COMPUTATIONAL BIOPROCESS ENGINEERING

A mathematical model is a description of a system using mathematical language. The process of developing a mathematical model is termed mathematical modeling. Mathematical models are used not only in the natural sciences (such as physics, biology etc) and engineering disciplines (e.g. computer science, artificial intelligence), but also in the social sciences (such as economics and political science); physicists, engineers, statisticians, operations research analysts and economists use mathematical models most extensively. Mathematical models can take many forms, including but not limited to dynamical systems, statistical models, differential equations, or game theoretic models. These and other types of models can overlap, with a given model involving a variety of abstract structures. Model evaluation is checking whether a model fits experimental measurements or other empirical data. In models with parameters, a common approach to test this fit is to split the data into two disjoint subsets: training data and verification data. The training data are used to estimate the model parameters. An accurate model will closely match the verification data even though this data was not used to set the model's parameters. This practice is referred to as cross-validation in statistics. Defining a metric to measure distances between observed and predicted data is a useful tool of assessing model fit. In statistics, decision theory, and some economic models, a loss function plays a similar role. While it is rather straightforward to test the appropriateness of parameters, it can be more difficult to test the validity of the general mathematical form of a model. In general, more mathematical tools have been developed to test the fit of statistical models than models involving differential equations. Tools from nonparametric statistics can sometimes be used to evaluate how well data fits a known distribution or to come up with a general model that makes only minimal assumptions about the model's mathematical form.

Pilot-scale and larger bioreactors differ from small laboratory-scale reactors in terms of a greater occurrence of noise and incomplete mixing of the broth. Conventional control tries to induce good mixing and to filter out the noise as completely as possible. As such an ideal operation is difficult to achieve, recent work has tried to exploit the non-ideal features to improve the performance using computational heuristics approaches. *The bioreactor is often used to gather information regarding the micro-organism in order to generate a mathematical model utilizing a set culture parameters. On the coexistence of two species which occur in handling the recombinant cells population, an interaction occur which may not be simply evaluated as of competitive type. The formation of product is directly related to the population of plasmid bearing cells which often having decreasing trend with respect to process duration due to plasmid instability. Mortality is often considered to lower the extent of inter specific competition and thereby promote the coexistence of competing species. In order to generate a mathematical model utilizing a set culture parameters bioreactor data is required. On the coexistence of two species which occurs in handling the recombinant cells population, an interaction occurs which may not be simply evaluated as of competitive type. The formation of product is directly related to the population of plasmid bearing cells which often having decreasing trend with respect to process duration due to plasmid instability. Various indispensable factors used to serve as significant parameter in this model. Their effective role may bring mortality or sluggishness in growth, moreover it facilitates the cells to carry out and enhance the state of plasmid instability. Mortality is often considered to lower the extent of inter specific competition and thereby promote the coexistence of competing species. So our endeavour should be to bring up a sophisticated model that has close resemblance to a natural chemostat in behaviour retaining the involved noticeable factors that seems to play relevant role in this context.*