

## Education

# University of Brescia

Use of Jack provides accurate, easy-to-implement ergonomics for collaborative projects with industry; serves as a great tool for graduate studies

### Product

Tecnomatix

### Business challenges

Analyze working environment conditions and safety

Prevent physical damage due to heavy load handling

Prevent upper limb injury due to repetitive motion

### Keys to success

Using Jack to model human figures, evaluate key ergonomic parameters and design corrective or improved measures specific to lifting and repetitive motion challenges

Leverage Jack as part of a digital manufacturing approach, which simulates and analyzes production in a virtual environment, prior to the physical setup

Implementation in coursework

### With Jack, university improves its strengths in ergonomics

#### A breadth of technical knowledge

The University of Brescia specializes in mechanical engineering, industrial engineering, industrial automation, civil engineering, information technology (IT) and electronics. Its Department of Mechanical

and Industrial Engineering was established in the early 1980s to deliver educational courses and support the industry with ergonomics research.

Within the department, Marco Alberti, full professor, guides a team of ten researchers and collaborators dealing with industrial production plants, plant and product safety, ergonomics and human factor

management, and environmental compatibility and management. Professor Alberti notes, "These four specialization domains encompass activities concerning the working environment as it relates to thermal, noise, lighting, chemical and other conditions; safety and accident prevention, that is, the prevention of physical damage; and



*The University of Brescia's Department of Mechanical and Industrial Engineering has extensive background and expertise in ergonomic studies and research.*

## Results

Integrated analysis of factors that impact the worker's health and wellness, resulting in healthier workers and higher throughput

Accurate evaluation and reporting, enabling even users with limited experience to perform analysis

Investigation of what-if scenarios through posture virtualization and simulation

New Production System Management Laboratory course

Greater knowledge and skill sets upon graduation for students of ergonomics



*Marco Alberti, full professor, and his team work with industrial production plants, plant and product safety, ergonomics and human factor management, environmental compatibility and management.*

industrial ergonomics, meaning methods and modes to avoid risks and improve working procedures and conditions from a biomechanical and cognitive point of view."

### Expertise in ergonomics

Professor Alberti is supported by Filippo Marciano, a research fellow who is focused on two main areas: manual load handling and limitation of related risks, and the risks related to repetitive motion and efforts of the upper limbs, especially relevant today. Professor Marciano explains, "In collaboration with several companies and our colleagues from the Department of Medicine and Surgery, we are focusing on the evaluation of two aspects: first, benefits offered by the use of industrial manipulators to handle heavy items by means of an operator-controlled system, and

second, the work of sonographers who assume affected body and limb postures during their daily activity."

Professor Alberti's team has extensive expertise and longstanding experience in ergonomic studies and research. "Competence in Italy is relatively common in this field," says Professor Alberti. "But it is often strictly application-oriented, whereas we try to supplement applications with scientific theory and a detailed investigation of basic concepts. Our team was created in 2000, when I moved from the Politecnico in Milan to Brescia." He points out that the application focus of the team's work is essential: all skills are dedicated to support companies in the Brescia area, mostly small and medium businesses where ergonomic risk awareness is still very low. "However, interest for ergonomic

issues is growing, as witnessed by several articles published in recent years in the bulletin of the Association of Engineers in Brescia," he adds. Interest is high because the benefits are significant, including healthier workers and fewer shop floor problems, resulting in greater throughput.

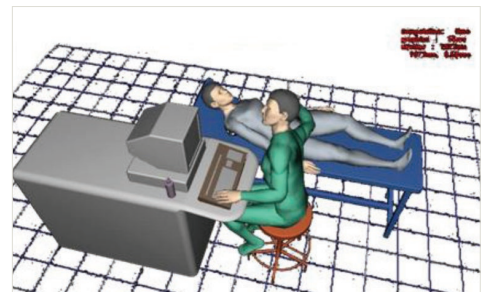
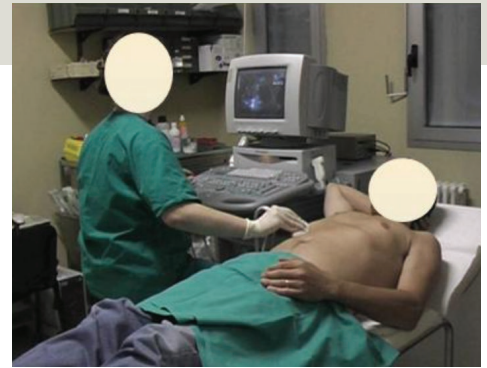
#### Virtualize to anticipate

In 2006, Professor Alberti's team started to look for a software solution that would support its research activities. By reading different international scientific publications, and through discussions with other universities, the team identified Jack™ software in the Tecnomatix® portfolio. Jack is the human process simulation technology from Siemens PLM Software. "After some early simulation of workplaces in industrial environments, we started to analyze the arm motion of table tennis players, in order to identify possible applications in different areas and evaluate the sophistication of the software," says Professor Marciano. "Later on, we tested the software in combination with motion capture systems. The latest test involved an optical motion detection system with cameras and markers that allow the user to reproduce and simulate the motion of the entire body and detect points. Now we are applying this method mainly to the use of manipulators for heavy loads."

The use of Jack delivered the benefits expected by the research team members, who had offered their support as beta testers to suggest possible enhancements and integrations. Team consensus was that while using Jack may initially require a bit more preparation work to build the model, it ultimately provides an easier, faster and integrated analysis of a number of factors affecting the health and wellness of the occupants of a workplace. In addition, the use of Jack delivers detailed analysis and reports even when the user doesn't have any advanced ergonomic expertise.

