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**A new pedagogical approach based on haptic devices and augmented reality**

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In education, theoretical concepts are the required scaffold for knowledge acquisition but they should be accompanied by practical applications to consolidate learning. However this is not always possible due to the nature of concepts or learning areas. In those cases, simulation processes can be an excellent tool to provide the practical approach. The closer these tools or systems are to reality, more effective will be the learning process.

This article describes one methodology to integrate haptic devices in education, providing a new and innovative learning method. Specifically, this project approaches the study of flight aerodynamics with resource to a low-cost haptic device - a tactile sensory interface between a person and a computer. A wind tunnel is the scenario depicted in the simulation and the interface shows a P-38 Lightning plane (from World War II). Students see a scheme that represents the magnitude of the four aerodynamic forces and data on speed, angle of attack and status of the airplane, which tells if the airplane is on the take-up, and so on. The resultant of the forces is "felt" by the user through the haptic mechanism.

Students are confronted to questions which they must answer by manipulating the haptic device. They are also confronted with situations that they must replicate in the simulator. By handling the simulation environment, students readily establish the connection between the theory (aerodynamic laws) and the practice (effects on a plane flight).

The system has been applied to first year Engineering students in a case study experiment to validate the learning methodology. In the end their knowledge was tested and their perception on the relevance and interest of the system was evaluated. Results show that physics understanding was greatly enhanced and that students motivation for learning, even theoretical aspects and concepts, was increased.

As a consequence new simulation contexts are being prepared, for the demonstration and study of electromagnetical and friction forces.