The World of Automation

2010 MARCH ISSUE II

ISA Student members at KFUPM

System Engineering Club

ISA-KFUPM & SE Club Technical Week

ISA KFUPM and SE club held several lectures and workshops during the period of System Engineering technical week 16-21 January 2010.

- **Introduction to PLC** (Programmable Logic Controller), presented by Dr. Mahmoud Kassas, associate professor, Electrical Engineering department.
- **Supply Chain Systems** by engineer Tariq Abdulaal, a project manager at P&G.
- **Bio Instrumentation,** presented by Dr. Bahattin Karagozoglu, associate professor, King AbdulAziz University.
- **Introduction to Embedded Systems**, design with PIC microcontroller, by engineer Yau Garba Isa, system admin CCSE network.
- **Real Successful Stories of Strategic Planning** by Dr. Omar Al Suwailem, the Dean of Admission and Registration at KFUPM.

Visit to SASREF

A Group of ISA KFUPM members including the president and vice president and Dr. Moustafa El Shafei, ISA KFUPM advisor visited SASREF (Saudi Aramco Shell Refinery Co.) in Jubail. The group took a tour in the plant and visited the new central control room. They also had an open discussion with Mr.Ahmad Al-Abdrabbuh - the instrumentation master plan project manager- about the new improvements in SASREF automation systems.

SASREF is a 50 / 50 joint venture company between Saudi Aramco and Shell Saudi Arabia Refining Ltd, with a production capacity of 305,000 barrels per day. It is an export refinery where Arabian Light Crude is upgraded into high quality refined products, including kerosene, naphtha, benzene, fuel oil and liquefied petroleum gas.

Senior Project

Get the Idea of Control While Taking a Shower!!

By Ahmad Qutbuddin

As you are enjoying your warm shower in a cold day, you can clearly see the effect of what is technically called Multi-Input Multi-Output (MIMO) system. You have the cold and hot water (as inputs) with almost constant temperatures for each. What you can change is the flow of the cold and hot water (as manipulated variables), which in return will change both the flow and the temperature of the mix (flow and temperature are considered controlled variables) differently. Systems of this kind are spread all around us in our daily live, for example, car speed and direction control, room temperature conditioning, walking, writing … etc. The same concept is used in the industrial chemical and power generation systems.

When you are taking a shower, you can tolerate small changes in the flow and the temperature of the water. However, in plants processing critical materials or making items with a very small error tolerance (e.g. food or medicine), variables cannot be dealt with in the same way you are controlling your shower. Any miscalculation may cause a disaster.

In the old days, controllers were built using basic elements such as electrical circuits (resistors, capacitors, diodes, transistors …) for electrically controlled systems.. For mechanically controlled systems, mechanical elements (mass, springs, axis, gears …).

The evolution of computers and integrated circuits (ICs) nowadays enables performing huge amount of mathematical operations in a small time, which give the opportunity of developing and testing of more advanced and sophisticated control schemes. One of the ways to control the temperature and flow problem is to couple each of the inputs (cold and hot water) to one of the outputs (flow and temperature).

In my senior project, (with my partner Mr. Mohammad Al-Junaid under the supervision of Dr. Sami El Ferik), we did a simulation study using Matlab/Simulink of a coupled MIMO with delays under different control conditions. In addition, the outcome of the project was educational software that can be used to understand, simulate, and control similar multivariable systems. In addition to the classical decoupling techniques, the software uses the advanced Model Predictive Controller to illustrate the effect of coupling. For the sake of illustration, assume that the cold water is coupled to the flow and the hot water is coupled to the temperature. That means any change in cold water should be compensated to keep the same mix temperature, and any change in hot water should not affect the flow. In real applications with such systems, decouplers are used to remove the effect of the cold water to the temperature and the effect of hot water to the flow as if they are two separated systems.

As such, if you want to increase the flow, you should increase the cold water. The decoupler will compensate for your increase in the cold water and simply will change the flow of the hot water. As a result, you should have the same water temperature. We studied this control theory in our simulation program besides basic control scheme. In basic control scheme, the controller is a mathematical function which is designed to overcome the error in the output(s) of the system. Other modern control schemes are based on a mathematical model of the system; where the controller is built based on previously known or calculated equations. One of the control theories which are based on this control scheme is called Model Predictive Control (MPC), which is also simulated in the program. There are other control schemes as neural networks, adaptive control, fuzzy logic … etc

Let your mind wonder the next time you take a shower!!

