

# HelmholtzMedia — A Fluid Properties Library

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For the simulation and design of power or refrigeration cycles, accurate properties of the working fluid are indispensable. All thermodynamic state properties, like pressure  $p$  or specific entropy  $s$ , as well as all partial derivatives of thermodynamic state properties can be calculated from fundamental equations of state. The most accurate equations of state available today for a variety of working fluids are fundamental equations of state in terms of Helmholtz energy [3]. Further properties of interest are surface tension or transport properties like viscosity and thermal conductivity. For each of these properties an independent correlation is necessary.

Both the Helmholtz energy equation of state as well as correlations for additional properties have been implemented as Modelica code in the *HelmholtzMedia* library. The library is compatible to and based on Modelica.Media [1]. The algorithms are written in a generalized form similar to the algorithms in RefProp [2].

## References

- [1] H. Elmqvist, H. Tummescheit, and M. Otter. “Object-oriented modeling of thermo-fluid systems”. In: *Proceedings of the 3rd International Modelica Conference*. 2003, pp. 269–286.
- [2] E. W. Lemmon, M. L. Huber, and M. O. McLinden. *NIST Standard Reference Database 23: Reference Fluid Thermodynamic and Transport Properties - REFPROP*. 9.0. National Institute of Standards and Technology, Standard Reference Data Program. Gaithersburg, 2010.
- [3] R. Span, W. Wagner, E. W. Lemmon, and R. T. Jacobsen. “Multiparameter equations of state — recent trends and future challenges”. In: *Fluid Phase Equilibria* 183-184.1-2 (2001), pp. 1–20. DOI: 10.1016/S0378-3812(01)00416-2.