

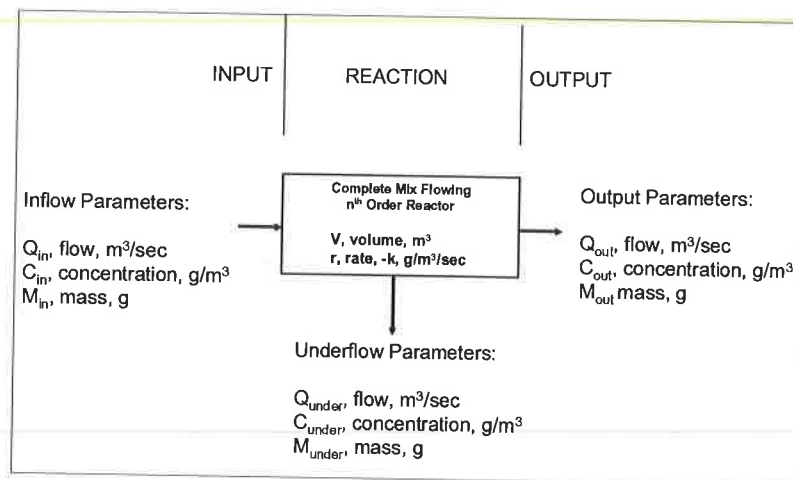
DRAFT  
**Design Heuristic Proposal**  
 August 23, 2012  
 by John Olofsson  
 Department of Civil Engineering

The project I have in mind is concerned with creation of interactive (smart) modules which describe individual unit processes used for the preparation of potable water and treatment of domestic wastewater. Unit processes include:

- Screening: separation of suspended solids
- Flocculation: production of precipitates for separation of otherwise soluble materials
- Conversion: biological, chemical and or physical reactions which will facilitate separation of objectionable constituents
- Transfer: oxygenation of water in support of a variety of reactions including, oxidation-reduction, biochemical, etc.
- Gravity settling: separation of suspended solids

Let's use a completely mixed, flowing, first order reactor as a rudimentary example.

Visualize a vessel (i.e., a reaction container) receiving a steady flow of fluid ( $Q_{in}$ , flow) which itself contains a uniformly distributed ( $C_{in}$ , reactant) material which is subject to decay (1<sup>st</sup> order shown here) in the production of a product ( $C_{out}$ , product). This is represented by the following schematic:



**Figure 1. Generic Unit Process Schematic**

This schematic is a common arrangement used for a variety of processes in water and wastewater treatment. It represents a model which can be useful in predicting various input, output and or underflow parameters essential for the design, operation and control of the process. For example, the underflow concentration might be specified as a design objective. It is clear that this

parameter will be dependent upon all of the other parameters. It should also be clear on closer examination that a unique set of values may not exist. It is more likely that there exists many solutions but that these solutions will require establish ranges of parameter values that interact to allow achievement of the design objective. By use of this simple generic model, sets of solutions can be identified. From these solution sets choices for creating physical facilities can be explored.

The objective of the work proposed here is, in part, to create an interactive model for heuristic exploration of unit process solutions. It can provide students, designers, process operators and managers a means of clearly understanding the effects of each parameter upon the overall process. This work element is intended to be imbedded with other technical information which elucidates the process in exhaustive detail and provides design examples.

The development task is to develop a graphical user interface element which can facilitate 'what if' games in support of process understanding, design analysis and operation.