Meeting Notes for the IAPWS Working Group Industrial Requirements and Solutions (IRS) Boulder, Colorado, USA, 01 - 05 October 2012

1. Opening Remarks; Adoption of Agenda

Agenda was unanimously accepted.

2. Appointment of Clerk of Minutes

A. Singh was unanimously appointed as the clerk of minutes.

3. OPAL Web Space for Working Material for WGs TPWS, IRS, and SC SW, joint with WG TPWS and SC SW (H.-J. Kretzschmar)

See TPWS meeting notes.

4. Potential International Collaborative Project

See TPWS meeting notes.

6. Editorial changes to the IAPWS-95 and IAPWS-IF97 documents, joint with WG TPWS

- Report (W. Wagner, I. Weber)
- Formal consideration of the editorial changes

See TPWS meeting notes

8. Industrial Requirements and Solutions for Steam Property Calculations, joint with WG TPWS

8.1 Report of the New Industrial Requirements Task Group (I. Weber)

A. Singh reported on some new requirements that covered the needs in areas such as dynamic and transient simulations, plant optimization & control, in-house or proprietary tool usage. The major theme was speed, consistency and robustness of the steam properties.

8.2 Report of the Industrial Survey Task Group (A. Singh)

A. Singh presented a proposal for an industrial survey. The proposal was discussed and the following steps were defined:

- Singh will prepare a draft questionnaire, distribute it among IRS and collect comments
- Weber will prepare an introduction section with some background information for recipients not familiar with IAPWS.
- The survey should be limited to 10 questions and clearly state that any further distribution is welcome

- When the final questionnaire is available the survey will be distributed to IRS members and the national committees of IAPWS for further distribution to companies not involved in IAPWS business, and also to companies in other countries

8.3 Report of the Task Group "Advisory Notes" (M. Hiegemann, W. Parry, B. Rukes, P. Murphy)

M. Hiegemann discussed the requirements for the task group and went over current advisory notes (4 in total – details of each advisory notes can be found in the slides presented). It was concluded that these notes are considered necessary, seems ok in language and needs minor editorial changes for the correctness of names, addresses etc.

Advisory note 2 doesn't mention any document related to transport properties and question was posed if this is ok. The completeness of references is essential.

Advisory note 4 is in a subpage of the respective webpage. It was proposed that the content be made part of the note itself instead of providing separately in the webpage.

It was recommended that Advisory note 2 should be updated to include transport properties and also change the title of the note to say thermo physical properties (instead of thermodynamic properties) and also include details for the additional properties in the note. Advisory note 3 should also be updated as necessary.

I. Weber put the question on the general ownership of these documents. After discussion it was decided that the question should be put forth to the EC to get a clear direction or decision on it.

Later in the joint TPWS and IRS meeting, M. Hiegemann presented the material again to the joint audience. Extended discussions on advisory note 2 and if transport properties should be included or not as proposed. J. Cooper suggested that it's not needed in this case and A. Harvey extended and agreed that we shouldn't include. M. Hiegemann referred to the book by Wagner and potential conflicts due to differences in standards and a lack of completeness. J. Cooper agreed to the issue, and proposed if a table listing all documents would suffice. J. Sengers & A. Harvey pointed that in some sense we already have a web page listing all this. J. Sengers suggested that this requires some more discussion. A. Harvey agreed. I. Weber suggested continuing the Task Group to look into these suggestions. A. Harvey was added to the task group as a member.

8.4 Usage of thermal property calculations in power plant simulations and performance monitoring (R. Pawellek, STEAG Energy Services)

R. Pawellek from STEAG Energy services gave a demo of their plant modeling tool Ebsilon He demonstrated some complicated cycles such as solar and district heating and transient simulations of a plant. At the moment transient modeling is achieved as a correction to the steady state solution and is available for limited components only. He pointed that Ebsilon's current implementation achieves very good execution speed; however he expressed a need for faster properties and better precision.

8.5 Modernization Efforts in Steam Properties Modeling for Enhanced Flexibility & Scalability (A. Singh)

A. Singh discussed the modularization efforts that are being done as part of ASME steam property work. This includes rewriting or improving the current wrapper ASME routines to better facilitate inclusion in various tools.

8.6 Report of Task Group "CFD Steam Property Formulations" (J. Hrubý, H.-J. Kretzschmar, A. Singh)

J. Hrubý reported on formulation needs for use in CFD applications. Important issues related to CFD simulations were discussed including, speed, super saturated metastable region, artificial boundaries across regions in current formulation, uncertainty compared with other sources of uncertainty, continuity etc.

8.7 Steam Property Calculations for CFD Applications (A. Singh)

A. Singh continued on discussing the needs for CFD applications and demonstrated some typical applications especially in the metastable region, simulation issues arising out of boundary definitions, comparison with experimental data and simulations based on equilibrium and multi-phase 3D CFD.

