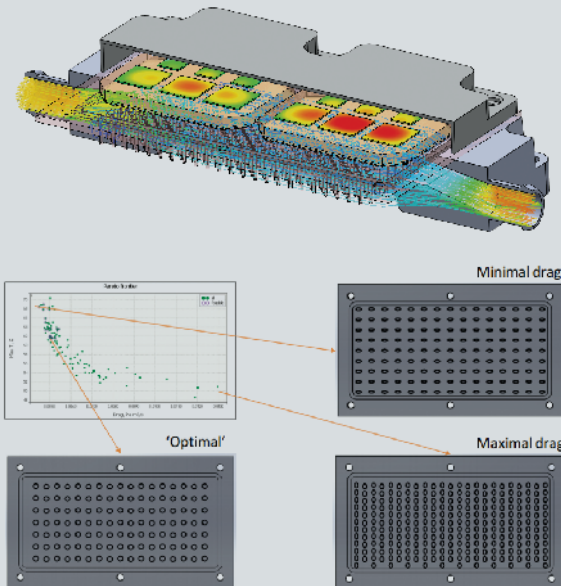- CAD/CAE Integration
- HPC Support

Algorithms and techniques for Design Space Exploration are also available as a standalone Python library **pSeven Core**.

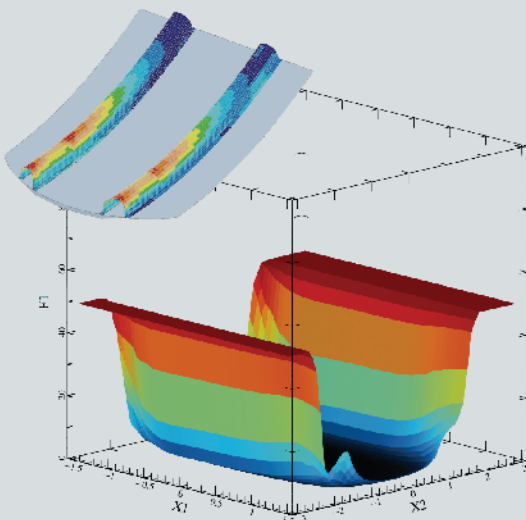Request a 30-day demo at datadvance.net/demo and try pSeven yourself!

DESIGN SPACE EXPLORATION

Dependency analysis of model parameters

IGBT cold plate optimization
using FloEFD and pSeven

Approximation model of structural element
safe load factor with different parameters

Data & Model Analysis

pSeven provides full control over data originated from various sources and rich post-processing capabilities for its exploration, including various visualization and statistics instruments, as well as a set of advanced tools for model analysis:
• Design of Experiments
• Sensitivity Analysis
• Dimension Reduction
• Uncertainty Quantification

Design Optimization

pSeven allows to efficiently solve optimization problems both with analytical models that are fast to evaluate and computationally expensive CAE simulations. The most efficient optimization algorithm and strategy are selected automatically with the help of SmartSelection.

Supported problem types:
• Single- or Multi-Objective
• Single- or Multi-Objective Robust

Supported methods:
• Derivative-Free Optimization
• Gradient-Based Optimization
• Surrogate-Based Optimization (SBO)
• Robust Design Optimization (RDO)

Predictive Modeling

By creating an approximation model based on existing data or simulations, pSeven allows to predict response values for new designs, accelerate complex simulations by many orders of magnitude and capture essential knowledge from vast amounts of data.
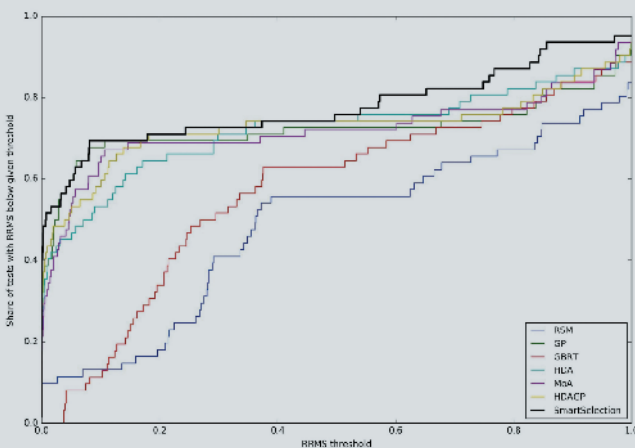
Available tools for predictive modeling:
• Approximation (with automatic selection of techniques via SmartSelection)
• Data Fusion
• Model Explorer
• Model Validator
• Export to C, Octave, FMI, Excel
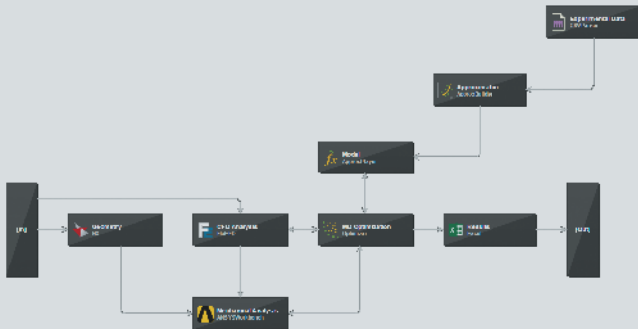
PLATFORM

