Hochschule Zittau/Görlitz
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Libraries for Calculating the Properties

of Working Fluids in Heat Cycles, Turbines, Heat Pumps, and Refrigeration Plants

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Steam, Water, and Ice

Library LibIF97

- Industrial Formulation IAPWS-IF97 (Revision 2007)
- Supplementary Standards
  IAPWS-IF97-S01
  IAPWS-IF97-S03ref
  IAPWS-IF97-S04
  IAPWS-IF97-S05
- IAPWS Revised Advisory Note No. 3 on Thermodynamic Derivatives (2008)

Library LibICE

- Ice from IAPWS-06
- Melting line and sublimation line from IAPWS-08
- Water from IAPWS-IF97
- Steam from IAPWS-95 and IAPWS-IF97

Library LibSBTL_IF97
Library LibSBTL_95

Extremely fast property calculations according to the

IAPWS Guideline 2015
Spline-based Table Look-up Method (SBTL)

applied to the Industrial Formulation IAPWS-IF97

and

to the Scientific Formulation IAPWS-95

for Computational Fluid Dynamics (CFD) and the simulation of non-stationary processes

Humid Combustion Gas Mixtures

Library LibHuGas

Model: Ideal mixture of the real fluids:

CO_2 - Span and Wagner (1994)
O_2 - Schmidt and Wagner (1995)
H_2O - IAPWS-95
Ar - Tegeler et al. (1999)
N_2 - Span et al. (2000)

and of the ideal gases:

SO_2, CO, Ne (Bücker et al., 2003)

Consideration of:

- Condensation of steam
- Dissociation and Poynting effect

Library LibIdGasMix

Model: Ideal gas mixture of 25 ideal gases from VDI Guideline 4670 (2003)

Humid Air

Library LibHuAir

Model: Ideal mixture of the real fluids:

- Dry air from Lemmon et al. (2000)
- Steam, water, and ice from IAPWS-IF97 and IAPWS-06

Consideration of:

- Condensation and freezing of steam
- Dissociation from the VDI Guideline 4670 (2003)
- Poynting effect from ASHRAE RP-1485

Library ASHRAE LibHuAirProp

Model: Virial equation from ASHRAE Report RP-1485 for real mixture of the real fluids dry air and steam.

Carbon Dioxide Including Dry Ice

Library LibCO2

Formulation of Span and Wagner (1994)

Ammonia/Water Mixtures

Library LibAmWa

IAPWS Guideline 2001 of Tillner-Roth and Friend (1998)

Water/Lithium Bromide Mixtures

Library LibWaLi

Formulation of Kim and Infante Ferreira (2004)

Dry Air Including Liquid Air

Library LibRealAir

Formulation of Lemmon et al. (2000)

Seawater

Library LibSeaWa

IAPWS Industrial Formulation (2013)

Ammonia

Library LibNH3

Formulation of Tillner-Roth (1993)

Hydrogen

Library LibH2

Formulation of Leachman et al. (2009)

Nitrogen

Library LibN2

Formulation of Span et al. (2000)

Siloxanes as ORC Working Fluids

$C_8H_{24}O_4Si_4$
Octamethylcyclotetrasiloxane
Library LibD4

$C_{10}H_{30}O_5Si_5$
Decamethylcyclopentasiloxane
Library LibD5

$C_{14}H_{42}O_5Si_6$
Tetradecamethylhexasiloxane
Library LibMD4M

$C_6H_{18}OSi_2$
Hexamethyldisiloxane
Library LibMM

Formulation of Colonna et al. (2006)

$C_{12}H_{36}O_6Si_6$
Dodecamethylcyclohexasiloxane
Library LibD6

$C_{10}H_{30}O_3Si_4$
Decamethyltetrasiloxane
Library LibMD2M

$C_{12}H_{36}O_4Si_5$
Dodecamethylpentasiloxane
Library LibMD3M

$C_8H_{24}O_2Si_3$
Octamethyltrisiloxane
Library LibMDM

Formulation of Colonna et al. (2008)

R134a

Library LibR134a

Formulation of Tillner-Roth and Baehr (1994)

Propane

Library LibPropane

Formulation of Lemmon et al. (2009)

Iso-Butane

Library LibButane_Iso

Formulation of Bücker and Wagner (2006)

n-Butane

Library LibButane_n

Formulation of Bücker and Wagner (2006)

Hydrocarbons

$C_{10}H_{22}$ Decane
Library LibC10H22

C_5H_{12} Iso-Pentane
Library LibC5H12_ISO

C_5H_{12} Neo-Pentane
Library LibC5H12_NEO

C_5H_{14} Iso-Hexane
Library LibC5H14

C_7H_8 Toluene
Library LibC7H8

Formulation of Lemmon and Span (2006)

Liquid Coolants

Library LibSecRef

Liquid solutions of water with

$C_2H_6O_2$	Ethylene glycol
$C_3H_8O_2$	Propylene glycol
C_2H_5OH	Ethanol
CH_3OH	Methanol
$C_3H_8O_3$	Glycerol
K_2CO_3	Potassium carbonate
$CaCl_2$	Calcium chloride
$MgCl_2$	Magnesium chloride
NaCl	Sodium chloride
$C_2H_3KO_2$	Potassium acetate
$CHKO_2$	Potassium formate
LiCl	Lithium chloride
NH_3	Ammonia

Formulation of the International Institute of Refrigeration (IIR 2010)

Ethanol

Library LibC2H5OH

Formulation of Schroeder et al. (2012)

Methanol

Library LibCH3OH

Formulation of de Reuck and Craven (1993)

Helium

Library LibHe

Formulation of Arp et al. (1998)

Other Fluids

CO Carbon monoxide
Library LibCO

COS Carbonyl sulfide
Library LibCOS

H_2S Hydrogen sulfide
Library LibH2S

N_2O Dinitrogen monoxide
Library LibN2O

SO_2 Sulfur dioxide
Library LibSO2

C_3H_6O Acetone
Library LibC3H6O

Formulation of Lemmon and Span (2006)

www.thermodynamic-property-libraries.com