Project Team

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Project Title

Illustrating Transport Phenomena at Boundaries and by Diffusive Processes with Flash Animation

Audience

Students in the undergraduate courses *Transport Phenomena I and II*, and the basic course *What is Engineering?*

Pedagogical Issue

In Chemical Engineering students often have difficulty developing intuitive understanding of the complex concepts necessary for understanding the subject. The fundamentals of the diffusive transport of particles related to the Microfluidic H-Filter are one of these complex yet important concepts. Currently, the abstract descriptions and examples available are insufficient for students to quickly grasp this essential building block and move on to subsequent concepts and theories.

Solution

Computer simulations have been used in research for further understanding of subjects such as particle transport phenomena. In response to this difficult subject matter an online simulation of the Microfluidic H-Filter has been developed that will aid students in understanding the diffusive transport at the micro-scale. Students will be able to experiment with the simulation by changing operating conditions and viewing the animated and graphical displayed result.

Technologies Used

Adobe PDF, HTML/Web Design, JAVA , JavaScript, Macromedia Flash, MatLab, Python

Project Abstract

We propose to develop a set of online virtual laboratories for the undergraduate courses of *Transport Phenomena I and II*, as well as for the basic course *What is Engineering?* These laboratories will provide students with an intuitive understanding of crucial aspects in the analysis of transport phenomena. Specifically, the virtual labs will focus on: 1) Mass Transport: Understanding the probabilistic nature of diffusion; 2) Momentum Transport: Momentum flow through collisions; and 3) Energy Transport: A molecular view of heat transfer in gases, liquids and solids. We will focus on these aspects because they are among the most exciting in the field of transport phenomena and because they are often the most difficult for students to grasp. Unlike other problems derived from basic physics, a physical intuition about the nature of mass, momentum and energy transport at the molecular or atomistic level does not naturally develop from interacting with systems in everyday life in a non-scientific way. For this reason, we set out to create a set of six online laboratories that will help students to build their physical intuition on the molecular basis of transport phenomena. We will make use of Adobe Flash animation to produce

virtual systems in which students can interactively explore the effects of altering material properties and other parameters. This type of exploration is not easily facilitated in class or in a textbook. In fact, the virtual systems will provide students with a better chance to explore the nature of transport than would possible were the experiments carried out in real world situations. By taking advantage of quantitative programming, the virtual labs will be able to give students information which is difficult to extract from a live experiment such as the ability to view flow fields and manipulate time-scales. The end result of this project will be students with better physical intuition about the nature of transport processes. Students with such an intuition will be able to understand the physical basis and meaning of the solutions to a transport problem.