Multidisciplinary optimization workflow
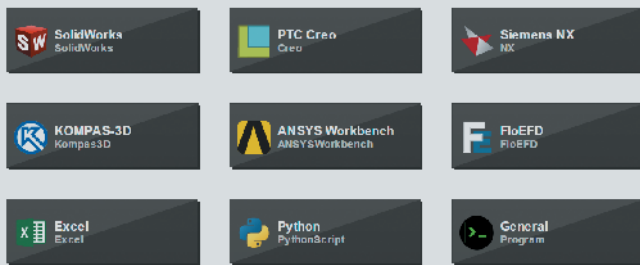
Direct and general integration blocks

SmartSelection vs. static algorithms
for approximation

Process Automation

pSeven is a platform that allows to capture even the most complex design processes by integrating tools for Design Space Exploration and CAD/CAE software you are using into a single workflow, define its logic and collect, manage and reuse engineering data.

CAD/CAE Integration

pSeven supports direct integration for popular major CAD/CAE systems, like ANSYS, FloEFD, SolidWorks, NX and others. You can also integrate almost any other software using generic integration blocks and text file, for example, Abaqus, MSC Nastran, MSC Adams, Star-CCM+, CST Microwave Studio, LS-DYNA, MatLab, Simulink, LMS Imagine.Lab Amesim and others.

SmartSelection — Automatic Selection of Algorithms

SmartSelection is a technique that automatically chooses the most efficient optimization or approximation algorithm and strategy for a given type of problem and data, hides algorithm complexity and opens expert level mathematics for Design Space Exploration even for non-math experts.

AIRBUS
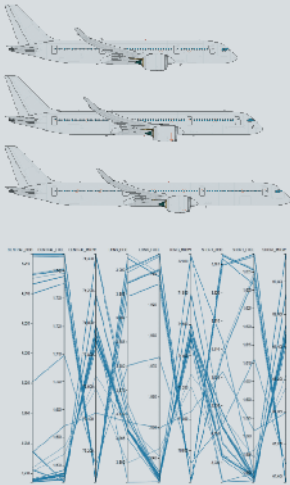
Multi-Objective Optimization of Aircraft Family

Objective
- Optimize a family of 3 airplanes at the conceptual design stage to ensure minimal model modification and related costs at later stages.

Challenges
- High dimensionality: 9 objective functions, 12 design variables, 33 non-linear constraints.
- Problem considered unmanageable by human.

Solution
- Gradient-based multi-objective optimization.
- Integration of in-house simulation tools.

Benefit
- ↑ 5% performance improvement.
- ↓ 20% design time reduction.

SAHARA Force india
formula one team

Optimization of Formula-1 Composite Side Panel

Objective
- Minimize mass of a car side panel exposed to impact loads.

Challenges
- Impact data coming from experiments and simulations.
- Layered panel material makes the problem discontinuous.

Solution
- Optimization of an approximation model created using all available experimental and simulation data.
- Specialized stacking sequence optimization in pSeven.

Benefit
- ↓ 10% mass reduction.
- Fewer expensive simulations and experiments.

THE URAL TURBINE WORKS

Multistage Steam Turbine Gas Path Optimization

Objective
- Maximize the efficiency of High-Pressure Cylinder (HPC) and Intermediate-Pressure Cylinder – 1 & 2 (IPC1, IPC2) with geometry and stress constraints satisfaction.
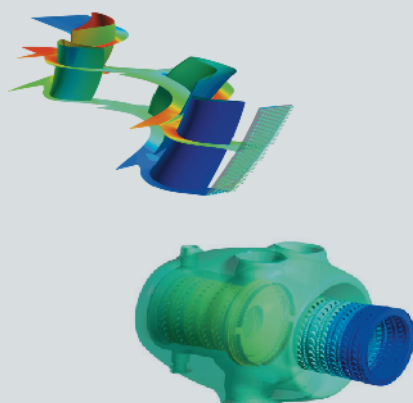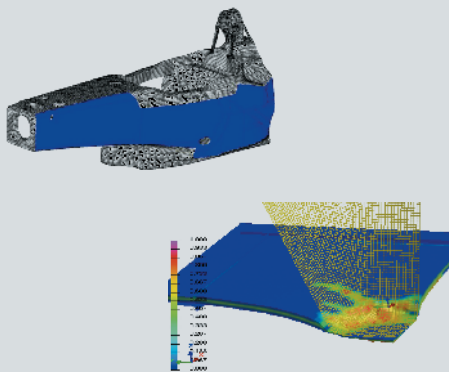
Challenges
- High dimensionality: HPC (69 parameters), IPC-1 (90 parameters), IPC-2 (72 parameters).
- Heavy CFD simulations in ANSYS CFX on HPC cluster.

Solution
- Local gradient optimization method.

Benefit
- Cylinders efficiency boosted by ↑ 2%-4%.
- Capacity increased by ↑ 3%-6%.

DATADVANCE

About Us

DATADVANCE is an independent software developer that offers its customers software solutions and consulting services for intellectual data analysis, design optimization and predictive modeling. We collaborate with leading global software vendors, research centers and universities to continuously innovate and improve our products.

Our Origins

DATADVANCE originates from joint projects between Airbus Group, a global leader in the aerospace industry, and Institute for Information Transmission Problems, one of the leading mathematical centers worldwide.

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