

Process Instrumentation

M-Tech 2013-15

Dissertation Abstract

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MIS: 121316001

ADVANCED CONTROL DESIGN AND HARDWARE IMPLEMENTATION OF ACTIVE SUSPENSION

Since the day of invention of vehicle, people are trying to improve it in different ways and different aspects, ride comfort is one of that. The suspension system mainly isolates the car body from the road disturbances i.e. pits, bumps and rough road surfaces. The type of suspension can be divided into three broad categories based on structure as passive, semi active and active suspension. The passive suspension consists of only spring and damper. It can be tuned for a specific condition i.e. for specific sprung mass and frequency range. For uncertain sprung mass and different road conditions, the passive suspension is not able give good comfort. The semi active suspension consists of passive suspension with varying damping coefficient. In the case of active suspension one active element i.e. linear motor, linear actuator, hydraulic actuator or pneumatic actuator is placed along with the passive system. The active element will create a force to negate the effect of road disturbances.

BLDC Motor Control for an Electric Bike

Name: Pratik Arlikar
MIS: 121316002

Abstract:

Using fossil Fuels has already been proved hazardous to the environment and eventually to us in many forms. The major use of fossil fuels is in Transportation and Automobiles. So if we can reduce or replace the use of Fossil fuel i.e. Petrol or Diesel with some eco-friendly energy source then it will help in saving our environment and us.

In this project, we have tried to do the same. The Electric Vehicles are a good replacement for the current Petrol and Diesel fuelled vehicles. The main focus in this project is to develop a BLDC motor control, so that it will very comfortable for the user of the electric bike to drive.

Here we will implement two control strategies, viz. Trapezoidal Control and Field Oriented Control. Trapezoidal Control is not very efficient but is easy to implement. Field Oriented Control is efficient but is complex in nature. The trade off is between the sufficiency of the performance and the control strategy complexity, because the it is to be implemented on a 16 bit Microcontroller, which may not be able to support very complex Control strategy

MIS: 121316003 (Jyoti D. Bambole)

Physical Quality Assessment of Rice grains

The agricultural industry is oldest and widespread industry in the world. In agricultural industries grain quality detection is very big challenge. Quality detection is important. After harvesting, based on quality parameters food grains are classified. These grains are graded differently. Rice is a vital worldwide agricultural product. Rice quality is the combination of physical, chemical and cooking characteristics. Cooking characteristics contains aroma, volume expansion ratio, kernel elongation ratio, water uptake and cooking time.

Grain quality is detected using manual methods. The results of such methods are varying, inaccurate and time consuming. Image processing techniques is an alternative solution proposed for grain quality detection. The algorithms consists of different image processing operations like pre-processing, morphological operation, edge detection, thresholding, particle analysis etc. the algorithms are implemented for grain size measurement, chalkiness, infected rice grains, presence of foreign particles like husk, pebbles. On the basis of the results of image processing algorithms quality of rice grains is predicted. NI LabVIEW platform is suggested to implement image processing algorithms.

Name:Kathwate Abhijit A.

MIS No:121316006

Title: **Digital Glove For Mute People**

Abstract

Mostly dumb people use sign language for communication but they find difficulty in communicating with others who don't understand sign language. This project aims to lower this barrier in communication. It is based on the need of developing an electronic device that can translate sign language into speech in order to make the communication take place between the mute communities with the general public possible. A data gloves is used which is normal cloth driving gloves fitted with flex sensors along the length of each finger and the thumb.

Mute people can use the gloves to perform hand gesture and it will be converted into speech so that normal people can understand their expression. Sign language is the language used by mute people and it is a communication skill that uses gestures instead of sound to convey meaning simultaneously combining hand shapes, orientations and movement of the hands, arms or body and facial expressions to express fluidly a speaker's thoughts. Signs are used to communicate words and sentences to audience. A gesture in a sign language is a particular movement of the hands with a specific shape made out of them. A sign language usually provides sign for whole words. It can also provide sign for letters to perform words that don't have corresponding sign in that sign language. In this project Flex Sensor Plays the major role, Flex sensors are sensors that change in resistance depending on the amount of bend on the sensor.

We are in process of developing a prototype using this process to reduce the communication gap between differentially able and normal people.

