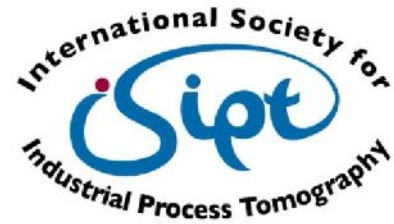

NEWSLETTER

SPRING 2022



www.isipt.org

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Goals for 2022

Recovery from Covid-19

The World is slowly recovering from the COVID-19 pandemic. We hope that all our members everywhere and their families are all well. The pandemic may have changed the way we may work together in future, perhaps with greater use of virtual engagement and support tools.

Following the unavoidable postponement of our World Congress event in Tianjin our successful Global Virtual WCIPT-10 event in September 2021 clearly demonstrated that our global community has continued with research, development and application of IPT technology. Our major World Congress series will continue in 2023 with WCIPT-11 in Mexico City.

Many researchers value the opportunity to meet colleagues on a face to face basis and discuss progress, new ideas and possible collaboration. But meeting in person has implications for travel carbon costs, and financial airfare and accommodation costs. Our Global Virtual WC IPT-10 experience, outlined in the Update Review below, indicates how we can support wholly virtual, but also hybrid events, in which some virtual attendees, particularly if do not wish to present papers, can participate and also contribute to congress costs via a reduced fee. We hope to explore these themes soon.

Please help us to continue our recovery from COVID by sharing your own excellent IPT research and applications in news of major new research projects, new industrial IPT applications, new IPT products, and of new organisations and companies who are able provide products.

ISIPT Executive Group

Celebrating ISIPT Membership

ISIPT is a global Learned Society whose members join to share their knowledge in our community to advance the technology and benefits of IPT. Other Learned Societies, such as IEEE and IET encourage members to indicate and celebrate their membership when abbreviating their academic and professional competence qualifications, e.g. **MIEEE**, **MIET** or **FIEEE**.

To celebrate ISIPT membership we would like to encourage all members to indicate their ISIPT membership using the simple abbreviation: **MISIPT**.

E.g. Dr A. Researcher, BSc MISIPT

We are most grateful to our Consultative Scientific Panel for their critical support. To recognise their esteem in our community we encourage all our expert panellists to indicate their ISIPT fellowship using the simple abbreviation: **FISIPT**.

E.g. Prof A. N. Expert, BSc PhD FISIPT

Membership of Our Expert Scientific Panel

Our panel has over 30 experts who are vital to maintain our quality standards in technical events and provide background guidance. We would like to limit workload requests for each member and hence we need an overlap of expertise.

If you have in-depth expertise in a specific aspect(s) of IPT please consider joining our panel - send a brief overview of your expertise and experience to info@isipt.org.

It would be very useful if you could identify your General Interest in terms of specific A, B or C topics shown in our World Congress papers section below – please list each relevant sub-topic with added brief notes of your expertise, with examples and a publication in each case.

Actions and Events Update

Major project news – Successful Completion of TOMOCON project

The European Training Network “Smart tomographic sensors for advanced industrial process control (TOMOCON)”, coordinated by our ISIPT colleague Prof Uwe Hampel, has been successfully completed. The programme linked 12 international academic institutions and 15 industry partners, who have worked together in the emerging field of industrial process control using smart tomographic sensors. The project began with its Kick-Off meeting in Dresden in April 2018, and has successfully overcome the considerable challenges for meetings and collaboration presented by Covid, with most meetings taking place virtually. Fortunately, the final meeting at Toulouse, France in August 2021 could be held in person for many attendees, with virtual attendance for others. The network has provided comprehensive doctoral training to 15 Early Stage Researchers (ESRs). We congratulate TOMOCON ESR’s who have completed their doctoral examination and offer best wishes to those who have yet to complete their final assessment. Project details are available at: www.tomocon.eu.

