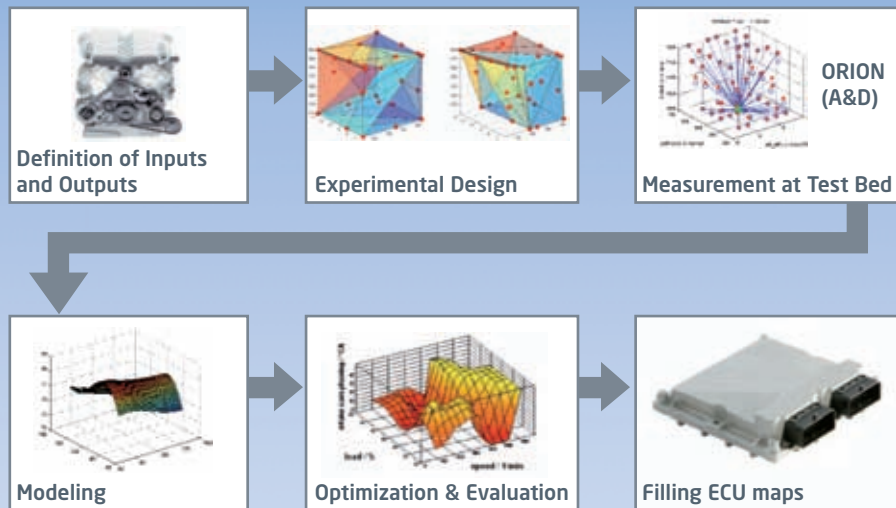


EasyDoE Toolsuite

Engine Optimization with Design of Experiments



EasyDoE Toolsuite for Design of Experiments

Design of Experiments (DoE) is a methodology framework widely used to plan experiments and evaluate the results in order to identify the optimum parameter settings for the whole operating range of combustion engines.

EasyDoE Toolsuite guides engineers through all steps of the DoE process:

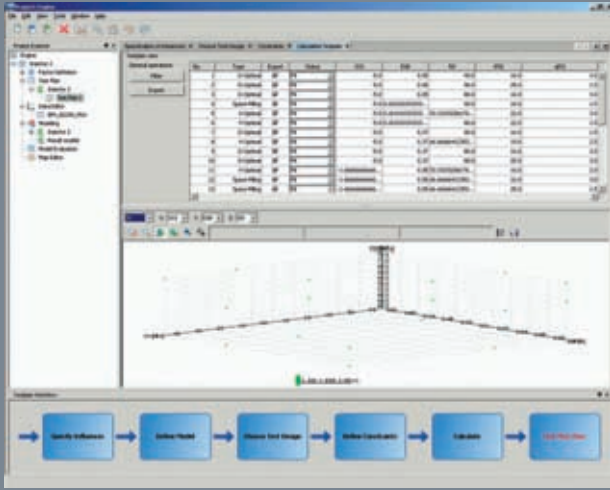
1. Defining the inputs and outputs and planning the required tests
2. Downloading the test plan to a test bed automation software like ORION from A & D Company, Ltd.
3. Importing the measured data, modeling the engine behavior and using those models to optimize engine maps

EasyDoE Toolsuite supports you in all these tasks by creating and visualizing test plans, models, optimized engine settings and smooth engine maps.

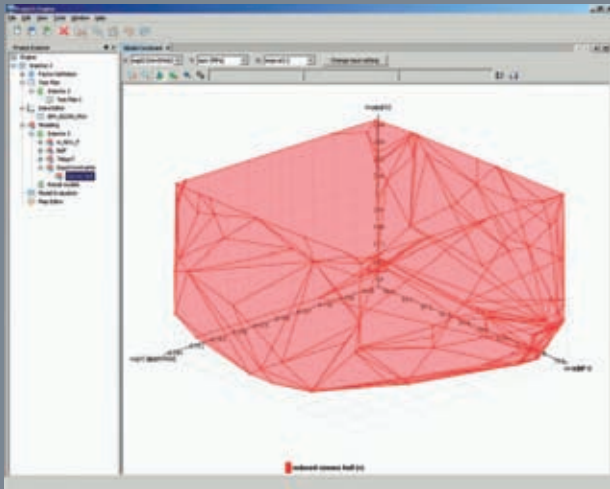
IAV has been using DoE in industrial projects for a long time. Facing real-world requirements, a team of DoE experts at IAV has developed and refined its in-house tools over the last years. These formerly single-task tools have now been redesigned and integrated into the EasyDoE Toolsuite, achieving an intuitive user interface consistent throughout the whole process and enabling engineers to design and evaluate test designs and models without the need of in-depth DoE knowledge. Advanced users can employ more sophisticated options to adapt the process to their needs - EasyDoE Toolsuite can even be customized with additional user functions programmed in MATLAB®.

Features

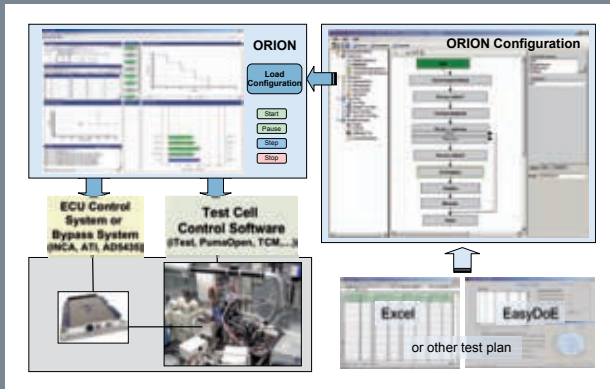
- ▶ Offline optimization of complex engine behavior using DoE
- ▶ Visual guidance through the entire DoE process in one tool
 - Factor definition
 - Test planning
 - Processing measurements
 - Modeling
 - Model evaluation (optimization)
 - Filling ECU maps
- ▶ Based on the IAV in-house tools EasyDoE & ModelAnalyzer
- ▶ Intuitive usage through easy workflow
- ▶ Integration of MATLAB® scripts
- ▶ Process automation with templates



EasyDoE Toolsuite: Test planning and modeling



EasyDoE Toolsuite: Visualization and optimization



ORION: Automated measurements

EasyDoE Toolsuite: Test Planning and Modeling

IAV engineers have used the in-house tool EasyDoE for test planning and modeling for a long time. Based on IAV's sound experience, the newly developed EasyDoE Toolsuite guides engine calibrators through the DoE process. An intuitive graphical user interface explains the required work step by step.

IAV has developed numerical methods to build representative models of engine behavior. Several types of models are implemented to meet different signal types and applications.

EasyDoE Toolsuite: Visualization and Optimization

Visualization enables engineers to inspect the models generated with EasyDoE Toolsuite or to import models from similar tools like the MATLAB®-based MBC toolbox from The MathWorks™. The tool contains 2D and 3D plots to visualize engine behavior showing the boundaries of the design space.

The tool can optimize engine maps for different constraints.

ORION

For several years IAV has been using an in-house tool called MPI² for conducting automated measurements at the engine test bed. This expertise has been combined with the needs of other test-bed users. IAV and test-bed producer A&D Company, Ltd. have developed the ORION software that can be used with several test-bed systems.

Please contact DoEToolsuite@iav.de for further details on EasyDoE Toolsuite. For information about ORION, please contact dnutter@aanddtech.com.