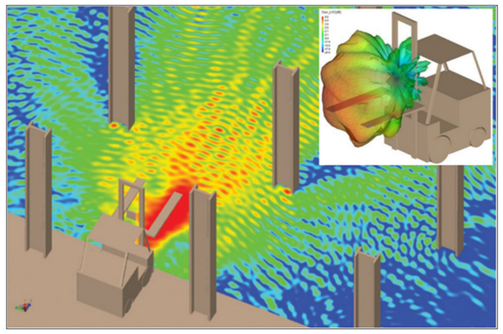
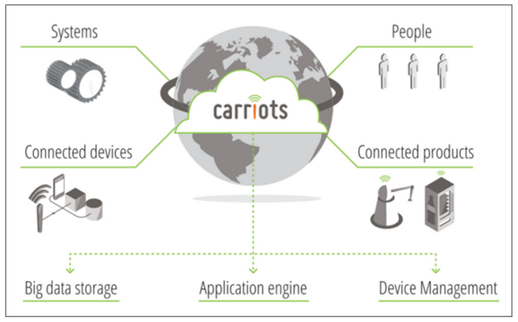
Secure operations thanks to accurate EMC analysis

Electromagnetic Compatibility (EMC) can be assured utilizing Altair HyperWorks' electromagnetic solvers, FEKO and Flux. FEKO includes a complete cable-modeling tool to analyze both radiation and irradiation of cables into or from other cables, antennas or devices, which can cause disturbance voltages and currents resulting in a malfunctioning system. FEKO is also used to simulate radiated emissions of Electronic Control Units (ECU) in a system, shielding effectiveness, radiation hazard analysis, electromagnetic pulses (EMP), lightning effects and High Intensity Radiated Fields (HIRF). With Flux on the other hand engineers can evaluate the magnetic field radiated by power cables and busbars. The effect of external fields on the operation of electromagnetic devices such as sensors or actuators can be determined. It also allows to design efficient shielding.



FEKO solutions enable the user to follow production assets precisely, depending on their location and environment, while optimizing the communication networks.



Carriots IoT Cloud platform allows easy development of new IoT enabled equipment, with features enabling device management and application development.

Improving performance thanks to IoT platform and analytics

The operation, interaction and the connectivity of modern industrial devices result in a vast amount of data. Handling, analyzing, processing, and visualizing this data in Real Time can be a challenge. But solutions exist.

Carriots PaaS, the leading platform for IoT Cloud applications, addresses this kind of solution and helps to convert IoT cobot ideas into real solutions enabling faster, cheaper, reliable, and scalable projects to be built on Altair's Cloud for the Internet of Things. Designers can now connect to a multitude of devices that contain an environment for developing cloud-based applications, and create their own applications while remotely managing thousands of machines anywhere in the world.

Moreover, Cloud - Edge based Business Intelligence dashboards such as Envision, Altair's data analytics platform offer new Real Time functions, thanks to a complete set of capabilities required for IoT and Industrial Analytics.

A global simulation platform to accelerate the design process

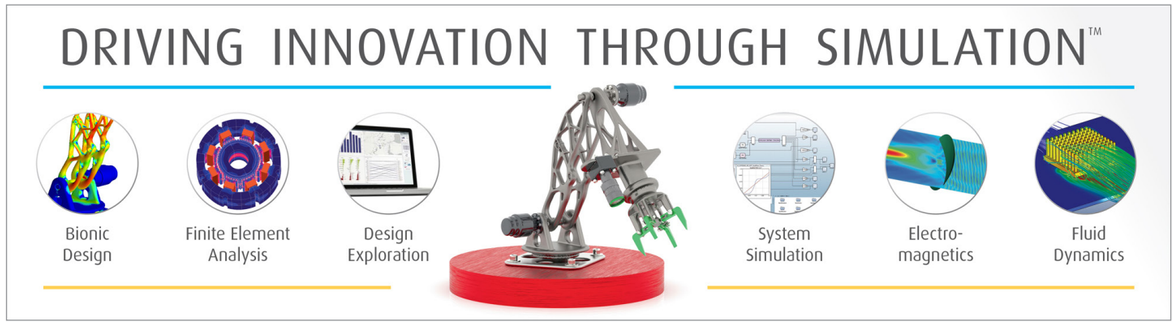
HyperWorks offers best-in-class modeling, linear and nonlinear analyses, structural and system-level optimization, fluid and multi-body dynamics simulation, electromagnetic compatibility (EMC), multiphysics analysis, model-based development and data management solutions., From 1D to 3D - sensors to optimized structures and data analytics - all required steps involved in the development process of products fit for Industry 4.0, can be conducted and solved with Altair's software platform and with a Simulation-driven Innovation™ approach.