Launch of New IPT Company – Stream Sensing

A paper presented at WCIPT9 at Bath was recommended by Session Chairs for an *Excellent Paper Award* and was included in our website *Research Paper Examples*: -

Machin, T D *et al*, *Electrical Resistance Rheometry – The Application of Multi-scale Tomography Sensors to provide In-pipe Rheology in Complex Processes*.

The sponsored project has since gained support to fund a new UK registered company: Stream Sensing Ltd. Further details of the company’s development, its Team and its Products are available at its website: www.streamsensing.com.

In brief Stream Sensing have launched a new *StreamLine Rheometer* series of products, to provide a direct inline measurement of product Rheology. This is a complex measurement that defines how products flow under force, e.g. how toothpaste flows when its container is squeezed; or how shampoo behaves when poured. It is typically currently measured off-line by periodic batch sampling and laboratory analysis, taking considerable time. This results in delays to product release and increases waste if a batch is found to be out of specification. It also means full continuous control cannot be achieved for a large range of FMCG and intermediate chemical products. The innovation, based upon electrical resistance tomography sensing, enables in-line, real-time monitoring, control and optimisation for Industry 4.0 goals, such as enhanced quality, elimination of waste, and significant reductions in energy and emissions. A recent IPCC “Industry” report estimated up to 30% of CO₂ emissions arise from Industry activity. Hence the enabled process up-step can bring a significant change as process plants are updated.



We note our warm congratulations to Dr Tom’ Machin for his nomination as a Finalist for the *IChemE Global Young Researcher Awards 2021*, for his IPT R&D work.

Review of Global Virtual World Congress WCIPT10, September 2021



Our flagship biennial World Congress event, postponed from 2020, was converted from a conventional meeting to a Global Virtual event whose aim was to present an *equal experience* to all delegates, irrespective of their geographic location. For members who did not attend we provide a brief overview, as the model and tools are reusable.

A Congress Programme was provided to all delegates, designed for web-access and providing active links to session timetable and abstract list with secondary direct links to paper abstracts. All sessions were timed within a 6-hour *real-time* period. This is illustrated below using local zone times for 7 cities, centred on Universal Time Coordinated (UTC). Timings marked * had Daylight Saving Time (DST) in effect during our Congress period; and are shown as DST (+1 hr) *summer-times*. Red zones are planetary night-time; Yellow zones are morning or evening; Green zones are core day-time.

Our selected 4-hour Congress period: 09:00-13:00 UTC, allowed *real-time* attendance on the same day from Wellington, New Zealand (20:00 .. 24:00); to Ottawa, Canada (05:00 .. 09:00). Time periods for cities at intermediate longitudes provide a global timing reference base for time

	Wellington	Tokyo	Beijing	Berlin	UTC	London	Rio	Ottawa
20:00		17:00	16:00	11:00 *	09:00	10:00 *	05:00	
21:00		18:00	17:00	12:00 *	10:00	11:00 *	06:00	06:00 *
22:00		19:00	18:00	13:00 *	11:00	12:00 *	07:00	07:00 *
23:00		20:00	19:00	14:00 *	12:00	13:00 *	08:00	08:00 *
00:00		21:00	20:00	15:00 *	13:00	14:00 *	09:00	09:00 *

conversion. The selected Congress time enclosed the majority of ISIPT members within a reasonable time-slot from morning to evening. We are very grateful for the kind attendance of presenters, in Australasia late at night, and in America early in the morning.

To support our *equal experience* aim, all sessions were recorded and all delegates were provided with individual links to view any session (soon after its close) until one month after the Congress. We encouraged presenters to adopt the mode introduced at WCIPT9, to restrict presentation to novel aspects using a short 15min slot. In order to allow wide-ranging questions from all delegates, as part of our *equal experience* aim we also included a web-based Q&A Forum. An Invitation link for access to the Forum was provided directly to all delegates before the start of the Congress. Presenters were requested to respond to all questions. This was found to be a valuable systematic way to efficiently manage useful Q&A and can be used at future events of all modes.

