

APACT 19

ADVANCES IN PROCESS ANALYTICS
AND CONTROL TECHNOLOGY
2019 CONFERENCE

Programme

**Tuesday 30th April -
Thursday 2nd May, 2019**

Pre-conference courses on Monday 29th April 2019

**The Crowne Plaza hotel,
Chester**



CENTRE FOR PROCESS ANALYTICS AND CONTROL TECHNOLOGY
www.cpect.com

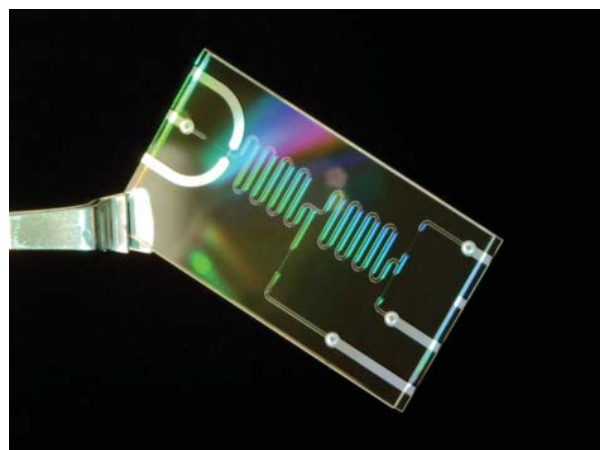
APACT is an open forum for the presentation and discussion of recent scientific and engineering advances relevant to process analytics and control technologies. Plenary and keynote speakers will report recent advances in the development and application of novel process analytics, predictive modelling and control technologies, and will review the benefits achieved. Following the success of previous conferences, APACT19 will be a 3 day meeting featuring plenary and parallel sessions on topics crucial to the achievement of manufacturing excellence.



The financial, safety and environmental benefits of process analysis and control (PAC) technologies have never been more important to modern manufacturing in the pharmaceuticals, chemicals, materials, petrochemicals, biotechnology and food industries, and many others.

The benefits of in-process measurements, real-time data mining and predictive modelling include:

- Improved process efficiency or conversion
- Reduction of waste products
- Better safety
- Improved fundamental understanding of your process



The conference is aimed at:

- Senior managers, scientists and engineers in the process industries
- Academics specialising in analytical science, control technologies and other related disciplines
- Companies that develop and market process analysis and control technologies

The programme will feature invited and contributed lectures, poster presentations and a vendor exhibition, including the unique APACT Exhibitor Showcase. The meeting is an ideal forum for networking and information gathering on PAC. Those new to process analysis or process control will benefit from the friendly atmosphere that typifies an APACT conference.



Pre-conference Courses

Four optional half day pre-conference courses will run in parallel on Monday 29th April 2019 at the Crowne Plaza Hotel. These courses will be open to both conference delegates as a low cost additional option, or may be attended on a 'course only' basis.

(COURSE 1)

DRIVING YOUR PROCESS MONITORING PROGRAMME WITH DATA ANALYTICS



Across industries one of the main challenges in manufacturing processes is to monitor and control variation. Successful variation control ensures predictable production and accompanying business benefits. Recently there have been major developments in sensor technology allowing and increasing the number of inline and online measurements. Together with improvements in IT infrastructure and technology, the sensor development contributes to rapid growth in the data available for any process. The big data challenge requires suitable timely analytics to enable each factory to make the most of the opportunities that the new paradigm is offering. A common label for this challenge is Industry 4.0.

Analytics is a key component within Industry 4.0. Relevant actionable results are required, and these results must be available for the control system in a timely manner. Multivariate methods are well established and proven useful within process monitoring. Lately there have also been a number of applications where machine learning and artificial intelligence (AI) have been considered. The choice of method depends on the type of data available and the purpose of the analytics.

In this training, the challenges and opportunities for monitoring and control within the big data paradigm are reviewed. The focus is on analytics and integration within the manufacturing process. The underlying question which we are trying to answer is how to create and apply manufacturing intelligence.

