

DESIGN SPACE EXPLORATION: ADOPTION DRIVERS,
ADOPTION CONSTRAINTS, POTENTIAL ADOPTION
ACCELERATORS

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ABSTRACT

Design space exploration today is enjoying ever-increasing levels of recognition, adoption, and successful application to some of the world's most challenging engineering problems. Nonetheless, there remain significant impediments to the even broader deployment and usage that champions of these tools and methods believe will be possible in the not-too-distant future.

Design space exploration, in the sense used here, encompasses a family of applications and work processes that include design of experiments (DOE), multidisciplinary optimization (MDO), multi-objective (Pareto) optimization, stochastic (robustness and reliability) optimization, and the broad array of structural optimization methods – shape, size, topology, topometry, topography, more.

These are some of the latest developments that are driving and accelerating the pace of adoption and impact today:

- Increasing levels of built-in intelligence to let design exploration software choose the best search algorithms and solution methods autonomously, based on the user's description of the problem in engineering terms.

- Application of simulation—the embedment of design exploration and optimization technologies inside easy-to-use, product- and customer-specific simulation apps.
- Full-cloud solutions that expand accessibility, affordability and usability of design space exploration.
- Continued vigorous marketing and sales activity by large CAE vendors that own premier design exploration and optimization technology.
- Compounding pressures on engineering organizations to find new ways to do more with fixed resources, for example meeting automotive CAE and emissions mandates.

On the other hand, these are some of the legacy conditions responsible for constraining and retarding adoption and impact:

- Design exploration and optimization are still not part of the standard work process at enough engineering organizations.
- The technology remains too often implemented at only the workgroup or department level, instead of as an enterprise competency.
- Many small software developers offering highly capable technologies continue to struggle under marketing/sales resource constraints.
- Some PLM vendors have yet to embrace design space exploration, fearing it a troublesome complication in an already complex CAE sales process.

These are some “wild-card” issues whose near- and intermediate-term impact will bear watching closely:

- Market-development ripple effects from the growing democratization of topology optimization?
- More acquisitions of design exploration/optimization software developers by major CAE and/or PLM vendors?
- New startups fielding breakthrough technologies?

The presentation will use these and related issues as a springboard to explore what steps can be taken by technology developers, engineering practitioners, and engineering management to further unlock the full potential of design space exploration.