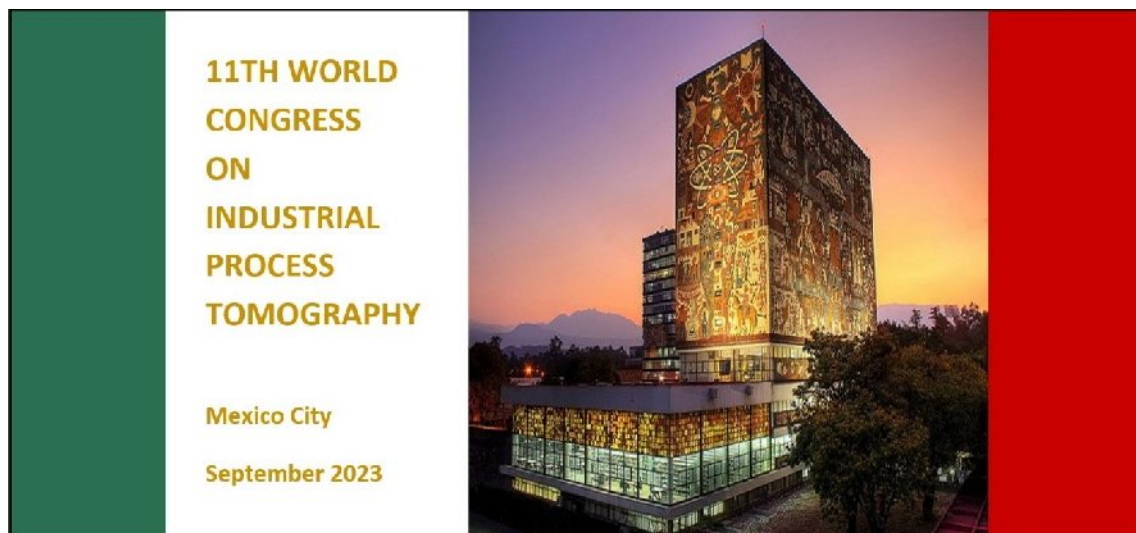
The Congress was attended by 80 delegates and 55 papers were presented. Each of first two days began with Keynote Presenters: Professor Saba Mylvaganam (University of South-Eastern Norway) presenting: *Deep Learning for Radical Application of IPT*; and Wadoud Hazineh, (Industrial Tomography Systems, with DEME Global Sea Mineral Resources Group) presenting *Deep Sea Industrial Tomography*. We are grateful to all presenters for maintaining almost perfect timing throughout the event, enabling delegates to join any session for a specific paper. The Congress ended exactly on time. A report on publications arising from the event is provided in the Publications Update below.

Advance Event Calendar Dates and Information

We plan to resume our biennial World Congress series with Events planned to take place in **September 2023** and **September 2025**. We will provide further planning information later in 2022 and issue a Call for Papers early in 2023. Congresses may offer in-person and virtual attendance (particularly for non-presenting delegates). They will be able to deploy the Q&A Forum tools which create major equal experience advantages for all delegates. Exact dates will be available soon on the ISIPT website.

A full Congress website will be available later when the Call for Papers is announced. Our practice is to provide truly global events having venues around the world. Due to Covid-19 our last in-person event was WCIPT9 in the UK at Bath in September 2018.

We next plan to move around the global in positive longitude terms with our next event on the American Continent in Mexico in September 2023, followed by our (postponed) Asian Continent event in China in September 2025, as indicated in the graphics below. Please plan to attend and share your IPT research and application experience at our future World Congress



Publications Update

WCIPT-10 Papers

Due to the special Covid circumstances from 2019 to 2021 to support members the ISIPT Executive Group agreed that Congress Publications would include a 2-page Extended Abstract, or a 6-page Full Paper. As always Congress Papers have a modest page limit to allow possible extension for a journal publication. The complete WCIPT-10 189pp Congress Proceedings (ISBN: 978-0-85316-364-0) is now available on at www.isipt.org/publications. ISIPT Members may login to access full text. Visitors who are not logged-in may only view Title, Authors and Abstract (for full papers). The Congress format focussed on developing new concepts and applications ..

