Review of: "Implementing Simulation Software to Develop Virtual Experiments in Undergraduate Chemical Engineering Education"

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Potential competing interests: No potential competing interests to declare.

The virtual laboratory concept at the simulation level (process and control loop) is very well presented for the field of Chemistry. This work presents very well the theoretical component and the simulation component, corresponding to the adopted process.

In my opinion, a virtual laboratory must emulate a process in real time to be an alternative to a real process. The term emulation differs from simulation in that the process equations and the control solution (PID) must be implemented in a real-time software application. The real-time application assumes a mechanism of the type: Timer # that generates an interruption at a specified time interval (which is the Sampling Period) # which has attached an interruption handling routine that will include all the necessary numerical processing. In this way, all processing is done with a certain sampling period, as it would be done in the real world, by using a process computer connected to a real process. Practically, the process implemented in the virtual laboratory will work (almost) the same as the real process. Moreover, if there were also the possibility of connecting (through a data acquisition and command generation system) to the real process, a comparison could be made between the 2 response signals: the simulated/emulated one and the real one. The comparison refers to putting the simulated/emulated mathematical model to work in parallel with the real process (to have the same input). The effect for students would be very attractive (from personal experience). At the same time, by changing some parameters in real time, the immediate effect can be tested as in reality.

As a recommendation, for the virtual laboratory concept, after the stage of theoretical presentation and stage of simulation (presented well in this paper), the stage of emulation and stage of connecting to the process (parallel operation of the model and the process) would follow.

Due to the fact that researchers from various scientific fields are not specialists in software programming, there is the possibility of using LabVIEW (National Instruments), which is a graphical development environment for scientific researchers who are not specialists in software programming.

The idea of developing a virtual laboratory in the field of engineering, which uses current numerical processing technologies, is starting to be widely approached.