Property Libraries and Software Interfaces for Working Fluids in Energy Conversion Processes

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The libraries and interfaces for calculating thermophysical properties of water and steam, mixtures with water and steam, and other working fluids are designed for practical use by engineers calculating heat cycles, steam or gas turbines, boilers, heat pumps, refrigerators, and other energy conversion processes. Thermodynamic properties, transport properties, thermodynamic derivatives, and inverse functions are calculable.

For extremely fast property computations in CFD or simulations of transient processes, the following property libraries utilizing the Spline-Based Table Look-up method (SBTL) are presented:

LibSBTL_IF97 for water and steam based on the Industrial Formulation IAPWS-IF97
LibSBTL_95 for water and steam based on the Scientific Formulation IAPWS-95
LibSBTL_HuAir for humid air also for high pressures and high water content
LibSBTL_CO2 for carbon dioxide
LibSBTL_H2para for para hydrogen.

In addition, the following property libraries are available:

LibIF97 for water and steam, *LibIF97-META* for metastable steam, *LibICE* for ice
LibSeaWa for seawater
LibHuGas for humid combustion-gas mixtures also at high pressures
LibHuAir for humid air also at high pressures and with high water content
LibAmWa for ammonia/water mixtures in absorption processes
LibWaLi for water/lithium bromide mixtures in absorption processes
LibIdGasMix for 25 ideal gases and their mixtures
LibCO2 for carbon dioxide including dry ice, *LibNH3* for ammonia
LibPropane for propane, *LibButane_Iso* and *LibButane_n* for iso-butane and n-butane
LibD4, *LibD5*, *LibD6*, *LibMDM*, *LibMD2M*, *LibMD3M*, *LibMD4M*, and *LibMM* for siloxanes used in ORC processes
LibCH3OH for methanol, *LibC2H5OH* for ethanol
LibH2 for para and normal hydrogen, *LibN2* for nitrogen, *LibHe* for helium
LibSecRef for secondary refrigerants

These libraries utilize accurate and fast algorithms for calculating thermodynamic and transport properties. The property libraries can be used in user-specific programs written in Fortran, C/C++, C#, Java, Python, Visual Basic or other programming languages on Windows, Linux, or Mac OS. In addition, add-ons for the use of these property libraries in Excel, MATLAB and Simulink, Mathcad, Mathcad Prime, Engineering Equation Solver (EES), LabVIEW, and Dymola and SimulationX (Modelica) are available.