

# Getting Thermodynamic and Transport Properties of Water in R

Jonathan Debove

November 17, 2022

IAPWS stands for International Association for the Properties of Water and Steam. One of its objectives is to provide formulations for thermodynamic and transport properties of water. The **iapws** package implements some of these formulations, in particular the so-called IAPWS-95 and IAPWS-IF97 formulations. The former is recommended for general and scientific use, the latter is designed for industrial use.

## 1 Installation

The simplest way to install **iapws** is to get it from CRAN. Type the following command in the R console:

```
> install.packages("iapws")
```

## 2 Usage

Let us load the **iapws** package:

```
> library(iapws)
```

And compute some water properties along the isochore  $\rho = 800 \text{ kg/m}^3$ :

```
> iapws95(c("p", "h"), rho = 800, t = seq(573, 623, by = 10))
```

	p	h
[1,]	72.58323	1323.453
[2,]	86.29644	1370.422
[3,]	100.03968	1417.171
[4,]	113.80655	1463.705
[5,]	127.59111	1510.032
[6,]	141.38777	1556.158

In this example, the pressure (**p**) and the specific enthalpy (**h**) are computed simultaneously for temperatures (**t**) between 573 K and 623 K. The units follows the convention used by the IAPWS, so pressures are in MPa and specific enthalpies are in kJ/kg. The different output properties and their units are listed in the function documentation (type `help(iapws95)` to see them all).

If more interested in isobaric properties, one can use:

```
> iapws95(c("rho", "h"), p = 0.101325, # atmospheric pressure
+         t = seq(293, 373, by = 20))
```

```
      rho      h
[1,] 998.2380  83.37969
[2,] 992.2736 166.98937
[3,] 983.2729 250.62096
[4,] 971.8838 334.42576
[5,] 958.4569 418.53375
```

All the functions in **iapws** are vectorized. They take vectors as arguments and return vectors or arrays. Type `library(help = iapws)` for more information.

### 3 License

GPL-3.0-or-later