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.

- **LibWal** 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.