8.8 Formulation of thermodynamic properties of steam for CFD computations based on a global function s(u,□) (J. Hrubý, M. Duška, J. Pátek)

J. Hrubý gave a detailed overview of developments for an equation of state for use with CFD. He also provided uncertainty comparisons with IAPWS-IF97 & IAPWS95. Questions about comparison of speed/computing time w.r.t. IAPWS-IF97

8.9 Fast and Accurate Calculation of Thermodynamic Properties Using a Spline-based Table Look-up Method (M. Kunick, H.-J. Kretzschmar, and U. Gampe)

M. Kunick described the spline based method, its speed and accuracy comparisons in the validity region and comparison with Tabular Taylor Series Expansion method. He demonstrated the software to generate the spline function tables (FluidSplines). The method overall provides better accuracy and speed. Results of process simulation are not expected to change. It covers wet steam and metastable region and provides numerical consistency.

Following the presentations an extensive discussion on the two approaches for CFD applications ensued and it was decided that the TG will continue to exist and will review available information and development in next year meeting and make a decision. At this point more information is required w.r.t. to benefits and challenges associated with either method.

Additional information on items 8.6 to 8.9:
Later during the week the TG discussed the next steps. If evaluation and testing of the spline interpolation method is successful with no major show stoppers, the TG plans to present a draft guideline on the spline interpolation method for discussion at the 2013 IAPWS meeting.

9. Advisory Note on the Properties of Sea Water for Industrial Use, joint with WGs TPWS and SC SW

   - Report of the Task Group (H.-J. Kretzschmar)

   I. Weber introduced the topic and gave a brief overview and background of the task group covering subjects such as how the task group came into existence, its purpose and it relevance to the subject matter being discussed.

   H.-J. Kretzschmar presented covering this in more detail that included the motivation for this work, details of proposals and references to Miyagawa's report confirming its usability and correctness of the proposed draft advisory note.

   An evaluation TG was recommended to be formed and was unanimously agreed upon by the working groups involved. The evaluation task group would consist of the following members:

   I. Weber, A. Singh (Chair), K. Orlov, F. Blangetti

   A schedule was also agreed upon as follows:

   Dec. 31, 2012 Advisory Note drafted & sent to Evaluation TG

   Feb. 28, 2013 Completion of evaluation by Evaluation TG

   March 15, 2013 Distribution of Advisory Note and evaluation report to WG

   April 15, 2013 Deadline for input from WG members

   May 15, 2013 Finalized draft to Editorial Committee

   June 15, 2013 Approval by Editorial Committee

   Refer to H.-J. Kretzschmar slides available at Opal Webspace (for access details refer to bullet 3).

10. Extension of Range of Formulation for Thermodynamic Properties of Sea Water, joint with WGs TPWS and SC SW

    See TPWS notes

11. Additional Seawater-related Topics (R. Feistel), joint with SC SW and WG TPWS

    See SC SW notes

17. Properties of CO2/H2O and related systems, joint with WG TPWS
    (R. Span, A. Harvey)

    See TPWS notes

18. Discussion of 16th ICPWS 2013 in London, joint with WG TPWS and SC SW
    (J. Cooper and WG Chairs)

    See TPWS notes

19. Reports on Other TPWS, IRS and SC SW Activities

    19.1 Guideline on Fundamental Constants (A. Harvey),
    joint with WG TPWS and SC SW

See TPWS Notes.

19.2 Proper incorporation of systematic experimental uncertainties in thermodynamic models based on regression and realistic uncertainties of predicted values (J. Hrubý)

See TPWS Notes.

19.3 Remarks on new data and re-evaluation of older data for steam at low pressures (J. Hrubý and M. Duška)

See TPWS Notes.

19.4 Status of ideal-gas properties for ordinary and heavy water (A. Harvey, J. Hrubý)

See TPWS Notes.

19.5 Status of D2O Thermodynamic Properties (A. Harvey, E. Lemmon), joint with WG TPWS

See TPWS Notes

19.6 Changes of IAPWS Statutes and By-Laws (A. Harvey)

See TPWS Notes

19.7 Live calculations linked from IAPWS website (V. Ochkov [speaker], K. Orlov, and G. Kondakova)

See TPWS Notes

19.8 Steam Tables for Excel®, Mathcad®, MATLAB, smart phones and Pocket Calculators for Education on the IAPWS Website (H.-J. Kretzschmar, M. Kunick), joint with WG TPWS

See TPWS Notes

20. Other Business

20.1 Report on International Collaborative Projects

20.2 Report on ICRNs

ICRN 23 – I. Weber gave an overview, background on the ICRN and presented a progress report on behalf of N. Okita: No additional information on the iranian paper that came out in 2011 could be obtained so far. Therfore it was suggested to close the ICRN. The WG agreed to this, N. Okita will be asked to provide an official closing statement.

21. Membership

H.-J. Kretzschmar nominated R. Pawellek as a new member of IRS WG. R. Pawellek was unanimously accepted as a member of IRS.

22. Contribution to Press Release
    I. Weber agreed to prepare this IRS WG based on the notes and report to J. Bellows.

23. Preparation of the Formal Motion to the EC
    I. Weber will prepare the formal motion to EC

24. Adjournment
    I. Weber adjourned the IRS session at 05-Oct-2012, 16:20 EST