Development of Quartz Crystal Microbalance Sensor for Explosive Detection

Nikhil V. Mangasule

MIS: 121316007

The researchers are working on two areas in Nitroaromatic compound detection, i.e. explosive detection such as detection of the trace concentration of explosives by analytical methods (gas chromatography, ion mobility spectrometry, etc.) and the second is the estimation of the state of explosives during their time storages in the objects. The chemical sensors are important tools for the rapid detection of explosive and find applications in forensic and criminal investigation. Various advanced methods of explosive detection such as the ion mobility spectrometers, gas chromatographs, mass spectrometers, and their combinations are commonly used technique. Metal detectors are commonly uses an indirect technique for sensing explosive devices packed in metal. In this study, an attempt is made towards development of quartz crystal microbalance sensor using conducting polymer. Conducting polymer used in this study is polyaniline (PANI). On exposure to gases, frequency shift occurs and the shift change is due to adsorption of gas molecules or more complex mechanism in case of polyaniline thin film sensor. In this research the effect of explosive components at room temperature on the molecular weight, sensitivity, response time and recover time of thin film sensor has been studied. The experimentation is related with the frequency change of quartz crystal. Change in frequency of quartz crystal microbalance sensor gives different frequency shift response for different material. Here for experimentation polyaniline (PANI) is used for detection for gold plated quartz crystal are used. Electroplating is used for deposition of material on quartz crystal substrate. It is observed that the sensitivity of developed sensor is compatible with market available sensors and efficiency of the system is achieved by implementation of advanced instrumentation technique used for data analysis.

DESIGN OF HARDWARE & ADVANCED CONTROL **DESIGN FOR ACTIVE STEERING SYSTEM**

MARAR ABHISHEK NARAYANAN

MIS NO: 121316008

ABSTRACT :

These days the emphasis in vehicle safety development is on electronic systems that can help prevent an accident happening rather than on measures to reduce the severity of injuries when one does occur. A vehicle stability control (VSC) prevents the vehicle from spinning or drifting out and instead helps the driver follow the desired trajectory path. They find their presence in the vehicle by the name of Electronic Stability Program (ESP) in today's manufactured vehicle. These are achieved through differential braking systems using ABS for controlling the vehicle yaw moment. Active steering control (ASC) is one which modifies the steering angle to the wheels electronically. It works on the principle of superposition such that the input given to the front wheel is the sum of the driver input and the controlled motor input. The yaw moment control is regarded as one of the most promising means of chassis control, considerably enhancing vehicle handling and safety under severe driving maneuvers.

A vehicle model based controller is developed for tracking desired vehicle behavior considering a two degree of freedom bicycle model and first order linearized dynamic tire model. Sliding mode controller (SMC) is utilized for yaw rate and sideslip stability. Robustness of the controller to system parameter uncertainties is achieved through a disturbance observer. The performance of the proposed controller is verified in MATLAB/ Simulink.

Implementation of Level 3 and Level 4 Automation for Bioreactor Pilot Plant.

ABSTRACT

A pilot plant is a small industrial system which is operated to generate information about the behaviour of the system for use in design of larger facilities .Computer simulations and Semi-empirical methods are used to determine the limitations of the pilot scale system. A bioreactor may refer to any manufactured or engineered device or system that supports a biologically active environment. In one case, a bioreactor is a vessel in which a chemical process is carried out which involves organisms or biochemically active substances derived from such organisms. This process can either be aerobic or anaerobic. These bioreactors are commonly cylindrical, ranging in size from liters to cubic meters.

The main function of a bioreactor (Clie, 1988) is to provide a favorable environment for the micro-organisms to achieve the optimal growth and/or product formation. Optimization of fermentation parameters such as pH, temperature, dissolved oxygen, etc. is therefore important to achieve optimal performance.

The main objective of this work is to design, develop and deploy the lab-scale Pilot plant of Fed-Batch Bioreactor/Fermenter for laboratory practical purposes of local student and student from different colleges through remote triggering. Student can do modelling, perform experiments on the setup, apply suitable control strategies for the process control and analyses and validate the results on actual hardware.

The analysis and validation of process and control aspects can done through a relative study by operating plant in five different modes i.e. Local

PLC(Schneider M340), Remote PLC, Remote DCS, through Mat Lab and from Remote Triggering.

The very important aspect in operating the plant in different mode is communication as single plant is controlled by different platform having different protocols. A Laboratory pilot plant implementation will deliver exceptional value to a process manufacturing facility, automates the production of information from this data and effectively communicates with the other critical systems throughout the Enterprise.