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FDT TECHNOLOGY: MAKING ALL YOUR FIELD DEVICES AS ONE FAMILY

By: Mohammad Abdul Gader

Throughout the last decades, many improvements have been introduced in field devices technology to maintain an optimum performance and high efficiency in the process & control field. Nowadays, an average plant contains thousands of *field devices* from different suppliers. Accordingly, each field device has its own software drivers as well as the corresponding management tool that differ from one device to another, according to the supplier. Obviously, it will be time consuming to get all these devices installed individually on the system and not to mention the huge effort needed to track the possible errors throughout the huge plant. Actually, we do not have to worry any more. During the last few years, a new technology has been introduced under the name of FDT Technology (**F**ield **D**evice **T**ool) that amazingly provides a typical alternative that can control all field devices via a standardized frame application (software) only in a window.

Basically, FDT standardizes the communication interface between field devices and systems. Each device has its own driver, called DTMs (**D**evice **T**ype **M**anager), and this can be added by the device manufacturer. Our system here is called Frame Application. Now, all your field devices speak the same language. Fortunately, FDT will apply to all field devices no matter which device type, supplier or communication protocol we have. FDT technology at the moment supports more than 60 field device suppliers with the DTMs needed and this number is definitely increasing. In addition, FDT also allows us to monitor all field devices in one window in real-time through the Frame Application with much facilitated GUIs (**G**raphical **U**ser **I**nterfaces). As we can see, FDT is offering a great chance to save a lot of money as well as excellent coordination between your field devices.

For more information please visit,

http://www.fdtgroup.org/

What is a PLC ?

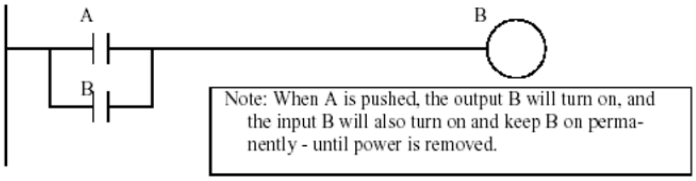
By: Amro Messaoudi

As a control engineer you will hear the term PLC frequently, and that is justified as it is used in almost every industry. PLC stands for Programmable Logic Controller, which is a digital computer used for automation of electromechanical processes, such as control of machinery on factory assembly lines. PLC was invented back in the late sixties as a natural response to the industrial revolution in the united states. To be more specific, it started in the automotive industry, and since then it became an essential part of industry equipment. What made PLCs popular is the fact that they solved the problems traditional logic circuits had and replaced many relays, counters and timers.

There are four different methods for programming PLCs, yet the easiest and most commonly used one is the Ladder diagram. This program executes sequential steps in the logic which is shaped like a ladder as shown in the figure. The advantage of this Logic is its simplicity; therefore someone making a Ladder diagram does not need any background in Computer Language. For

more complex programs Another programming method known as Sequential Function Chart is used. One of the biggest advantages of using a PLC is that no physical wiring changes are needed when the logic is modified. This is not the case when it comes to electromechanical relays.

However, PLCs have some Drawbacks, one of which is that they need special protection from harsh weather conditions such as high temperatures. Nowadays, you can find a PLC everywhere you go in the industry.



Note: When A is pushed, the output B will turn on, and the input B will also turn on and keep B on permanently - until power is removed.

Note: The line on the right is being left off intentionally and is implied in these diagrams.

Find the Hidden Word

* Cross the following words to find out the name of a Russian mathematician and physicist who marks the first development of stability theory.

Actuator - Sensor - DCS - PLC
Instrumentation - Closed loop
Pneumatic - FDT - Feedback
Thermocouple - Stability
Block diagram - Steady State
Automation - Overshoot - Filter
Robots - Modeling - Valve
SCADA - Signal - Pole - ISA
PID - Response - MEMS
Nonlinearity - Root locus -
Tachometer.

E	S	N	O	P	S	E	R	S	S	N	E	L	Y	N
R	V	Y	D	I	P	R	T	R	O	C	T	L	O	A
E	A	P	T	I	T	A	O	I	O	H	A	I	O	M
T	L	C	S	I	B	O	T	T	E	B	T	D	A	P
L	V	A	L	I	R	A	O	R	A	A	O	R	A	S
I	E	C	L	P	M	A	M	H	T	U	G	T	T	R
F	R	I	L	O	C	O	E	N	S	A	T	E	S	E
K	T	O	T	O	C	I	E	N	I	R	A	C	M	T
Y	C	U	O	O	S	M	T	D	I	D	E	O	A	E
L	A	A	U	T	U	E	K	A	Y	L	D	V	R	M
U	A	P	B	R	L	C	D	S	M	E	N	O	O	O
F	L	N	T	D	O	O	T	L	L	U	S	O	M	H
E	D	S	G	L	E	A	C	I	O	N	E	E	N	C
N	N	T	B	I	T	E	N	U	E	O	M	N	O	A
I	S	C	D	E	S	G	F	S	S	S	P	V	P	T

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