About Whitehouse

Whitehouse Consulting is an independent consulting organisation specialising in the application of advanced process control and information systems. It has no connection with any system vendor or installer. Further it does not itself provide such technology. Its consultants each have about 35 years of relevant experience, working on behalf of a large number of companies in the process industries.

Whitehouse offers a blend of technical, commercial and organisational advice. Recommendations are based on a sound understanding of the business, the available technology and the organisational change necessary to fully exploit the profit improvement potential.

About the Training Courses

The practical application of modern control technology can have a significant impact on process performance. In many processes it can double profitability. Course delegates will learn not only the importance of process control but also how it is applied. Successful implementation depends also on the awareness of others of the benefits and effort involved in installation. The course is of value therefore not only to those directly involved in implementation but also to process management and other technical support groups who have responsibility for maintaining and improving process profitability. Delegates would include control engineers, process engineers, mechanical engineers, instrument engineers, instrument technicians and plant supervisors.

The courses stress the *practical application* of basic and advanced control techniques, using the minimum of control theory. They comprises a number of relatively short classroom sessions each followed by more lengthy 'hands-on' work. Delegates work in small groups on a process simulated on a PC.

Delegates retain a copy of Whitehouse Process Control Toolkit and Training software. They also have ongoing access, free of charge, to Whitehouse's expertise.

Course Tutor

The course tutor, Myke King, has over 35 years' experience in the practical application of process control. His early career was spent with ICI and Esso. For the last 30 years he has been an independent consultant working for many of the world's leading companies. He has taught process control to over 2,500 engineers. Delegates will have the opportunity to discuss, with Myke, application of the technology to their own process. Most delegates are able to return to their plant and make an immediate impact on its performance. Myke can similarly offer advice on how larger projects should be progressed and which vendors and technologies should be considered.

Generic Modules

A detailed description of Whitehouse's course modules is given below. They are split into two groups - generic techniques which can be applied to most processes and process-specific techniques. Whitehouse regularly generates new modules to meet client demand. Those currently available include:

Introduction (2 hours)

benefits
regulatory control
constraint control
optimisation
terminology
hierarchy of control

Process Dynamics (4 hours)

gain, deadtime and lag
concept of order
simplifying approximations
dynamics from plant tests
linearity
non-self-regulating processes

PID Control (8 hours)

published tuning methods
setpoint and load changes
manipulated variable response
cascade control
split-ranging and dual-acting
anti-reset windup

Signal Conditioning (4 hours)

linearisation
gas flow compensation
heating value compensation
steam drum level correction
filtering noise
impact on controller tuning

Level Control (4 hours)

tight vs. averaging control
tuning methods
error squared algorithm
gap control
linearity
problem of noise

Feedforward Control (4 hours)

use and advantages
ratio and bias algorithms
types of decoupler
tuning feedforward controller
impact on feedback controller
compensation for process gain changes

Deadtime Compensation (4 hours)

use of predictive techniques
Smith predictor
dynamic reconciliation
tuning
impact of modelling error
limitations

Non-linear Control (4 hours)

use of linear algorithms
gain scheduling
PV linearisation
programmed adaptive control
model reference control
application to pH

Constraint Control (12 hours)

types of constraint
PID based techniques
single input, single output
multi-input, multi-output
2x2 decoupling
multivariable predictive control

Inferential Properties (16 hours)

regressed vs first principle
data requirements
process dynamics
validation
bias updating
measuring performance

Statistics (24 hours)

central value and dispersion
moments
distribution function
confidence interval and outliers
sample size
extreme value analysis

Optimisation (8 hours)

optimiser structure
steady state detection
process model development
impact of model errors
use with constraint control
available technologies

Project Execution (16 hours)

identifying the benefits
choosing the suppliers
project stages
safety considerations
getting operator acceptance
getting management support

Process Specific Modules

These modules address both technologies specific to the process and the application of generic techniques. Some knowledge of the generic techniques is assumed.