For more information about this topic please visit:
www.altairhyperworks.com/iot

Altair Engineering, Inc., World Headquarters: 1820 E. Big Beaver Rd., Troy, MI 48083-2031 USA
Phone: +1.248.614.2400 • Fax: +1.248.614.2411 • www.altair.com • info@altair.com

Altair

Cobot, the Collaborative Robot - Get Ready for Industry 4.0



"As connectivity and intelligence become part of almost everything with which we interact, Altair's tools for multidisciplinary simulation and development will become increasingly important in helping product designers create outstanding user experiences." James R. Scapa, Founder, Chairman and CEO, Altair

In the context of industry 4.0, product development can become a challenging journey for engineers and it becomes obvious that in order to be successful, engineers and processes have to leave the traditional paths of the past. Development tools and methods, such as simulation, are increasingly important to face and address the pressure of innovation. As an example, for successful new design methods and to show how simulation tools are used, Altair developed a virtual demonstrator based on a cobot application. This complex machine interacts with a human operator as the ultimate smart manufacturing equipment - to show how challenges in modern product design can be overcome.

When creating complex products such as this virtual cobot demonstrator, engineers should consider the entire mechatronics system, including structure, sensors, actuators with dynamic controls and electromagnetic compatibility. Last but not least, they also have to interconnect machines for more flexibility and increase productivity, optimizing the maintenance process. Such complex design constraints can only be addressed with modern comprehensive design platform.

Global equipment simulations to efficiently edit sub-systems specifications

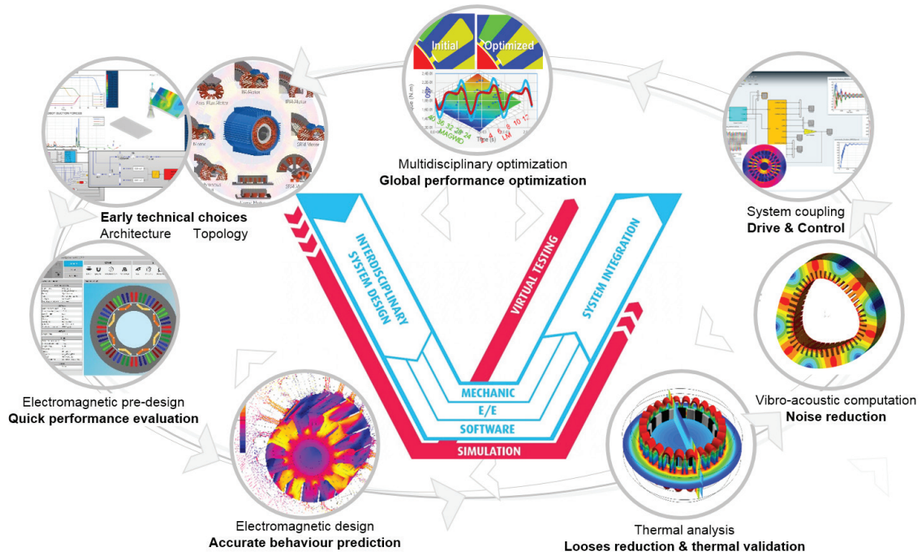
Altair's HyperWorks® simulation platform can be used to develop a cobot from the early design stages and analyze its connectivity within the environment, as well as its sensors and communication network. Furthermore, it is possible to design and optimize the control system of the power unit.

To begin with, system simulation is the basis of load determination needed – as an example - for topology optimization. For this development step, engineers can use solidThinking Activate, a product available as a standalone and as part of the HyperWorks suite. Activate enables product creators, system simulation and control engineers to model, simulate and optimize multi-disciplinary systems. By leveraging model-based development (MBD), it can be ensured that all design requirements are successfully met, while also identifying system level problems early in the design process. Moreover, Activate supports multi-body dynamics co-simulation with MotionSolve, connecting 1D and 3D analyses to perform advanced system level simulation and optimization.

"Engineering, intensively but wisely using simulation capabilities is a key to innovation. Modeling known applications has shown limitations and restrictions, when Simulation Driven Design opens door to new concepts, sometimes leading to disruptive technologies. It enables our customers to differentiate and remain ahead from their competitors."
Vincent Marché – Project Manager, Altair

Motion design at the heart of the producing process efficiency

The choice of the electric machines that will actuate the cobot can be initiated using FluxMotor. It is an intuitive design tool to help search for the best machine configuration that answers the constraints of the system.
Electrical performance of the actuators can then be enhanced using Flux™, which captures the complexity of electromagnetic and thermal phenomena to predict the behavior of the products with precision. This will help improve the efficiency of the equipment, e.g. increasing its reactivity or its torque. This is a key to suppress mechanical gears, limiting the arm performance because of their weight and inertia in movement, mechanical wear and tolerance in the system. From 2D to 3D simulation capabilities, Flux™ can determine precisely the losses and the dynamics of the machine. Furthermore, it can be used to reduce noise, make the actuators more compact, etc. It also allows the possibility of multi-physics studies to deal with thermal constraints coupling Flux with AcuSolve, Altair's CFD solver, or look at the vibrations generated by the machine coupling Flux with OptiStruct for NVH analysis. Within Flux or using HyperStudy, parametric analysis, sensitivity studies and optimizations can be easily performed to reach the best performance within the system requirements.



