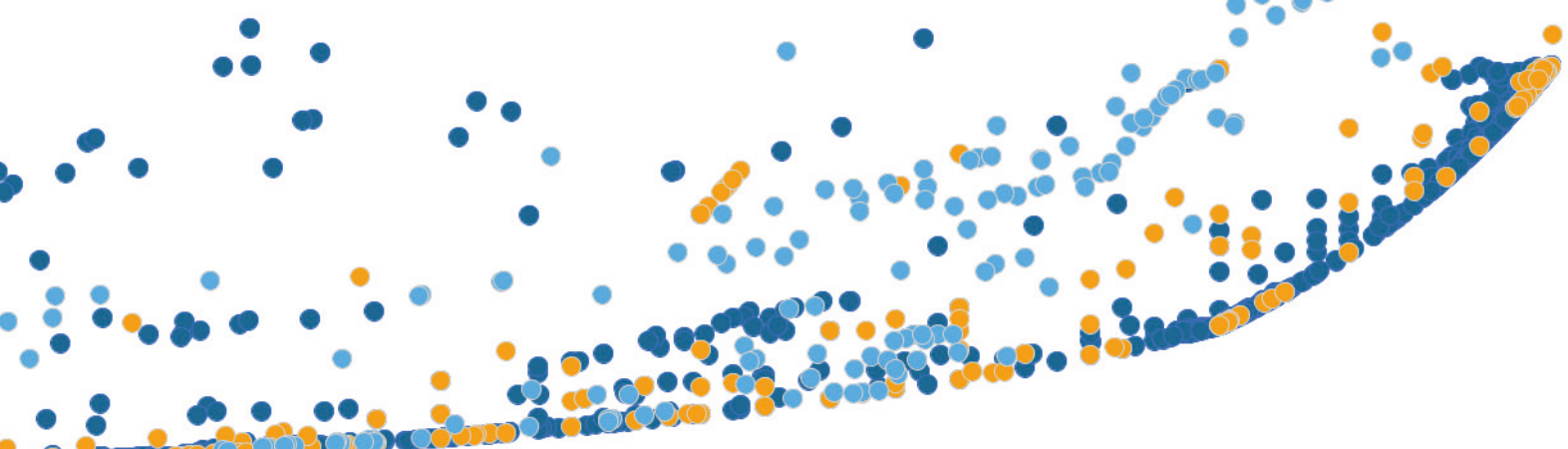




Effective Optimization Driven Design

- ESTECO numerical technology enables efficient Design Space Exploration and Optimization processes



Outsmart the competition with optimal product performance and design innovation

When approaching the design of a new product, knowing upfront the performance potential and the development time is key to stay competitive in the current market scenario.

Design Space Exploration technologies enable engineers to achieve their design targets by determining appropriate parameter values, eliminating the traditional trial and error approach. At the same time an in-depth understanding of the design space is reached with the development of a set of optimized physical or virtual prototyping experiments, validating the realistic product performances.

Used across all sectors and simulation disciplines, the ESTECO numerical technology and the innovative engineering workflow automation have evolved to respond to the most varied needs of designers and have become a reference in the industry.



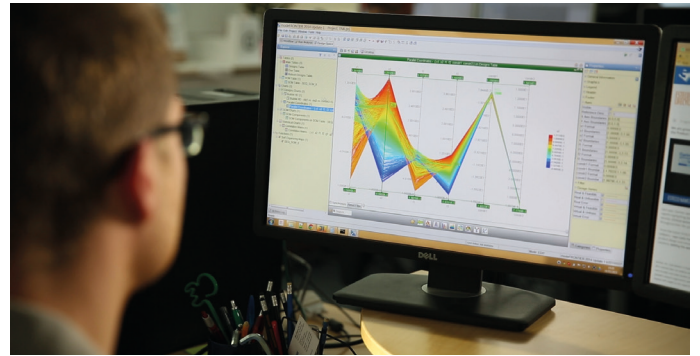
With 20 years' experience, ESTECO supports leading organizations in designing the products of the future, today.

modeFRONTIER and VOLTA are products of ESTECO SpA



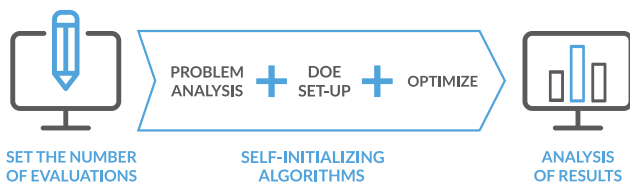
When approaching new design challenges or time to deliver keeps shrinking, design exploration automation becomes the essential tool to succeed in improving product performances.

