Chapter 2.14
Real Time Interface for Fluidized Bed Reactor Simulator

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INTRODUCTION

Nowadays, the world witnesses a large technological revolution which has brought new information distribution forms, interpretation and storage. With that, computational tools can be used to sustain the education, as with the learning objects case. A learning object is any digital product that could be re-used for knowledge acquisition, with significant economy and reduction of computer time.

Learning objects have led to new solutions, which resulted in good structured and safe programs. Hereby, they rend possible creations of simple units, and the objects, which are associated with each other, can produce large units. Some of them are distinguished among the presence or absence of simulation functions.

The software SEREA has been developed to reach undergraduate and graduate chemical engineering for studies about fluid dynamics of fluidized bed reactors motivating students in order to acquire a successful learning process. Motivating students is certainly a stimulating and challenging problem, and is always present in teaching methodologies (Tannous, 2007). This article will present a comparison between two methodologies for interface creations, to sustain the chemical engineering learning and other correlated fields.

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BACKGROUND

Since 2002, the Laboratory of Particle Technology and Multiphase Flow at State University of Campinas have developed new learning objects, mainly simulator modules, to evaluate their limitations as educational software.

Several denominations are found in the literature about the concepts of learning objects such as: instructional object, educational object, knowledge object, intelligent object and data object (Gibbons, Nelson, & Richards, 2000). Nevertheless, it does not matter what denomination has been improved, as the object can be practically the same.

The IEEE Learning Technology Standard Committee (2002) defines learning objects "*as any entity, digital or non-digital, which can be used, reused, or referenced during technology supported learning.*" Chronological and instructional texts, class activities, books and revision aids are some examples of nondigital learning objects.

However, concerning digital learning objects, the main idea is to break the contents in small pieces that can be re-used in different learning environments, following the "spirits" of oriented-objects programming (Wiley, n.d., Verbert & Duval, 2004). According to Downes (2001), the idea of object-oriented tends toward the development of real pattern that, once defined, are copied and used in a part of the software. In this way, the simulators associated with the object-oriented programming can be classified in this definition.

According to Logmire (2001), for designing and developing material to be reused as learning objects, it should consist of features such as flexibility, easy to update, search and management, customization, interoperability, facilitation of competency-based learning, and increased value of content. All these characteristics show that the learning object models can make an easier and enhanced quality of learning, providing several facility tools for professors, students and administrators.

The simulation is a learning resource that allows the students to observe the different system behaviors through mathematical graphics or symbolical modeling of the phenomenon. In this context, the simulations have an important role to minimize the problems due missing equipment and laboratories for undergraduate students.

Tannous (2005) and Rimoli, Assis, and Tannous (2006) described some of the strategies and methodologies applied to develop learning objects (simulators with or without instructional program). It is important to remark that, in general a few works are applied to chemical engineering.

DEVELOPMENT OF LEARNING OBJECTS

General Information

SEREA (Fluidized bed reactors modules) is simulator software for undergraduate chemical engineering students. It was developed to simulate the fluid dynamics parameters of different fluidized bed reactors, being divided by behavior of particles and project of distributors. As SEREA expanded, it was split in one real time process named "slipping controls."

The following sections cover two modules for basic parameters that consist of the determination of minimum fluidization velocity and porosity, and bed expansion. The fluidization engineering concepts are based upon Geldart (1986), Kunii and Levenspiel (1991) and Martin (1998), and are also covered in other texts (Tannous, 1993).

Required Hardware

For an educational tool to be effective, it must be readily accessible to students. SEREA has been developed on personal computers sufficiently supplied with the necessary amount of memory and processing of operational systems. The exact hardware chosen was processor Intel Pentium 4