A) New Generation Systems for Wider Support of Industrial Applications, 31 papers

Multi-modal and multi-spectral methods addressing complex process distributions – 7 papers

Multi-dimensional systems that radically extend length and/or temporal scales – 4 papers

Smart tomographic systems that provide direct application data, or process control – 13 papers

Machine learning from IPT data – 7 papers

B) New Developments in Foundational System Elements for Enhanced Process Interaction, 18 papers

Excitation and response sensing methods and topologies for all modes – 3 papers

Data acquisition architectures to enhance performance for focussed IPT products – 4 papers

Raw data processing such as direct inversion/high-speed reconstruction methods – 4 papers

Interpretation data processing yielding industry relevant information – 7 papers

C) Pioneering Industrial Case Studies, 6 papers

Holistic study of industrial application for pilot investigation - 6 papers

Holistic study of industrial application for on-line control - 0 papers

It was positive to see an increasing research trend in novel **New Generation** methods, rather than incremental development. **Foundational Systems** papers also had a clear trend towards novel approaches. Unfortunately, there is clearly scope for more in-depth **Industrial Application** case studies, which were perhaps limited by commercially sensitive issues.

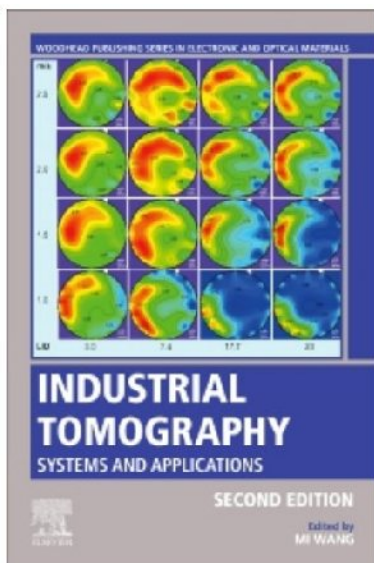
Pagination for our 8th World Congress, which was not available for original papers, has now been added so that all our Congress Proceedings papers are now bibliographically accessible.

Special Edition Journals

13 papers were submitted to *IoP Measurement Science and Technology* journal for the Special Edition on *Tomographic Process Measurement*. *IoP - Measurement Science and Technology*, ISSN: 0957-0233, Online ISSN: 1361-6501, Impact factor: 1.585 - covers all aspects of the theory, practice and application of measurement, instrumentation and sensing across science and engineering.

14 papers, including two review papers, were submitted to *MDPI Sensors* journal for the Special Issue on *Tomographic Sensors for Industrial Process Control* (Open Access Online, ISSN: 1424-8220, Impact factor: 3.576). The papers introduce latest scientific and technical achievements in the field of process control using process tomography techniques with a focus on demonstrations of this technology for typical industrial processes in the fields of chemical, environmental, and energy engineering. https://www.mdpi.com/journal/sensors/special_issues/TSIPC.

New Book - Industrial Tomography 2nd Edition



New chapters, many updates and revisions are featured in the 2nd Edition of *Industrial Tomography Systems and Applications*, edited by Professor Mi Wang (University of Leeds, UK) was published on April 22, 2022.

The updated book thoroughly explores the important techniques of industrial tomography, including systems all aspects and a wide range of applications including emergent novel developments. For example, the study of complex processes using three-dimensional methods for multiple cross-sections provides insight into filtering, mixing, drying processes, and chemical reactions inside vessels and pipelines. All previous chapters have been updated and many new chapters catalogue new developments.