Along with the traditional MANUAL approach, where engineers can set all the parameters and targets, we have now introduced the SELF-INITIALIZING and AUTONOMOUS mode. These new ways of accessing optimization techniques help basic and expert users to set up an initial investigation of the design space when little knowledge is available.



SELF-INITIALIZING ALGORITHMS

With the Self-initializing mode, teams can bring their optimization projects on the fast track exploiting the single-parameter setup of the classic ESTECO algorithms.



Most of ESTECO's optimization algorithms can now be exploited in the self-initializing mode, where the algorithms analyze the problem characteristics, automatically initialize the most suitable strategy and start searching for optimal solutions. **All by setting a single parameter: the number of evaluations.**

AUTONOMOUS ALGORITHMS

The Autonomous mode requires no parameters to seek optimum solutions while minimizing the amount of iterations required. **Users simply press Play to start it.**

The algorithms use the information gathered from the problem analysis to drive the optimization in the right direction and stop when there is no further improvement.

	MANUAL	SELF-INITIALIZING	AUTONOMOUS
GRADIENT-BASED	✓		
GLOBAL SEARCH	SINGLE-OBJECTIVE simplex, powell	✓	
	MULTI-OBJECTIVE moga II, nsga II, ES, armoga, mopso, mosa, hybrid, fast, mogt, sangea MEGO	✓	✓
piLOPT		✓	✓

STEER YOUR OPTIMIZATION THE SMART WAY

piLOPT proprietary algorithm encloses multiple numerical investigation strategies to offer a smart exploration of the design space.

Designers benefit from search capabilities in multiple scenarios in the explorative concept phase, or when little knowledge about variable behavior/problem characteristics is available or when resources, both in terms of computational capability and time slots, are scarce.

WITH piLOPT YOU CAN

- make the best out of time and computational resources available
- generate new design ideas
- rapidly identify variable correlations
- set up an initial investigation of the design space
- identify promising areas of the design space to further exploit



ESTECO numerical expertise offers a wide range of DOE algorithms and fillers, along with surrogate methods to increase the amount of knowledge of complex engineering problems and thoroughly explore all design options before assessing the performance.

After exploring and understanding relations underlining the Design Space, engineers can access a **wide selection of innovative algorithms** to further refine their designs and identify optimal candidate solutions. The suite of ESTECO optimization algorithms is shaped to respond to **different design needs** and tackle both **discrete and continuous variables** to solve single and multi-objective problems. Together with the reliable implementation of traditional methods consolidated by the engineering practice, ESTECO offers **sophisticated multi-strategy algorithms** that boost engineers' knowledge with advanced artificial intelligence.

FINE-TUNED MULTI-STRATEGY OPTIMIZATION ALGORITHMS

ESTECO provides fine-tuned multi-strategy optimization algorithms able to multiply the capabilities of single approaches. Engineers can combine powerful optimization methods to further reduce the time and effort required to complete the design cycle.

Multi-Objective Efficient Global Optimizer (MEGO) |

Teams can now achieve high converge rate and efficiency in finding the global optimum particularly when performing heavy simulations. The MEGO algorithm is best used with constrained single-objective problems with many local optima.

FAST | accelerates the process by exploiting RSM performance over the region of most interest in the Design Space, reaching a high-speed detection of the optimal solutions.

HYBRID | automatically combines the robustness of Genetic Algorithms with the accuracy of Gradient methods, providing an unprecedented balance between exploration and refinement capabilities.

SAnGeA | provides an automatic screening phase, coupled with a Genetic Algorithms global search phase, reliably identifying the most meaningful variables to face high-dimension and unconstrained problems.

ADAPTIVE SPACE FILLER

Limited computational resources and small experimental datasets are often an issue: space filling algorithms are the best suited option to increase design space knowledge. The Adaptive Space Filler (ASF) combines state-of-the-art strategies with the predictive ability of Response Surface Modelling (RSM).

The space filler iteratively adds points to the design space and uses them to train and constantly improve the accuracy of an RSM based on one or more user-defined criteria. ASF masters the design space exploration by building a finely distributed Design of Experiment dataset and at the same time by training a reliable RSM for optimization or further design space investigation.