Programme

- 11:45-12:00 Registration
- 12:00-13:00 Lunch
- 13:00-15:00 Industry 4.0 and analytics; Analytical strategies - trending and modelling; Which methods for which data
- 15:00-15:20 Tea/coffee
- 15:20-17:30 Multivariate analysis and machine learning and AI; Process monitoring program - what, how and when; Manufacturing intelligence

This course will be facilitated by Geir Rune Flaten, CAMO Analytics

(COURSE 2)

SCREENING AND OPTIMISATION DESIGN OPTIONS FOR DOE



Programme

- 11:45-12:00 Registration
- 12:00-13:00 Lunch
- 13:00-15:00 Theory: Introduction to Design of Experiments (DoE). Introduction to designs including: Full & Fractional Factorial (classical), Plackett-Burman, Response Surface, Mixture and Definite Screening Designs. The theory behind some of the most commonly applied designs from a design and analysis perspective will be explored with practical examples. Advantages and disadvantages of the designs with a particular focus on Definitive Screening Designs will be discussed. Course delegates will share their knowledge and any industrial case studies with the rest of the learning cohort.
- 15:00-15:20 Tea/coffee
- 15:20-17:30 Application: Setting up and analysing designs within software. Course delegates will practise using the designs within a statistical software package. The session will close with a summary discussion and action planning.

This course will be facilitated by Matthew Linsley, University of Newcastle

Pre-conference Courses continued

(COURSE 3)

ADVANCED SPECTRAL PREPROCESSING WITHOUT EQUATIONS



Advanced Spectral Preprocessing without Equations takes up where our Chemometrics without Equations course leaves off. It is assumed that participants will have a working knowledge of Principal Components Analysis (PCA) and regression with Partial Least Squares (PLS). The course concentrates on improving chemometric models via advanced preprocessing methods.

The critical difference between inadequate and successful chemometric models is often data preprocessing, i.e. what is done to the data before using PCA, PLS etc. The goal of preprocessing is to remove variation not related to the problem of interest so that the variation of interest is more evident and can be more easily modelled. The course focuses on advanced preprocessing methods, including baselining, normalisation, smoothing and derivatives, Extended Multiplicative Scatter Correction (EMSC) and Generalised Least Squares (GLS), for improving models. The effect of preprocessing on the robustness of the final models is also considered.

11:45-12:00	Course registration
12:00-13:00	Lunch
13:00-15:00	Review of PCA/PLS, centering, normalisation, and baselining methods and specialised scaling
15:00-15:20	Tea/coffee
15:20-17:30	Filtering and derivatives, GLS, EMSC

The course will be facilitated by Barry M. Wise, President of Eigenvector Research and creator of PLS_Toolbox chemometric software

(COURSE 4)

AN INTRODUCTION TO PROCESS CONTROL FOR SCIENTISTS, CHEMISTS AND PHARMACTISTS



The course will provide an overview of closed loop process control for scientists and engineers that have no background in process control and automation. Sufficient knowledge will be provided to allow delegates to appreciate the scope of process control techniques and the challenges that need to be considered when implementing process control strategies within a PAT and QbD environment. The topics will include classical feedback control with process examples; feedforward and inferential control; multi-loop control; analytical feedback control; and will finish with a brief overview of more advanced control systems now being applied. Industrial case studies will be used.

Programme

11:45-12:00	Registration
12:00-13:00	Lunch
13:00-15:00	The Building Blocks of Process Control: An Introduction to Feedback Control, Proportional Control (P); Proportional + Integral Control (PI); Proportional + Integral + Derivative Control (PID) Control
15:00-15:20	Tea/coffee
15:20-18:00	Multi-loop Control Systems; Cascade Control; Ratio Control; Feedforward Control; Model Based Predictive Control; Inferential Measurement & Software Sensors

This course will be facilitated by Julian Morris, CPACT

TUESDAY 30 APRIL 2019

- 11:00 Registration and Exhibition open
11:00-12:00 Exhibition
12:00-13:00 Lunch and Exhibition
13:00-13:10 Welcome
13:10-14:00 Plenary 1
Formulation and processing: optimisation manufacturability
Peter Fryer, University of Birmingham, UK
14:00-14:50 Plenary 2
Opportunities and challenges for AI in industrial processes and applications
Stephen McArthur, University of Strathclyde, UK
14:50-15:30 Keynote 1
New digital technologies and their impact on validation methodology and compliance for GMP and non-GMP applications in life sciences
Lee Hough, Emerson, UK
15:30-16:00 Tea/Coffee and Exhibition and Posters
16:00-16:40 Keynote 2
Application of in-line technology in crystallisation
Andre Powell, AstraZeneca, UK
16:40-17:20 Keynote 3
In situ high speed NIR imaging to monitor form change and drug release from rapidly disintegrating tablets
Lucy Hawarden, Bristol-Myers Squibb, UK
17:20-18:20 Exhibitors' showcase presentations (inc. refreshments)
19:00-20:00 Dinner
20:00 Social activity