Manufacturing Execution Systems (MES) are computerized systems used in manufacturing. MES can provide the right information at the right time and show the manufacturing decision maker "how the current conditions on the plant floor can be optimized to improve production output." MES work in real time to enable the control of multiple elements of the production process (e.g. inputs, personnel, machines and support services).MES might operate across multiple function areas, for example: management of product definitions across the product life-cycle, resource scheduling, order execution and dispatch, production analysis for Overall Equipment Effectiveness (OEE), and materials track and trace.

Enterprise resource planning (ERP) is a business management software usually a suite of integrated applications that a company can use to collect, store, manage and interpret data from many business activities, including: Product planning, Manufacturing or service delivery, Inventory management and Asset tracking and management.

Use of Level 3 and Level 4 in labs gives us features like Asset audit, Asset tracking, Asset management, Historian of all plant run for data analysis and plant optimization, Messaging and e-mail for alarming condition, maintenance tracking, project management and issue tracking.

Name: Sadik Ibrahim Tamboli

MIS No: 121316013

Project Name: Implementation of Level 3 & Level 4 Automation for Batch Process & Bottle Filling Pilot Plant

Abstract:

Batch processing involves the production or processing of products in finite batches, rather than in a continuous production process. Batch production is a flexible manufacturing tool, allowing multiple products to be produced on a single production line. Batch automation must accurately process the correct amounts of the right ingredients in order to create a quality product, then be able to start all over again to configure a completely different product using different ingredients and processing steps. Consistency and repeatability across multiple batches is critical, along with maintenance and retrieval of the various recipes" used to create product variations.

Bottle filling is a task carried out by a machine that fill liquid products such as cold drinks or water. Methods of bottle filling involved placing bottles onto a conveyor and filling only one bottle at a time. Mostly used filling process is onto a conveyor and time based filling.

The Batch process and Bottle filling operation are controlled using Siemens Step 7 PLC, Allen-Bradley RSLogix 5000, Emerson DeltaV DCS. Level 3 (Manufacturing Execution System) and Level 4 (Enterprise Resource Planning) are used in higher level automation.

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Name: Samiksha Sanjay Meshram
MIS no: 121316014
Project name : Implementation of Advanced Control
Strategies for a Quadruple Tank Pilot plant
Abstract

Chemical process industries are strongly integrated process, that exhibit nonlinear behavior and complex dynamic properties. Many industrial controlled problems have more number of manipulated and controlled variables. It is common for industrial processes to have significant uncertainties, strong interaction of minimum and non-minimum phase behavior. MULTIVARIABLE control techniques have received increased industrial interest.

A new laboratory process was designed to illustrate performance limitations due to zero location in multivariable control systems. This process is called the quadruple-tank process and consists of four interconnected water tanks and two pumps. It was first given by Karl Henrik Johansson, Member, IEEE.

The same model is designed here at COEP and is further commissioned to apply advanced control strategies and compare them. The model consists of a water reservoir. The water from this reservoir is pumped to the 4 tanks through a combination of 2 positive displacement pumps and control valves. The water distributed is split into diagonally placed upper and lower tanks. The purpose of doing so is to add disturbance by changing the valve positions. The quadruple tank is made highly interactive by continuously draining them at their bottoms. The main aim of this process is to maintain the levels in the lower two tanks in spite of the disturbances created by valve openings. The same process is to be controlled in minimum as well as non minimum phase by controlling the pump speed. The pilot plant is tested and commissioned and run through the local controller which is a Micrologix 1400 B Series PLC. Also, SCADA for it is developed so that it can be brought to level 2 of automation. Further, the communication between the local and 3 remote controllers is done so as to run the pilot plant through 3 more remote locations, viz, Remote PLC (Control logix), DeltaV DCS and Virtual PLC/DCS. Also, SCADA for the respective controllers is to be designed.

Name: Saurabh Sharma

MIS 121316015

Abstract

In India rice is major staple food, also many food products are made from rice or its flour. Nowadays people are dietary cautious about food contains and its quality parameters. In case rice amylose contents is good quality parameter. Amylose contents decide digestion time which predicts the absorption of glucose in blood. So, diabetic patients are suggested to use high amylose content rice. Detection of amylose contents in rice needs attention as a part of dietary as well as selection for rice for a typical application. Qualitative analysis of rice to detect amylose contents becomes motivation. Many different methods are used for checking amylose contents like NIR spectroscopy, colorimetry, and latest cyclic voltammetry. In amylose-iodine colorimetry, a standard color chart was used instead of a spectrophotometer to successfully classify a wide range of cultivars with known and unknown amylose content. Near-IR spectroscopy can also be used to measure the amylose contents. As an alternative method, voltametric electronic tongue can be used for classification of amylose contents in rice. The interest in electronic tongue applications has grown enormously in recent years for recognition and quality analysis of various food and agro products. All current methods/techniques of amylose detection require a typical experimental setup. Amylose content is predicted corresponding to output values of setup.