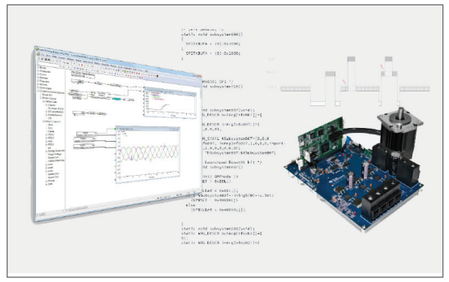
A multiphysics simulation platform to accelerate the motor design process

Solutions to implement effective motion drive & control

In addition to the classical automation functions, the cobot must also consider the physical interactions with humans in a shared workspace, which adds to the complexity of the motions instructions. Here system level analysis comes into play. From the study of load impact (mechanical or electrical loads, thermal effects, etc.) to the design of complex drives, coupling Flux with solidThinking Activate will be helpful. Users can combine the two tools through co-simulation or reduced models to look at the interactions between electromagnetic devices such as rotating machines, filters, actuators, sensors or even induction heating devices with the system. It allows for the design of efficient drive and control strategies of electric machines. The co-simulation considers various phenomena such as saturation, eddy currents, motion, control loops, etc.

Lightening the structure and limiting gears for higher productivity

Moving to the structure, topology optimization ensures lighter structures via bionic inspiration because only light structures guarantee the required efficiency and precision, offering the kind of workplace security that is requested from an industrial cobot. For optimization, HyperWorks offers the FE-solver and optimization tool OptiStruct and the concept design tool solidThinking Inspire. Running an industry-standard optimization engine such as OptiStruct, allows for couple motion analysis with several other disciplines - such as topology, topography or gauge optimization. CAD-designers as well as structural engineers are able to optimize and analyze their designs easily. Functionality, lightweight design, bolt pretensions or manufacturability are just a few achievable objectives.



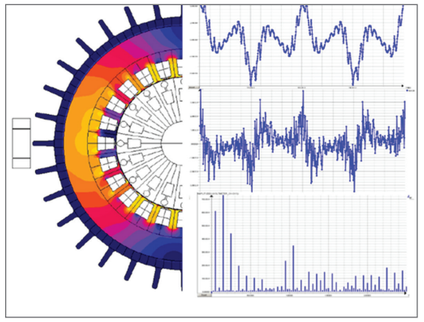
Machine programming with solidThinking Embed

Customizing and parametring machines for safe executions

In the design of a cobot, digital control algorithms are key elements. Tools such as solidThinking Embed help cobot designers to rapidly develop code for microprocessors with an intuitive user-interface. It provides a complete tool chain for the development of the control system covering Software-in-the-Loop, Processor-in-the-Loop as well as Hardware-in-the-Loop simulations. From a control diagram, it can automatically generate real-time capable code that can be directly used via a micro-controller. Once deployed and running on the target, the control parameters can be updated interactively, enabling the set-up of precise and efficient control strategies.

Accurate insight into remote machine monitoring

To reduce the maintenance costs and optimize the service process, the machines should be highly reliable. Flux™ can be used to build fault tolerant motors. It can also help to define the settings of machine health monitoring strategies. Major faults in the motor such as abnormal connections in the windings (short-circuited or open turns, phase-to-ground, phase-to-phase faults) or rotor static and dynamic eccentricities, can be reproduced by simulation. The impact of the faults on the motor operation, as well as non-invasive fault detection methods: for example, motor-current signature analysis or field monitoring using magnetic field measurement coils, can be evaluated. These results, coupled to signal-processing techniques and data analysis tools using advanced analytics, will enable the implementation of predictive and even preventive scenarios, avoiding costly machine downtime by detecting faults at their inception.



The analysis of the external sensor signal allows the detection of faults in the motor, and the implementation of predictive maintenance programs.

Connecting machines for a higher level of productivity

In the age of Industry 4.0, flexibility of the processes revolutionizes the rules of programmed automation, largely based on machine interactions with Machine to Machine (M2M) connectivity.
Altair's comprehensive electromagnetic simulation software suite is ideal to simulate field interactions of antennas. The complete FEKO solver offering provides approaches for each design stage, from conceptual investigations to an accurate prediction of the radio frequency (RF) and safety performance of the final system. Moreover, the use of radio frequency identification (RFID) solutions is widespread in the manufacturing environment. From simply tagging retail items, to comprehensive supply chain management, tags are being used to automate the tracking of items. One of the major challenges in designing and deploying RFID systems is to ensure proper communication between tag antennas and reader antennas, taking into consideration the potentially complex operating environment.
Once the antenna has been designed, communication network should be set. WinProp, Altair's solution for wave propagation and radio network planning will enable engineers to optimize the coverage and capacity of the sensor and gateway mesh.