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PROPERTY LIBRARIES FOR WORKING FLUIDS FOR CALCULATING HEAT CYCLES, TURBINES, HEAT PUMPS, AND REFRIGERATION PROCESSES

H.-J. KRETZSCHMAR
Zittau/Goerlitz University of Applied Sciences,
Zittau, Germany
hj.kretzschmar@hs-zigr.de

I. STOECKER
Zittau/Goerlitz University of Applied Sciences,
Zittau, Germany
i.stoecker@hs-zigr.de

I. JAEHNE
Zittau/Goerlitz University of
Applied Sciences, Zittau,
Germany
i.jaehne@hs-zigr.de

S. HERRMANN
Zittau/Goerlitz University of
Applied Sciences, Zittau,
Germany
herrms@web.de

M. KUNICK
Zittau/Goerlitz University of
Applied Sciences, Zittau,
Germany
matthiaskunick@hotmail.com

ABSTRACT

The program libraries developed for calculating the thermophysical properties of working fluids can be used by engineers who routinely calculate heat cycles, steam or gas turbines, boilers, heat pumps, or other thermal or refrigeration processes. Thermodynamic properties, transport properties, derivatives, and inverse functions can be calculated.

Today gas turbines are being developed for higher and higher temperatures and pressures. However, the calculation of the combustion gas as an ideal gas mixture will be inaccurate at high pressures. For this reason, a property library has been developed for humid combustion gases calculated as an ideal mixture of real fluids. The advanced adiabatic compressed air energy storage technology requires very accurate algorithms for the thermodynamic and transport properties of humid air at low temperatures and high pressures. At these parameters, humid air cannot be calculated as an ideal gas mixture. For this reason, a property library with real gas algorithms has been developed.

The following property libraries will be presented:

LibHuGas for humid combustion gas mixtures at high pressures calculated as an ideal mixture of real fluids. The library also includes mixtures of steam and carbon dioxide. The dissociation at high temperatures, the poynting effect, and the condensation of water are considered as well.

LibHuAir for humid air at high pressures calculated as an ideal mixture of the real fluids dry air, steam and water or ice. The dissociation at high temperatures and the poynting effect are taken into consideration.

LibAmWa for mixtures of ammonia and water in the Kalina cycle and in absorption refrigeration processes.

LibWaLi for mixtures of water and lithium bromide in absorption refrigeration processes.

LibIdGas for combustion gas mixtures calculated as an ideal mixture of ideal gases using the VDI-Guideline 4670.

LibIdAir for humid air calculated as an ideal mixture of the ideal gases dry air and steam using the VDI-Guideline 4670.

LibIdGasMix for 25 ideal gases and their mixtures.

LibIF97 for water and steam calculated from the Industrial Formulation IAPWS-IF97 and all new backward equations of the four supplementary releases adopted by IAPWS between 2001 and 2005.

LibCO2 for carbon dioxide.

LibNH3 for ammonia.

LibR134a for the refrigerant R134a.

LibPropane for propane.

LibButane_Iso and *LibButane_n* for Iso- and n-butane.

LibHe for helium.

LibH2 for hydrogen.

The libraries contain the most accurate algorithms for thermodynamic and transport properties.

The following software solutions will also be presented:

- DLLs for Windows® applications
 - Add-In *FluidEXL* for Excel®
 - Add-On *FluidLAB* for MATLAB®
 - Add-On *FluidMAT* for Mathcad®
 - Property libraries for HP, TI, and Casio pocket calculators.
- Student versions of all programs are available.