University of Patras
Academia Case Study

LMS

Challenge
The University of Patras and its Laboratory for Manufacturing Systems & Automation (LMS) needed a solution to help European Union vehicle manufacturers optimize their assembly process.

Solution
LMS chose Dassault Systèmes' **3D**EXPERIENCE applications DELMIA and 3DVIA to simulate robot cells and develop a Virtual Reality (VR) application.

Benefits
With the **3D**EXPERIENCE Platform, LMS was able to detect robot interferences and cut implementation times, and to identify design improvements early on using VR.

Combining research and education experience with virtual simulation

Innovative solutions often begin in a laboratory. The Laboratory for Manufacturing Systems & Automation (LMS), under the direction of Professor George Chryssolouris, at Greece's University of Patras is one of those innovation drivers. It is a state-of-the-art laboratory with a focus on mechanical engineering and aeronautics.

Dr. Nikos Papakostas, project manager at LMS, manages research projects at the European and national level, and teaches first and second-year students. "At LMS, we cooperate with European industry including a number of high tech firms in the automotive, white goods and aerospace sectors," he explained. More than 70 researchers work at LMS along with university students who are completing their master's thesis or PhD degrees. "Our pre-graduate and post-graduate students take part in our research, which gives them invaluable industrial experience and a head start in their career."

Go beyond state-of-the-art

For each project, LMS identifies what current state-of-the-art solutions can offer, and develops tools that go beyond to help firms gain competitive advantage. For their research, Dr. Papakostas and his team use Dassault Systèmes (3DS) applications in a variety of projects.

One such project was the "My-Car" project that focused on the long-term sustainability of European Union vehicle manufacturing and what needs to be done to differentiate it from non-European Union competitors. One of the objectives was to build an assembly plant that would enhance knowledge management by providing the different solutions and services needed to capture and manage manufacturing process information.

The goal of one of the LMS research experiment was to design a robotic cell with two cooperating robots. One robot was equipped with a gripper used to pick up two parts, while the other one performed a series of welding spots so that these two parts would be welded with minimal use of fixtures and additional equipment. "We used DELMIA to develop a new algorithm for testing the cell configurations of cooperating robots for welding Body-in-White automotive parts," Dr. Papakostas said. "DELMIA helped us validate whether the assembly process was collision-free or not. We were then able to discard the options that would lead to a collision and only keep the feasible or collision-free alternatives. In the end, we managed to reduce the cycle time for this specific robotic cell by 3%. The geometry of the parts and the robots' trajectories were so complex that the entire process could not have been simulated using conventional mathematical tools. We needed a complete digital platform that could simulate a complex process like this," he explained.

The LMS team also says that the overall time required to physically implement this robotic cell configuration may be substantially shortened by testing the configuration in a digital environment prior to physical installation. "Without the digital platform and digital simulation capabilities, the engineers would have to go down to the shop floor and test each robotic configuration manually. DELMIA saved us a lot of time," Dr. Papakostas said.
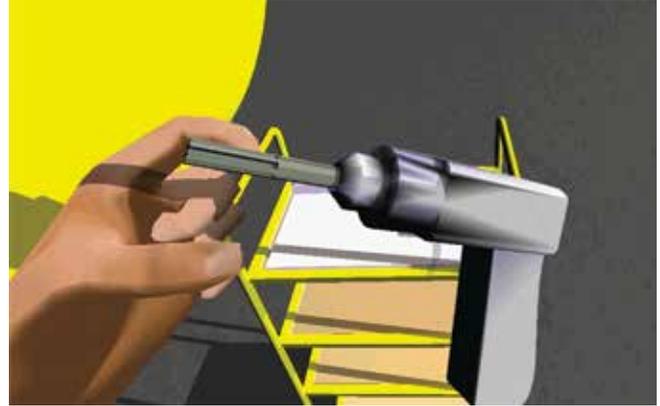

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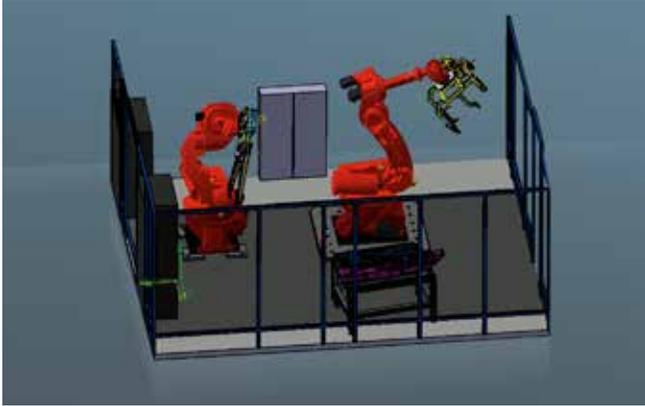
Three-dimensional robot cell simulation with DELMIA

Virtual reality experiment with 3DVIA

Virtual immersive environment

LMS uses 3DVIA technology to perform a number of virtual reality experiments in 3D. For example, the laboratory created a virtual cabin application for the design of an aircraft cabin's lighting configuration. "The flexibility of the application makes it possible to test a wide variety of lighting schemes," Dr. Papakostas said.

"We also use 3DVIA to train our students on digital prototyping techniques during product development. Some of our second-year students designed a radio-controlled model of a car in 3D and evaluated their design and the way the car functions in an immersive environment. By inserting the digital prototype in this virtual environment, the students were able to identify design errors or points where the design needed to be improved."

Next collaborative step

LMS also uses ENOVIA to manage manufacturing information for their latest project currently underway – the design of an Internet-based collaborative and knowledge management platform for the automotive sector. "By managing all our information with ENOVIA rather than storing it in different engineering files, our data is consistent and easily accessed by the different project participants. Collaboration with our external partners will be greatly facilitated," Dr. Papakostas concluded.

Focus on the University of Patras

The University of Patras was founded in 1964 and is the third largest university in Greece. It includes 22 departments with 754 faculty members, a teaching staff of 238 and a student body of 21,200 undergraduate and 3,260 postgraduate students. The Laboratory for Manufacturing Systems and Automation (LMS) is part of the university's Mechanical Engineering and Aeronautics department. One of its missions is to provide undergraduate and postgraduate students with the opportunity to participate in high-tech European research projects.

Products: Mechanical engineering and aeronautics laboratory
Headquarters: Patras, Greece

For more information:
www.lms.mech.upatras.gr

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