THE POWER OF RSM

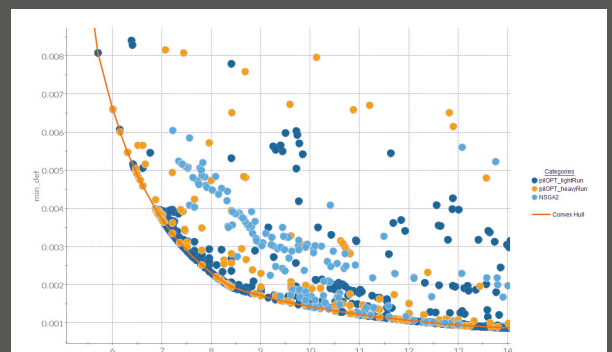
The ESTECO optimization platform generates reliable meta-models effective in approximating the multivariate input/output behavior of complex systems with no computational effort.

The training, validation, and screening tools help create the most accurate model choosing from a wide range of methods. By evaluating the accuracy indicators, comparing surfaces and contextually understanding variable correlations, experts can focus on RSM tuning while the entire team benefits from model re-use.

TRY piOPT ALGORITHM IN AUTONOMOUS MODE FOR HEAVY SIMULATION

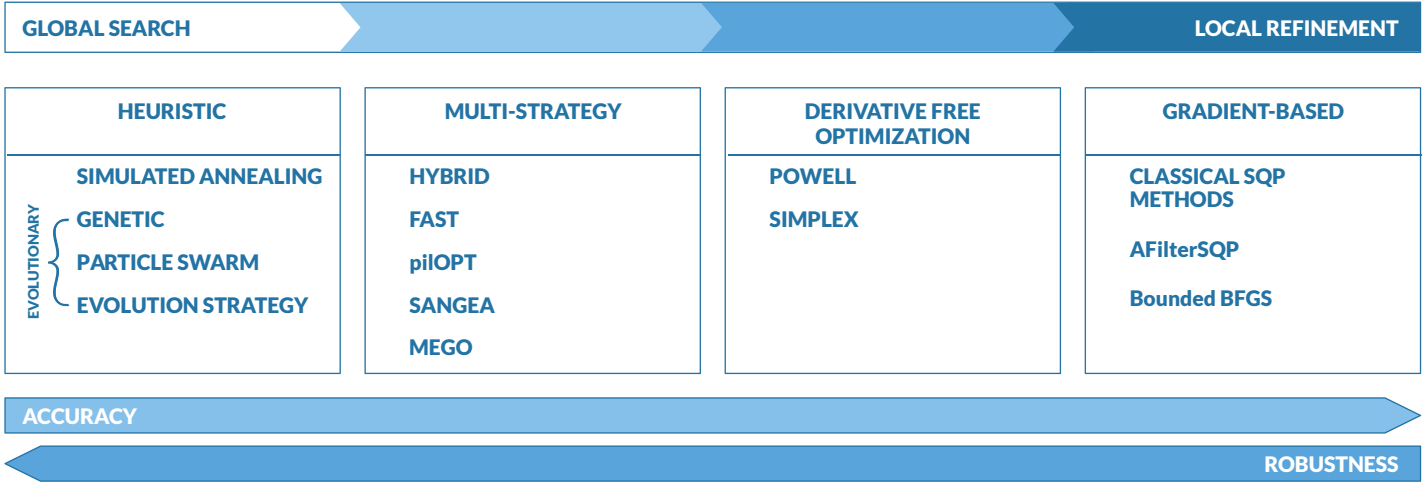
The algorithm has been tested in two application cases by considering a light and heavy simulation process scenario.

As a result, the autonomous piOPT algorithm finds automatically the number of designs needed to reach the Pareto frontier and explore it properly, even in the Heavy Run case. By considering the same number of runs, a classical genetic algorithm is less performant.



A FULL COLLECTION OF BEST-IN-CLASS ALGORITHMS

The unique expertise of ESTECO in the field of numerical methods for design optimization is made available through its software solutions, empowering companies to improve their product development process. With the all-encompassing set of Design of Experiment (DOE) and Optimization algorithms, engineering teams find crucial support to their Design Space Exploration. **Discover the full list of powerful ESTECO algorithms created to enable optimization-driven design.**



“ piLOPT algorithm in autonomous mode is not only conceptually revolutionary but really effective in seeking optimum solutions while minimizing the amount of iterations required. ”

MATTEO NICOLICH
ESTECO
 Product Manager

EXPLORE DESIGN PERFECTION

ESTECO HQ | Trieste, ITALY
 +39 040 3755548
 info@esteco.com

ESTECO North America | Novi, MI, USA
 +1 248 912 6890
 na.sales@esteco.com

ESTECO India | Pune, INDIA
 +91 96731 54456
 in.sales@esteco.com

ESTECO is an independent software provider, highly specialized in numerical optimization and simulation data management with a sound scientific foundation and a flexible approach to customer needs.

With 20 years' experience, the company supports leading organizations in designing the products of the future, today.