WEDNESDAY 1 MAY 2019

- 09:00-09:50 Plenary 3
Chemometrics in PAT: models, measurements and information
Anna de Juan, University of Barcelona, Spain
09:50-10:30 Keynote 4
Autonomous calibration and the impact on process analysis and control
Brian Rohrback, Infometrix, USA
10:30-11:00 Tea/Coffee and Exhibition and Posters

PARALLEL SESSIONS

Multivariate Methods

Reaction Monitoring - Session sponsored by RSC Process Chemistry and Technology Group

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|-------------|---|---|
| 11:00-11:30 | Doing more with less: Semi-supervised calibration with domain-invariant partial least squares regression
Ramin Nikzad-Langerodi, RECENDT, Austria | Data driven process understanding
Gillian Turner, GlaxoSmithKline, UK |
| 11:30-12:00 | In-line monitoring of solid sulphate precipitation behaviour in natural and synthetic brines using Raman spectroscopy and MCR
Werner Barnard, Nouryon, The Netherlands | Reaction monitoring of complex systems by NMR spectroscopy - Real examples from the pharmaceutical industry
Steve Coombes, AstraZeneca, UK |
| 12:00-12:30 | Combining design of experiments and development of a model predictive controller for industrial scale-up of liquid-liquid formulated product
Min Zhang, University of Birmingham, UK | Performance of inline NIR probes in aqueous polymer dispersions
Jurjen ter Maat, Nouryon, The Netherlands |

WEDNESDAY 1 MAY 2019 (Cont'd.)

- 12:30-13:30 Lunch and Exhibition
- 13:30-14:00 Exhibition and Posters
- 14:00-14:40 **Keynote 5**
Inline spectroscopy: the journey from concept to function
Marion O'Farrell, SINTEF Digital, Norway
- 14:40-15:20 **Keynote 6**
Online NMR spectroscopy for process analytical applications and aspects on automation and digitization of process industry
Michael Maiwald, BAM, Germany
- 15:20-15:50 Tea/Coffee and Exhibition and Posters

PARALLEL SESSIONS

Machine Learning & Classification Methods

Process Analysis - Session sponsored by RSC Molecular Spectroscopy Group

- 15:50-16:20 **A comparison of ANNs, SVMs and XGBoost in challenging classification problems**
Barry Wise, Eigenvector Research Inc, USA
- 16:20-16:50 **Machine learning for pharmaceutical process control and monitoring; Revolution of evolution?**
John Mack, Perceptive Engineering, UK
- 16:50-17:20 **Detecting valve stiction using classifiers trained on features extracted from time series**
Harrison O'Neill, University of Chester, UK
- 17:20-18:10 Free time
- 18:10-19:00 Exhibitors' showcase presentations (inc. refreshments)
- 19:00-19:30 Free time
- 19:30 Conference dinner and entertainment
- 15:50-16:20 **Dynamic drying monitoring of a fixed bed using 3D-electrical capacitance tomography**
Giuseppe Forte, Johnson Matthey Technology Centre, UK
- 16:20-16:50 **Beyond the boundaries of conventional spectroscopy: The benefits of high-throughput Raman for process analysis**
Mark Kemper, Tornado Spectral Systems, Inc., Canada
- 16:50-17:20 **PAT for Industry 4.0: Developments in embedded spectrometer systems and Raman spectroscopy**
Christian Lux, tec5 AG, Germany

THURSDAY 2 MAY 2019

Pharma & Biopharma Monitoring and Control

- 09:00-09:40 **Keynote 7**
The continuous manufacturing control strategy lifecycle
Martin Warman, Martin Warman Consultancy Ltd, UK
- 09:40-10:20 **Keynote 8**
Integrated control strategy for continuous manufacturing direct compression by using NIR and residence time distribution (RTD) predictive models: Experiences and challenges
Stephen Conway/Juan Rosas, Merck Sharp and Dohme (MSD), UK
- 10:20-11:00 Tea/Coffee and Exhibition and Posters
- 11:00-11:30 **NIR spectroscopy for process characterisation and monitoring of continuous direct compression (CDC)**
David Wilsdon, Pfizer, UK
- 11:30-12:00 **In-line process monitoring of cell viability and apoptosis in bioreactors using dynamic imaging analysis**
Claudia Corredor, Bristol-Myers Squibb, USA
- 12:00-12:30 **Next generation manufacturing at Biogen - PAT as an enabler for enhanced process control in commercial antibody manufacture**
Oliver Steinhof, Biogen International GmbH, Switzerland
- 12:30-12:40 **Poster prize presentation (sponsored by Clairet Scientific Ltd.)**
- 12:40-12:45 **Closing remarks followed by lunch**