#### Important combination: accuracy and ease of use

"The reasons we decided to implement Jack have proved right," states Professor Alberti. "All benefits arise from the possibility to model a human figure that moves, works or performs other activities, and then obtain an evaluation of key ergonomic parameters in real time. After that, we can modify specific parameters to see how they affect measured values."



Jack is used to analyze the work of sonographers, who assume affected body and limb postures during their daily activities.

**“By virtualizing and simulating postures, we can push the production of physical prototypes and test execution further along the development cycle.”**

Filippo Marciano  
Research Fellow  
Department of Mechanical and Industrial Engineering  
University of Brescia

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Full Professor  
Department of Mechanical and Industrial Engineering  
University of Brescia

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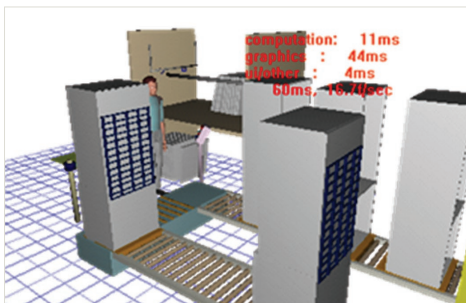
Marco Alberti  
Full Professor  
Department of Mechanical and Industrial Engineering  
University of Brescia

Using Jack provides both accurate results and easy-to-employ assessment methods. "As part of a broader digital manufacturing approach, which supports virtual analysis of production processes, the big benefit of using Jack is that we can analyze working conditions and situations when there are still no real operators or workplaces, so you don't have the necessary elements for traditional paper-based analysis," says Professor Marciano. "We can do this with ample levels of

accuracy and reliability. By virtualizing and simulating postures, we can push the production of physical prototypes and test execution further along the development cycle. Methods for initial approximate evaluations are very simple. If the results are positive, we carry on with development; otherwise, we use alternative methods that are more complicated, rigorous and analytical."

### An educational edge

In addition to industrial applications, the Department of Mechanical and Industrial Engineering uses Jack for educational purposes, primarily for the production of graduate theses that require deeper insight into the ergonomic domain. These theses are generally drafted in collaboration with independent companies to leverage real or realistic situations. The team also plans to use Jack in a new course called Production System Management Laboratory, an IT-focused class to be introduced in 2012.



Using Jack, researchers can model human figures and investigate key ergonomic parameters in real time.

## Solutions/Services

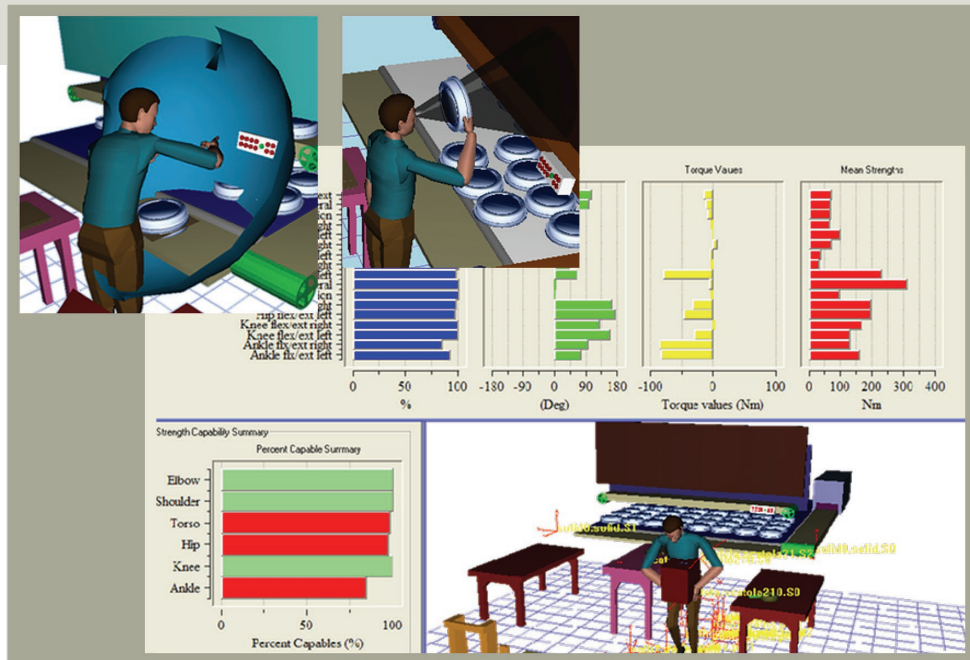
Tecnomatix (Jack)  
[www.siemens.com/tecnomatix](http://www.siemens.com/tecnomatix)

## Customer's primary business

The University of Brescia provides a broad spectrum of educational and research opportunities in mechanical engineering, industrial engineering, industrial automation, civil engineering, information technology and electronics.  
[www.unibs.it](http://www.unibs.it)

## Customer location

Brescia  
Italy



Jack is used to investigate ergonomics related to the use of manipulators for heavy loads.

While the use of Jack provides a real educational competitive edge, industrial applications remain the team's primary focus. "Our aim is to simulate the posture of employees for a major manufacturing company," says Alberti. "Recently, using Jack, we collaborated with a glass processing firm that manufactures washing machine portholes. The transition from conventional to extra-large portholes for

new-generation machines has caused a significant increase in the loads to be handled in the factory, so the company asked us to analyze the working process of porthole controllers in order to identify suitable solutions to eliminate possible risks." According to the professor, the project went smoothly, with highly accurate results obtained quite easily.

## Siemens PLM Software

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