Techfest 2005
Faculty Defined Problem

Introduction:

Process control is not only applicable to process units such as distillation columns and reactors. The concepts can be applied in many fields of engineering and even in other areas such as finance, medicine and politics.

The presented problem deals with the automatic control of blood glucose in the human body. **Diabetes mellitus** is an incurable disease affecting millions of people worldwide. Type I, or insulin-dependent diabetes mellitus (IDDM), is characterized by insufficient secretion of insulin from the pancreas, resulting in plasma glucose concentrations elevated beyond the normal glycemic range 70 to 100 mg/dL.

We seek to automate the delivery of insulin for the diabetic patients using our knowledge of process dynamics and control.

Problem Statement:

- Three patients PATIENT1, PATIENT2 and PATIENT3 are available to you as SIMULINK files; a detailed first principles model available in the literature has been implemented on SIMULINK .
- In each of the patient SIMULINK files (patient1.mdl, patient2.mdl and patient3.mdl), the simulation time has been set from -1000 minutes to 2000 minutes.
- The transients in the first 1000 minutes of simulation from (-1000 minutes to 0 minutes) are to be ignored. There are two inputs to the "patient" - one of them is the nominal insulin amount (which is required to keep the output glucose concentration at 81.1 mg/dL) and the other is the meal disturbance (programmed in file meal.m). The meal disturbance is pre-programmed and always "disturbs" the patient at t = 1000 minutes.
- Between time t = 0 to 1000 minutes, you are allowed to "experiment" on "patient1" only and determine a suitable model of the patient.
- ***Develop an appropriate model based controller that is capable of maintaining the blood glucose level between 70-100 mg/dL even during the meal disturbance period. Test this controller on "patient2" and "patient3".***
- ***Explain your observations.***

Judging Criterion:

- The judges will rank the entries based on the best control performance for all the three patients in terms of standard control error criteria.
- The submissions will have to be simulink/ matlab files that describe the control performance and also generate the error criteria via graphical and quantitative measures.
- Final evaluation will be based on technical presentation by the group. The participants will be provided with a computer and an LCD display with Microsoft power point.

Elligibility Criterion and team size

- All the participants must be bonafide students of some academic institute
- Faculty can only act as a support but cannon help the students directly in cracking the problem
- Maximum size of team is 2