HOCHSCHULE ZITTAU/GÖRLITZ

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Research Activities on the Thermodynamic Properties of Water and Steam
Report "Research in Progress 2001"

1. Supplementary backward equations $p(h,s)$ for water and steam
   - The test calculations of the Evaluation Task Group of IAPWS were supported. The Task Group has confirmed and recommended the equations as supplement to the Industrial Formulation IAPWS-IF97.
   - The Draft of the "Supplementary Release on Backward Equations for Pressure as a Function of Enthalpy and Entropy $p(h,s)$ to the IAPWS Industrial Formulation 1997 for the Thermodynamic Properties of Water and Steam" was revised und completed. The Supplementary Release is ready for adoption by IAPWS at its annual meeting in 2001.
   - The iteration variants for calculating $p\&T(h,s)$ from the basic and backward equations of IAPWS-IF97 were investigated.

2. Development of backward equations $T(p,h)$ and $T(p,s)$ for the critical and supercritical regions of water and steam
   - The division of IAPWS-IF97 region 3 into subregions was investigated.
   - First equations $T(p,h)$ and $T(p,s)$ for IAPWS-IF97 region 3 were developed.

3. Test of the TTSE method for calculating the thermodynamic properties of water and steam in process modelling
   - The accuracy of the TTSE functions was compared with IAPWS-IF97.
   - The numerical consistency of the TTSE functions was investigated.
   - The computing speed of the TTSE functions was compared with that of the IAPWS-IF97 equations

4. Preparation of program packages including the Industrial Formulation IAPWS-IF97 for the power industry
   - The property library LibHuAir for humid air calculated as ideal mixture of the real fluids air, steam, and water was set up. The air is calculated by the NIST standard of Lemmon at al. Water and steam are calculated by IAPWS-IF97.
   - The Add-In FluidEXL^{Graphics} for Excel® including graphical representation of the calculated data in thermodynamic charts was improved.
   - The Library FluidMAT for Mathcad® 2001 was completed.

5. Implementation of the Industrial Formulation IAPWS-IF97 on pocket calculators

   - The program FluidHP for the model HP 49G of Hewlett Packard® was set up.

   - The program FluidTI for the models TI 92 and TI 89 of Texas Instruments® was expanded to calculate the properties of combustion gases and humid air.

6. Program FluidDIA for generating camera ready thermodynamic diagrams

   - The program FluidDIA was expanded to calculate and plot h,x-diagrams for humid air at variable pressures.

7. Property libraries including the Industrial Formulation IAPWS-IF97 for education

   - The Versions for students of the programs

        Add-In FluidEXL for Excel®

        FluidMAT for Mathcad®

        FluidTI for the pocket calculators TI 92 and TI 89

        FluidHP for the pocket calculator HP 49G

        FluidCASIO for the pocket calculator CASIO FX 880P

     were revised.

Zittau, August 23, 2001

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