Optimization Applied to Mechatronics

Mechatronics

The term mechatronics comes from the two words mechanics and electronics, with the latter having the meaning that is embraced in today's concept of information engineering: electronics, automation, computer science and telecommunications.

A large number of machines and processes are electromechanic in nature, having electronic controls. Some examples are found in the automobile, aerospace and manufacturing industries, consumer products (household appliances and video recorders, for example), machine tools and robots. The ever greater use of applied electronics and electromechanical processes, and in particular the use of programmable electronic systems with microcontrollers, has lead to a new approach to the design of these processes that can be defined as an integrated process. The philosophy at the base of mechatronics is the integration into a single project of the three competences that were traditionally and distinctively those of electronic, electrical and mechanical engineering.

A machatronic project is thus essentially the integration into a mechanical project of the modern technologies of sensors, actuators, and movements controlled in real time by programmable devices such as microprocessors, DSP, PLC etc. This integration is, moreover, only possible if the mechanical project is managed using modern techniques able to calculate movements and stresses, foresee noise and vibrations, calculates laws of motion and torque for input to input to the electronic systems as references for the correct operation of the system. The mechanical approach to the project results, for example, in the substitution of some mechanical functions by electronic ones which are more flexible and sometimes less expensive and more reliable. The results are higher performance products which are easily reconfigured using software and thus more flexible for the user and able to keep pace with markets that are ever more demanding in terms of price and performance.

modeFRONTIER

modeFRONTIER™ is an integrated Platform for Multi-Objective and Multi-Disciplinary Design Optimization. modeFRONTIER™ provides a powerful and easy to use solution to include any product into an integrated design chain where CAD, FEM, CFD, cost prediction, Six-Sigma design, etc. are used simultaneously and in a distributed environment to push the envelop in product development.

modeFRONTIER™ includes a wide range of numerical methods for DOE, Robust Design, Optimization and data-modelling. A powerful post-processing and easy-to-use process flow integration greatly enhance both the engineers as well as the decision maker capability, automating frequent tasks while filtering only useful information.

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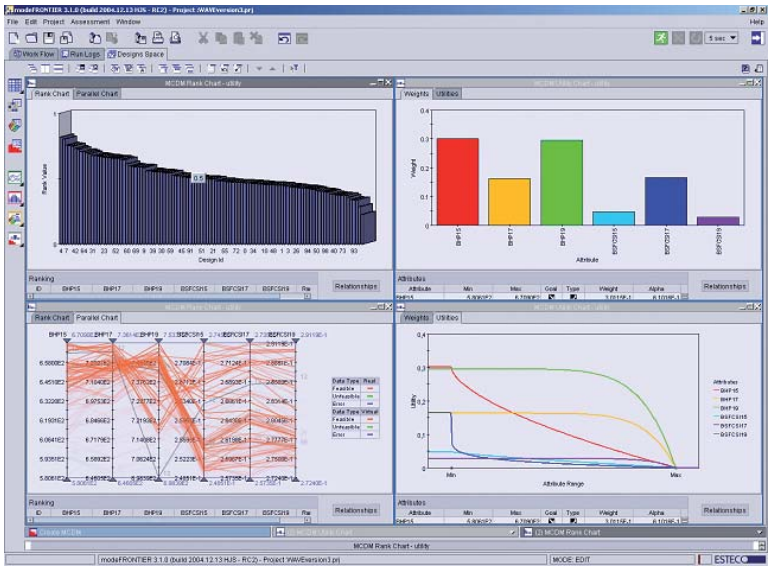
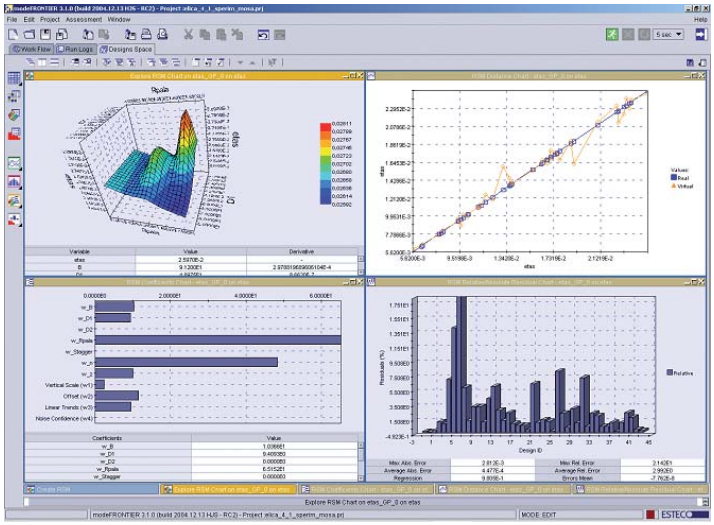
Why modeFRONTIER applied to Mechatronics in the Design of Dynamic Systems

Good design in mechatronics involves a very wide range of skills, while the fields of application span mechanical and electrical engineering, thermodynamics, hydraulics, pneumatics, heat transfer and control systems. This implies an all but common broad understanding and vision, and above all the difficult interpretation of optimisation using DOE.

This is precisely the field of application for modeFRONTIER, namely the integration of an optimisation system with one for a decision support, and basically when the design team has to work with a multitude of knowledge sectors. modeFRONTIER differs from other optimisation systems also in that in addition to providing full support and algorithm base for DOE and multi-objective optimisation, it internally





integrates tools to judge and weigh the possible solutions obtained that meet the needs of the team as a whole.

Let us take an example of a project in which it is necessary to optimise both the mechanical component as well as the associated control and pneumatic systems. Any optimiser can find a range of solutions in a given time, but the final decision then has to obtain the optimum that satisfies all the disciplines involved, without upsetting anyone, and perhaps not reviewing the improvements possible with small variations to the set parameters.

The integration of monodimensional codes or block systems is very strong in modeFRONTIER and this enables the rapid construction of multidisciplinary optimisation models with an equally fast solution that permits the team to concentrate on the important decisional phase of the project.