

UNIVERSITY OF APPLIED SCIENCES OF ZITTAU AND GOERLITZ

Department of Technical Thermodynamics

Property Libraries for Calculating Heat Cycles and Turbines

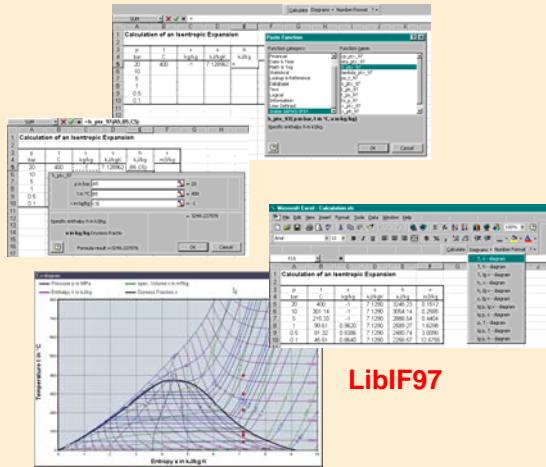
Water and Steam

Library LibIF97

- Industrial formulation IAPWS-IF97
- Supplementary backward equations IAPWS-IF97-S01
- Development of further backward equations for region3 of IAPWS-IF97

Thermodynamic Charts

- T, s - Diagram
- h, s - Diagram
- $\log p, h$ - Diagram
- $\log p, \log v$ - Diagram
- $\log p, T$ - Diagram
- p, T - Diagram
- T, h - Diagram
- $T, \log v$ - Diagram
- $\log p, s$ - Diagram
- $h, \log v$ - Diagram
- $s, \log v$ - Diagram



LibIF97

Humid Combustion Gases

Library LibIdGas

VDI-Guideline 4670
for low pressures, high temperatures

Library LibHuGas

Model: Ideal mixture of real fluids
for high pressures, low temperatures

- Ideal mixture of the real fluids
- CO₂ - Span and Wagner
- H₂O - IAPWS-95
- N₂ - Span et al.
- O₂ - Schmidt and Wagner
- Ar - Tegeler et al.

and the ideal gases:

- SO₂
 - CO
 - Ne
- scientific equations (Bücker et al.)

Consideration of - Dissociation from VDI-Guideline 4670
- Pointing effect

Humid Air

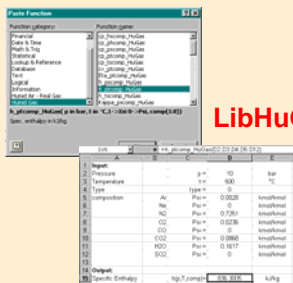
Library LibIdAir

- Ideal mixture of the real fluids
- dry air: Lemmon et al.
- steam and water: IAPWS-IF97
- Consideration of - Dissociation from VDI-Guideline 4670
- Pointing effect

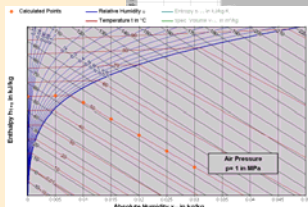
Thermodynamic Charts

- h, x - Diagram

Add-In **FluidEXL Graphics**
for **Excel®** including
thermodynamic charts



LibHuGas



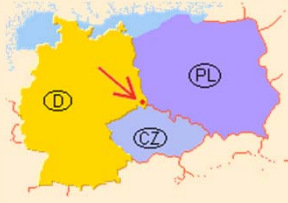
LibHuAir

<http://thermodynamics.hs-zigr.de>

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Software for Pocket Calculators



FluidMAT for Mathcad®

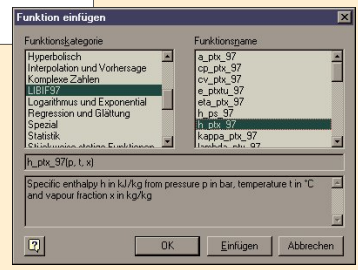
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Calculation of the Enthalpy of Steam from the IAPWS-IF97

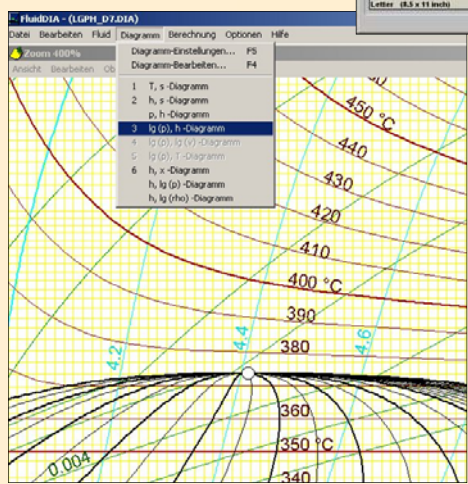
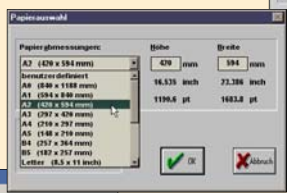
p := 10      bar      given pressure
t := 300    °C       given temperature
x := -1     kg/kg    vapor fraction (-1 for single face region)

h := h_ptx_97(p, t, x)  call of the function from FluidMAT

h = 3051.70  kJ/kg   result for enthalpy
  
```



Program FluidDIA



Using FluidDIA large size (up to A0) thermodynamic charts can be calculated and plotted in publishing quality. For the creation of the thermodynamic chart it is possible to choose

- The fluid / formulation (IAPWS-IF97, humid air)
- Charts for water and steam:
 - right-angled h, s - diagram
 - oblique angled h, s - diagram
 - T, s - diagram
 - log p, h - diagram
 - $h, \log p$ - diagram
 - $h, \log r$ - diagram
- Charts for humid air:
 - h, x - diagram for several pressures