

Designing in VR (DeVR)

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1- Introduction.

This session mainly has the aim to offer a vision of the potentialities that the simulation technologies based on the Virtual Reality (VR) can produce in order to improve “*design*”. The costs to be sustained for the employment of the VR in the design are notable as well as the plant costs and the management due to the continuous demand of updating of the structures and the operators. For this reason the applications concretely realized to date are related to industrial compartments such as the automotive and aeronautical industry that are able to sustain the costs. Nevertheless in the last years VR has been spread in every design compartment of big, medium and small companies, and not only in industrial engineering activities but also, for example, in the management of town and land planning design.

The design methodologies based on the VR produce two positive results. The first one is that they offer the unexpected liberty to the designer to invent new solutions different among them and from the traditional, because the tool that they have available allows them the contextual experimentation. The second advantage is that the design with the aid of the VR necessarily require the meticulous and punctual analysis both of the functional requisite, and of the project parameters, and of the constrains. These considerations, that spring not only from the necessity to model and to simulate the objects, but also from the simulation and the experimentation of their functionalities and their employment, determine a knowledge more deepened and detailed of the project. A such advantage, would already represent an appreciable result. To date, the modelling and the simulation activities based on information technology represent an important tool to achieve optimum outcomes in the “*design*”. These tools realize in the VR their most efficacious and powerful synthesis, because VR, better than any other instrument, realizes the right essence of the designing which consists, essentially, in conceiving and realizing innovative ideas in order to satisfy real requirements of the society where we live.

The session deals with industrial engineering design topics (from “*Concept Design*” to “*Virtual Manufacturing*”) and land and town planning design. It presents both methodologies and very interesting and practical applications.

2- Concept Design

The concept design is a very important phase in the development process of a new product. The early identification of the optimal concept is a critical task of the design process in order to increase the chances of satisfying customers. Currently, VR environment offers the

opportunity to evaluate the characteristics of different virtual prototypes by involving several experts and/or customers, overcoming the need for several physical prototypes. On the other side, the dynamics of simulation and the stereoscopic visualization in VR environment provides a more realistic and impressive interaction with virtual prototypes than in CAD environment. In the session an innovative methodology for modelling and evaluate virtual concept of train seats is presented (figure 1).

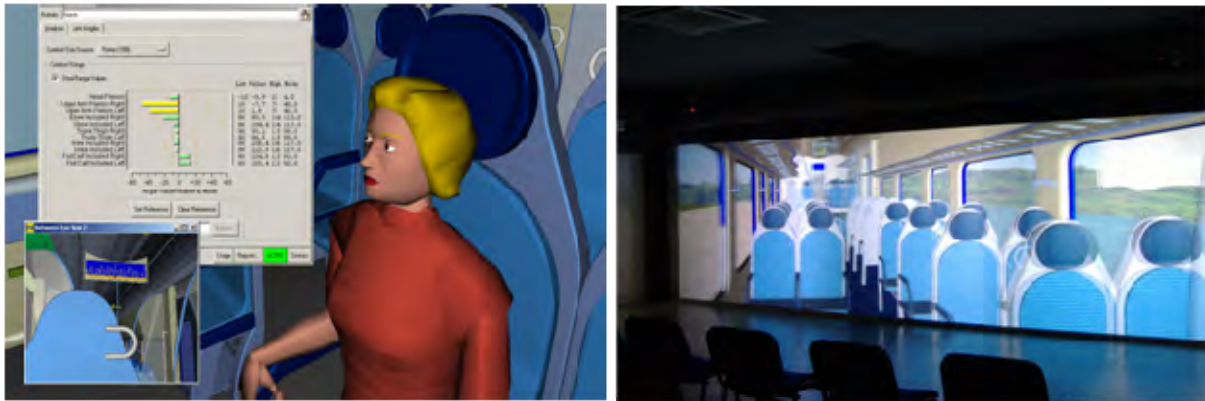


Figure 1. Ergonomics evaluation through virtual manikins and immersive visualization in the Virtual Reality Laboratory “*VRTest*” (University of Naples Federico II) of new concept solutions for a regional train.