Electronic, Hardback, and Paperback versions are available. The book is organised in 3 parts: -

Part I: Tomographic Modalities

1. Electrical Capacitance Tomography
2. Electrical Impedance Tomography
3. Electromagnetic Induction Tomography
4. Magnetic Resonance Imaging
5. Chemical Species Tomography
6. X-ray Computed Tomography
7. Radioisotope Tracer Techniques
8. Ultrasound Tomography
9. Spectro-Tomography
10. Electron Tomography

Part II: Tomographic Image Reconstruction and Data Fusion

11. Mathematical Concepts for Image Reconstruction in Tomography
12. Direct Methods for Image Reconstruction in Electrical Capacitance Tomography
13. Machine Learning Process Information from Tomography Data
14. Advanced Electrical Tomography Visualization

Part III: Tomography Applications

15. Electrical Resistance Tomography Applications to Chemical Engineering
16. Examples of Applications in Industry
17. Applications of Tomography in Oil-Gas Industry: Part 1
18. Applications of Tomography in Oil-Gas Industry: Part 2
19. Applications of Tomography in Multiphase Transportation
20. Slurry Flow Characterization with ERT
21. Applications of Tomography in Microreactors
22. X-ray Tomography of Fluidized Beds
23. Applications of Tomography in Bubble Column and Trickle Bed Reactors
24. Applications of Tomography in Mixing Process
25. Applications of Capacitance Tomography in Gas-Solid Fluidized Bed Systems
26. Applications of AI and Possibilities for Process Control
27. Diverse Tomography Applications

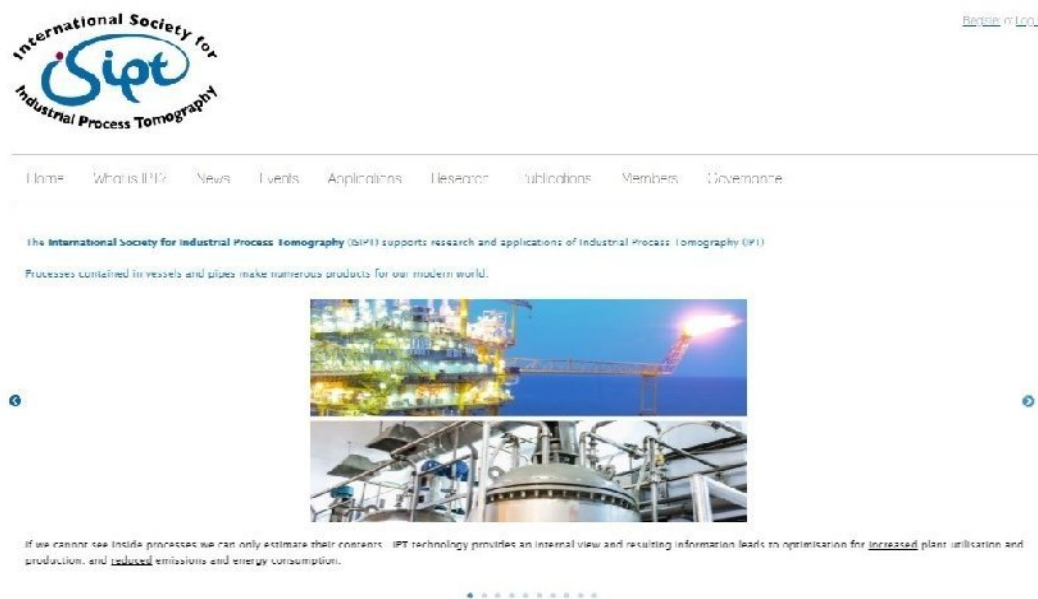
Further details of availability and ordering are available at: -

<https://www.elsevier.com/books/industrial-tomography/wang/978-0-12-823015-2>

ISIPT Website Enhancements

We hope that Members continue to enjoy our **Active Homepage** website. The Homepage cycles automatically through a small set of illustrative content. This begins with overviews showing IPT insight provided in two contrasting industries: oil/gas production monitoring; and manufacturing using mixing. The timed sequence then shows examples of excellent research papers, industrial application case studies, publications and event details. Navigation through the sequence can also be controlled with Forward and Back buttons.

