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13/ENG01/005

CHE 531 ASSIGNMENT II

Feedback and feed forward are two types of control schemes for systems that react automatically to changing environmental dynamics. Each utilizes sensors to measure important factors and a set of rules to react to changes in those factors. Feedback and feed forward controls may coexist in the same system, but the two designs function in very different ways.

**FEEDBACK**

A feedback system measures a value and reacts to changes in that value. For instance, your thermostat measures the ambient temperature in your home, and if the temperature falls below its minimum setting, the thermostat activates the furnace to warm your home back to the appropriate temperature. The thermostat measures the temperature, but it also feeds that value back into its control scheme to maintain the temperature.

**FEEDFORWARD**

A feed forward system may measure a number of secondary variables in addition to the primary one. For example, a feed forward thermostat might measure external as well as internal temperatures, and it might sense whether doors and windows are open or closed. If the system senses that it is cold outside and someone opens a window, the system will proactively turn on the furnace in an attempt to prevent the temperature in the house from falling. Instead of waiting for the temperature to change at the thermostat, the system anticipates the effect of the open window and attempts to counteract the heat loss. Another example of a feed forward system is a video card that increases fan speed in response to intense graphics activity in an attempt to dissipate heat before the temperature actually begins to climb.

**ADVANTAGES**

Feedback-based systems have the advantage of being simple. The system measures a variable, and uses that variable to make decisions. Feed forward systems, on the other hand, have the ability to anticipate changes in the measured variable, working proactively instead of reactively. The more secondary factors the system measures, the more accurately it can work against these changes.

**DISADVANTAGES**

Feedback systems can be somewhat inaccurate. A thermostat does a good job of maintaining approximate temperatures, but the actual ambient temperature fluctuates to some degree as the furnace switches on and off in response to the thermostat's signals. Unexpected variables, such as a window or door left open, can make it difficult for the system to keep up. Likewise, feed forward systems are only as good as the information with which the system has to work. The system cannot consider an unmeasured variable when making its decisions, and these blind spots can cause control to break down. This is why many designs couple feed forward logic with a feedback system, providing a backup level of control.



(a) open loop

(b) feedforward

(c) feedback

**DIFFERENCES BETWEEN FEEDFORWARD AND FEEDBACK CONTROLLER**

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| S/N |  | FEEDBACK | FEEDFORWARD |
| 1 | Definition | Systems in which corrective action is taken after disturbances affect the output | Systems in which corrective action is taken before disturbances affect the  output |
| 2 | Necessary requirement | Not required | Measurable Disturbance or noise |
| 3 | Corrective action | Corrective action taken after the disturbance occurs on the output. | Corrective action taken before the actual disturbance occurs on the output. |
| 4 | Control Variable adjustment | Variables are adjusted depending on errors. | Variables are adjusted based on prior knowledge and predictions. |
| 5 | Example | Use of roll sensor as feedback element in ship stabilization system. | Use of flowmeter as feed forward block in temperature control systems. |