Conference Venue

APACT 19 will take place at the Crowne Plaza hotel in Chester. This hotel is situated within the city's historic walls with views over the surrounding areas and the Welsh hills. The hotel has a health and fitness club with pool, gym, sauna and spa.

The Crowne Plaza is close to many of the area's attractions including Chester Zoo, Cheshire Oaks, Blue Planet Aquarium and Liverpool Docks.

Chester is the perfect destination to get away from it all. As well as offering diverse and top-class shopping, entertainment and dining venues, the city is home to many sites of historical importance and also boasts some of the UK's leading tourist attractions.

Chester has a great number of historical references, landmarks and attractions. Founded by the Romans in AD79, Chester still bears signs of its past with its Roman Amphitheatre, historic City Walls and Chester Castle all remaining intact.

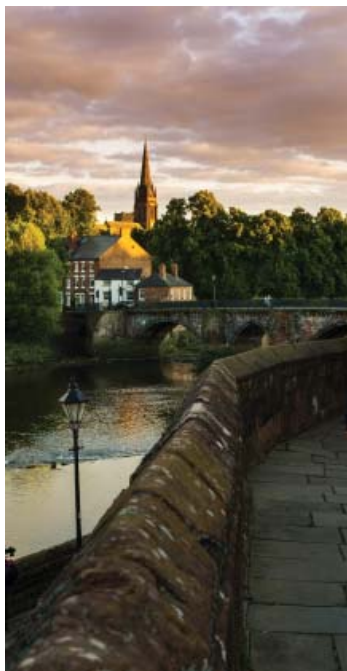
The City Walls give Chester one of its nicknames as The Walled City. The Walls have a rich history having been altered and extended during both the Saxon and Medieval eras.

Travel to the Crowne Plaza Hotel -

Air: Liverpool Airport is 25 miles away and Manchester International Airport is 35 miles away.

Road: Hotel is just minutes from Jct 15 on the M56.

Rail: Chester Station is 1 mile from the hotel. In order to get to Chester you need to change at Crewe. There are inward services to Crewe from London, Scotland, Derby, Birmingham & the West Midlands.



CONFERENCE REGISTRATION FEES

Click here to Register Online - www.apact.co.uk

Conference registration fees include the abstract book, tea/coffee and lunch during the three days of the conference. Dinner and social activity on Tuesday 30th April and a special conference dinner on Wednesday 1st May are also included.

Early Bird Registration Deadline: Thursday 28th February 2019

CPACT members - £550

Non-members - £700

Student Discounted Registration Fee (student ID will be required) - £250

Registration after Thursday 28th February 2019

CPACT members - £700

Non-members - £850

Student Discounted Registration Fee (student ID will be required) - £250

The following pre-conference courses will run in parallel on the afternoon of Monday 29th April:

- (1) Driving your process monitoring program with data analytics
- (2) Screening and optimisation design options for DoE
- (3) Advanced spectral preprocessing without equations
- (4) An introduction to process control for scientists, chemists and pharmacists

Pre-conference course registration if attending the conference:

£150

If attending pre-conference course only:

£300

CANCELLATION: Fees are refundable only up to eight weeks before the event. Substitution may be made at any time.

ACCOMMODATION has been reserved at a special rate of £110 B&B per night at the Crowne Plaza Hotel, Trinity Street, Chester, CH1 2BD Telephone no: +44 (0)1244 899988. Website: www.crowneplaza.com/chester. Accommodation should be booked online when you register at www.apact.co.uk. Only rooms booked by 25 February 2019 will be guaranteed at this rate. After this date, the rate and bedrooms will be subject to availability.

NOT CURRENTLY A CPACT MEMBER? If your organisation is interested in joining CPACT, please visit: www.cpact.com

If you require assistance or further information, please contact the conference organiser:

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