The figure below shows our current homepage - please visit the website at: www.isipt.org to try it for yourself. Please pass the URL to others.



This will also be enhanced soon to increase display space and optimise operation across all devices, from large desktops displays, to laptops, notepads and phones.

Excellent Research Examples

A further new website enhancement features a **Research** menu section, currently offering 6 complete papers from WC-IPT-9, selected for their quality by Sessions Chairs. They provide a wide illustration of novel IPT methods and/or new applications and are available in PDF format.

We hope to feature other selected Excellent Research papers from any past WC-IPT proceedings. For Copyright reasons we cannot feature any other publications. If you wish to nominate any previous WC-IPT paper please send its WC-IPT reference data, with brief comments on: novelty in method and/or application and quality of presentation, including clarity of results and figures. Please send your recommendation by email to: info@isipt.org. We plan to review nominations in groups using

our Expert Panel. Some nominations may not be accepted, hence please maintain confidentiality until the review process has been completed.

Industry Application Case Study Examples Needed

Our Society is concerned with Industrial Process Tomography. We are interested in research, but this must commonly lead to exploitation and application. The ISIPT website currently includes a small number of case studies of Industry **Applications**, some are featured as overviews on the Homepage. We are interested in showcasing more Industry Case Studies in 'full-time' use on any industrial processes in any industry sector. If you have an example, please compile descriptive base data in the form shown in the current public examples and forward by email to: info@isipt.org. We can format your materials and refer the completed case study back to you for approval, and then mount on the ISIPT website.

Proposed Research and Industry Organisation Listings

A further proposed enhancement is intended to provide information and support collaboration through a list of website links. A relevant **Organisation** entity may:-

- (i) carry out research in IPT systems and applications;
- (ii) be an industry company in which IPT is used; or
- (iii) be a supplier of IPT systems or related services.

It may be one research unit in a larger body such as a University, or the whole University. Similarly, it may be one department in an industrial company, or the whole company. Each entry in the list must be proposed by a registered ISIPT member. The ISIPT website would then offer a corresponding entry featuring an entity name, a short description, a contact name, and a URL linked to more detailed information. The proposing member will act as Representative of the Organisation for the material and must ensure that linked content is relevant to ISIPT interests and complies with ISIPT ethical standards. Specific conditions will be provided to proposing members.

Where a link exists to an activity in one unit of an entity an interest may arise by other member(s) to add information of other unit(s) of the same entity. In such cases we expect that the single linked data is revised so that multiple activities are integrated by collaboration within the entity. ISIPT does not have web resources to support multiple entries and ongoing revisions. We plan to suggest a layout for data so that there is some basic uniformity.

If you are interested providing details for a first release, please email: info@isipt.org.

Future Focussed Symposium Events

The ISIPT supports an unlimited number of events that contrast (and importantly do not compete) with our World Congress series in their focus on a narrow theme using a variety of modes: e.g. symposium, workshop, round-table, sand-pit. These can be simple to organise typically with less than about 30 attendees.

Support on organising Events in general is available from the ISIPT website at www.isipt.org/events. Use the **Propose an Event** link, where an overview is provided, plus a downloadable Guide-note that provides a brief template of questions for direct use in a proposal. A simple planning spreadsheet can also then be supplied to highlight the main costs and predict 'break-even' numbers needed. Please forward questions or proposals to: info@isipt.org.

Development of our Global Community

We currently have more than 550 members from 55 states. The ISIPT can only effectively deliver its aims if it extends coverage to everyone who has an interest, as a researcher, developer, a user or simply for people interested in how science and technology is applied.

Please pass on information about ISIPT to your colleagues and contacts to grow our community. We are all affected by 'succession planning'; please help the ISIPT to continuously renew our community by encouraging junior colleagues to become members - so that they can benefit and 'stand on our shoulders'.

It is completely free to join and be a member of ISIPT.

Acknowledgements: Thanks to Philip Ronson of Aggelia for his work on our website and electronic communications.

ISIPT Executive Team – June 2022

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