The aim is to develop a portable setup to measure the amylose content of different rice grains and portable set up giving output in the terms of current or voltage.

Topic: Parameter optimization of Boiler using Taguchi Method

MIS No: 121316016

Branch: Process Instrumentation

Abstract

Climate change and green energy policies are driving the pursuit for environmentally friendly and thermodynamically efficient technologies. This work will focus on the developing the method for analysis of Boiler parameter and optimization of parameter.

Ever increasing population has created the power crises in the developing world to meet the demand of today's need process industry particularly has adopted the optimization method for the existing the boiler. To meet the demand of power, unit operation should be handled with great efficiency and control to save energy and enhance the production quality and quantity.

The demands for rapid changes in power generation is increasing. This leads to more stringent requirements on the control systems for the processes and their optimization technique. Boiler is drawing significant attention in community of process control and instrumentation, as far as its efficiency and optimization is concerned. Taguchi Method is a statistical approach to optimize the process parameters. The objective of this study is to illustrate the procedure adopted in using Taguchi Method to Boiler parameter optimization. The orthogonal array, signal-to-noise ratio, and the analysis of variance are employed to study the performance characteristics on parameter. In this factor will be identified and a suitable orthogonal array need to be selected and experiments will be conducted. After conducting the experiments Signal to Noise ratio will be calculated. With the help of graphs, optimum parameter values were obtained and the confirmation experiments is to be carried out

Shikha Singh

MIS: 121316017

HARDWARE DESIGN AND ADVANCED CONTROL IMPLEMENTATION OF ANTI-LOCK BRAKING SYSTEM

Anti-lock braking system(ABS) is an integral component of chassis control system. It is a safety system used in automobiles and is used in hard braking conditions to avoid locking of the wheels and avoid uncontrolled skidding. It was first developed in 1930's for aircrafts with a purpose to avoid skidding of the wheels in the process of landing. Nowadays, some of the two wheelers and almost all four-wheeled vehicles employ ABS as a safety measure.

The system considered for work has two wheels where the lower wheel called the car-road wheel shows motion of vehicle whereas the upper wheel shows motion of the wheel on the road. The upper wheel remains in contact with the car-road wheel. A disc brake system is used in upper wheel for braking which is driven by a small high torque DC motor.

The aim is to design of hardware of prototype of quarter car model for ABS and implement different advanced control strategies.

Title

Design and Implementation of sensor characterization framework for Torque and Vibration sensor using remote triggered laboratory

Rupesh Thoriet

MIS: 121316018

ABSTRACT

Torque and Vibration is not actually a process parameter but it effect on the Process so it become very important for the process or any mechanical operation and machines. Vibration is a mechanical phenomenon whereby oscillations occur about an equilibrium point. The oscillations may be periodic such as the motion of a pendulum or random such as the movement of a tire on a gravel road. Vibration is occasionally "desirable". For example, the motion of a tuning fork, the reed in a woodwind instrument or harmonica, or mobile phones or the cone of a loudspeaker is desirable vibration, necessary for the correct functioning of the various devices. More often, vibration is undesirable, wasting energy and creating unwanted sound noise. For example, the vibrational motions of engines, electric motors, or any mechanical device in operation are typically unwanted. Such vibrations can be caused by imbalance in the rotating parts, uneven friction, the meshing of gear teeth, etc. Careful designs usually minimize unwanted vibrations. Torque, moment, or

moment of force is the tendency of a force to rotate an object about an axis, fulcrum, or pivot Just as a force is a push or a pull, a torque can be thought of as a twist to an object. Mathematically, torque is defined as the cross product of the lever-arm distance Vector and the force vector, which tends to produce rotation.

The characterization of the sensor is play a vital role in selection of the sensor for specific application. For characterization of Torque, Vibration and speed sensor have design a plant with that we can give different test signal to the sensor and we can design a different test scenario. The Torque and Vibration plant are controlled using GE Versamax PLC, Allen-Bradley Control logix, Emerson DeltaV DCS. Also we can control by it from remote PLC.