Compressor Control (8 hours)

compressor types
discharge throttling
inlet guide-vanes
speed control
anti-surge control
multi-compressor balancing

Boiler and Fired Heater Control (12 hours)

fuel flow and heating value
dual firing scheme
compensating for swell
rate and enthalpy feedforward
cross-limiting control
O_2, CO and smoke control

pH Control (4 hours)

definition of pH
non-linearity problem
conventional techniques
process modelling
linearising pH measurement
adaptive control

Distillation Control (24 hours)

This module aims to demonstrate how basic and advanced control techniques may be applied to the distillation process. It assumes that the student is generally familiar with the techniques covered by Whitehouse's introductory courses, although brief refresher material is included where needed.

Process Technology

mechanism of distillation
vapour pressure
relative volatility
azeotropes
key components
cut and separation
impact of column design
modelling correlations
adjusting product quality

Basic Controls

control problems
maintaining energy balance
column pressure control
condenser duty control
internal reflux control
flooded condenser
hot gas bypass
inverse response problems
manipulation of vapour rate
use of split range control
maintaining mass balance
energy vs. material balance
Rijskamp scheme
overcoming reflux drum lag
tuning the drum level control

Quality Control

temperature profile
locating tray temperatures
choice of manipulated variable
pressure compensation
model based control
cut and separation models
feedforward on feed rate
maintaining reboiler duty
feedforward on feed enthalpy
feedforward on composition
$\Sigma T/\Delta T$ control
steady state decouplers
relative gain analysis
dynamic decoupling
on-stream analysers
dynamic reconciliation
towers with sidestreams
multivariable control packages
technology suppliers

Optimisation

available variables
common constraints
benefits
available technologies
flooding protection
pressure minimisation
energy/yield optimisation

Training Software

Developed by Whitehouse to support both its own training courses the software is available for use by others to develop their own expertise or to run training courses.

The package operates around a dynamic simulation of a typical process plant. It runs under Microsoft Windows (version 3 or 95) using the latest Windows display standards. The user interface is impressive, comprising process graphics, controller configuration panels and configurable trends, much like those used by modern control systems. Throughout the package are interactive context sensitive Help screens which take the inexperienced user through all the process control techniques included.

The manual provided includes full installation and operating instructions along with an extensive structured work programme, similar to that followed by Whitehouse when presenting its own courses. Model answers for the exercises are given in the software under password protection. The software can store multiple control configurations for case studies or multi-user systems.

Feed drum

This module describes controller tuning techniques for both tight and averaging level control. It allows the user to configure and test a variety of linear and non-linear control algorithms. Measurement noise and filtering can be added to demonstrate the special problem that noise can give and how non-linear algorithms cope with it.

Fired Heater

This allows the user to identify process dynamics from plant testing and to tune a simple feedback controller using a variety of techniques. Both proportional on error and proportional on PV algorithms can be tested with both setpoint and load changes. The user is also shown how to set up feedforward control. Measurement noise and a variety of filters can be added to explore the impact on control performance.

Effluent Treatment

This addresses the problem of controlling highly non-linear processes. Although the example is based on pH control many of the techniques covered can be more generally applied. The user can experiment with linear control, gain scheduling, PV linearisation, adaptive control and model reference control. The effect that temperature has on pH control can be investigated.

Compressor

Load can be adjusted by throttling the discharge, adjusting inlet guide-vanes, varying speed and manipulating recycle. The user can develop control strategies based on each of these and investigate their impact on power consumption. A variety of anti-surge schemes can be commissioned and each tested by varying suction and discharge pressures, gas flow rate and molecular weight. Operation can be continuously displayed on compressor performance curves.

Reactor

The reactor generates a large process hold-up, permitting the user to apply a number of deadtime compensation techniques in order to control product quality. Each can be tested with setpoint and load changes. The importance of model accuracy is demonstrated.

Distillation Column

This helps the user understand and explore all of the common distillation control strategies. These start with material versus energy balance control and the Rijskamp scheme. The user can select tray locations for temperature control, set up pressure compensation, specify choices of manipulated variables and establish full decoupling to permit two product quality control. Feedforward on feed rate, feed temperature and feed composition can be commissioned. Energy/yield optimisation can be explored. A steady state model is included which supports pre-defined columns as well as user-defined designs.

Process Optimisation

Once the user has properly configured the lower schemes this module can be commissioned to manipulate setpoints. The lower level modules must therefore be in place for this to operate. It develops an overall process optimisation strategy, starting with a single input, single output constraint control strategy building up to a multivariable controller and a full equation-based optimiser.