3- Virtual Manufacturing

To date, the VR is largely used to develop new methodologies for the design of automated assembly lines, in order to realize innovative products whose manufacturing process is the more possible automated. The virtual simulation environment allows either to evaluate the best workplace layout configuration, which minimizes the lead time in the line production, or to optimize the automation level and the human component for each workplace.

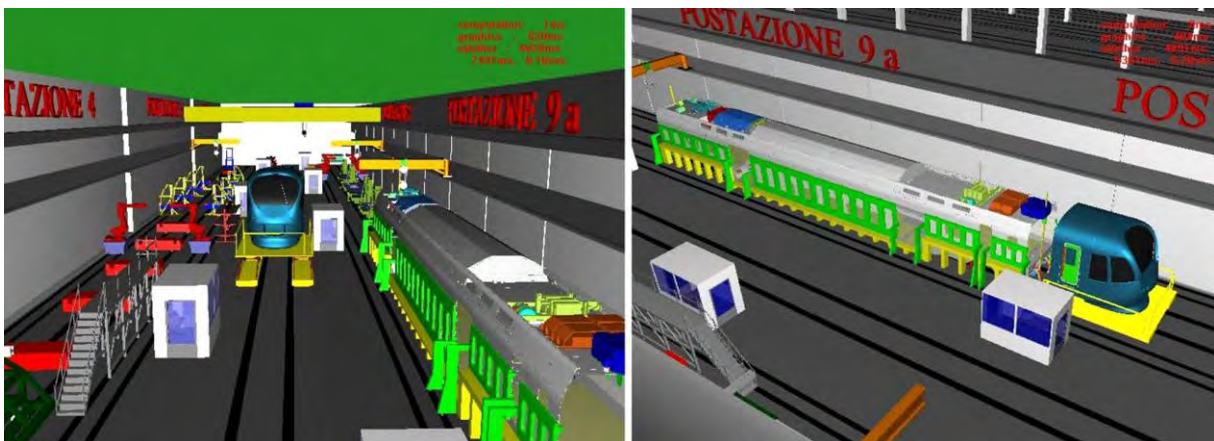


Figure 2. Innovative Assembly Process and Tolerance Analysis of Modular Trains in Virtual Environment.

This means it is possible to carry out kinematic simulations of robots and ergonomic evaluations of operators in order to compare the results of these simulations with safety requirements. In manufacturing environment many software packages have been developed for virtual applications. These packages provide important functions that can be used to develop and create virtual manufacturing environment and to address process planning, cost estimation, factory layout, ergonomics, robotics, inspection, factory simulation, and production management. Virtual Manufacturing can be realized with the integration of different software tools, each dedicated to simulate three main production environments: robotized work cells, manual work cells, hybrid work cells.

All these topics are discussed in the session, highlighting also the necessity to carry on tolerance analysis during assembly simulations.

4- Land and Town Planning Design

The benefits deriving from the three-dimensional representation of lands and towns planning designs can be achieved since the first design stages: the preliminary analysis of a planning allows to have a global knowledge of the project in order to assure the complete satisfaction of the commitment requirements. The VR presentation of land or town planning design could allow, in call for tenders, a deepened evaluation of the projects for the juries and a successive more efficacious divulging of the same projects to the press and the public.

In session are presented two experiences developed, respectively, at the Graphitech Fondation in Trento (Italy) and at the University of Naples Federico II.



Figure 3. Virtual Walk through in the “Sport’s Park” in Bagnoli (Naples).

5- Final Remarks

Design methodologies have to be ever followed by practical applications. If we want to spread the use of VR technologies we, university researchers, have a duty. We have to make clearly visible the possibility to solve industrial problems. This will be possible if we will be able to develop and to integrate design methodologies based on VR technologies in the industrial Product Development Processes, supporting the activities of engineering design and production. Following this way we can reach the final objective to improve all the aspects of the “quality”, both of the manufacturing process, and of the product: the “quality” of the design/manufacturing system perceived by the company, in terms of efficiency (despondency of time and costs), and by the operators, in terms of safety and ergonomics; the “quality” perceived by the final user during the “use” of the product and, last but not least, the “quality” of the product life cycle evaluated by the maintenance management system. In this case with the term “product” I intend not only an industrial product, but all the objects built by the humans and used by the humans.