Engineering Toolkit

This is required by all the modules but is primarily intended for use on the real process. It comprises a number of tools. These identify process dynamics, determine PID tuning constants, develop inferential properties, display parallel coordinates, perform Fourier transforms, analyse MPC matrices, design pressure compensated temperatures, develop control valve linearisation functions, determine vessel volume, perform statistical analysis, provide a physical property database and convert engineering units.

Licensing

The package is normally licensed on a site basis. This permits an unlimited number of copies to be in use by staff normally based on the site. Corporate and individual licences are available.

Other Services from Whitehouse

Whitehouse's aim is to establish a guiding partnership with its clients, to identify the profit improvement opportunities available with advanced control and information systems and to ensure that these are fully exploited. Because of the wide variation in the areas of expertise already within its clients, its services are designed to be adaptable.

Whitehouse will often begin its relationship with a client with a study which addresses the profit improvement opportunities either briefly or in great detail. Whitehouse tackles such work from an understanding of the process requirements and its economics. Technology is only recommended if proven and where there is a clear economic or strategic reason for its installation.

Whitehouse will often assist its clients in progressing the appropriation request. It can present the economic arguments to senior management and help resolve their concerns. It can arrange visits to other users of the proposed technology to demonstrate its effectiveness and to discuss the experiences of the users.

Whitehouse's flexible approach means that its assignments are often a blend of services, adapted to meet the client's specific needs. The client may already have completed the economic analysis and has project approval. Alternatively he may wish only to supplement his own organisation, or that of his contractor or supplier, with expert help from Whitehouse.

Pre-project services include:

- awareness seminar
- competitive positioning
- opportunities survey
- master plan
- benefits/feasibility study
- troubleshooting
- organisation studies

Project support services include:

- conceptual design
- technology evaluation
- invitations to bid
- bid evaluation and selection
- project co-ordination
- post-project audits

For suppliers of control systems, Whitehouse offers a unique insight into the process industry and can assist with evaluation of potential products and the development of market strategies.

Whitehouse values greatly its long term working relationships and treats all of its clients with equal priority, irrespective of the size of the contract or the types of systems installed. It recognises its clients' preference to deal with known individuals within Whitehouse and, wherever possible, also maintains these personal relationships.

Whitehouse's Clients

ABB
ADGAS
Agip
Aker
Akzo
Albright & Wilson
APV
Aramco
Aspen Technology
Atlas
Babcock Contractors
BASF
Bayer
Belgian Refining Corporation
Borealis
BP
British Gas
British Sugar
Brown and Root
Burghuizer Papierfabriek
Carbon Black Nederland
CB&I
Celanese
Chevron
Compact GTL
ConocoPhillips
Continental Engineering
Crosfield
DSM
Du Pont
Elf Petroleum
ENCI Nederland
Engen
ESD Simulation
Fabriques de Tabacs Reunies
Fluor Daniel BV
Frames Process Systems
GLG
Gulf Oil
Health and Safety Executive
Hellenic Petroleum
Hercules
Hess
Holborn Europa Raffinarie
Honeywell
Husky
ICI
Ineos
KBC Process Technology
Kemira
Kennedy & Donkin
Keuken and de Koning
KOA
Koch
KTI
Kuwait Oil
Kuwait Petroleum Europoort
Logica
London South Bank University
Lyondell Chemie
Marathon Oil
Merck Sharp and Dohme
Metso Automation
Mobil Oil
National Petroleum Refineries of South Africa
NBM
Netherlands Energy Research Foundation
Netherlands Refining Company
Newcastle University
NPRC
North Sea Petrochemicals
Nottingham University
PACT
Petrochemical Corporation of Singapore
PDO
Petrogal
Petronas
Petroplus
Phillips 66
Phillips Imperial Petroleum
Preem Raffinaderi
Premier Oil
Priva
Repsol
Rhenindo
SABIC
Sakhalin Energy
Saras
Sasol Synthetic Fuels
Scheepvaart en Transport College
Shell
Shin-Etsu
Sibur
Siemens
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Vietsovpetro
Yokogawa
YPF
Zeneca Fine Chemicals

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