



# Introduction

This book consists of three parts, Part A to Part C.

**Part A** presents the current internationally agreed equations for industrial calculations of the most relevant thermophysical properties of water and steam.

The current industrial standard for the *thermodynamic* properties, which replaced the former industrial standard IFC-67 [1], was adopted by the International Association for the Properties of Water and Steam (IAPWS) in 1997 under the name “IAPWS Industrial Formulation 1997 for the Thermodynamic Properties of Water and Steam” or simply IAPWS-IF97 for short. All relevant numerical details of the entire set of equations of IAPWS-IF97 are given in Chap. 2.

For the so-called basic and backward equations of IAPWS-IF97, all revisions of the Releases and Supplementary Releases adopted after 2008 have been taken into account. In addition to the uncertainty values given in IAPWS-IF97 for the properties specific volume, specific isobaric heat capacity, speed of sound, and saturation pressure, this book contains uncertainty values for the specific enthalpy and differences in specific enthalpy. Moreover, formulas are presented to calculate all partial derivatives from the equations of IAPWS-IF97 formed by any three combinations of the properties pressure, temperature, and the specific properties volume, enthalpy, internal energy, entropy, Gibbs free energy, and Helmholtz free energy. Examples for such calculations are given when using the needed property values given in the tables of Part B or when these values are determined with corresponding software tools.

In addition to the equations for the thermodynamic properties of water and steam, Chap. 3 of Part A summarizes current equations for industrial use for the *transport* properties dynamic viscosity and thermal conductivity and also equations for the surface tension, dielectric constant, and refractive index. In comparison to the second edition, this chapter has been fundamentally revised. The equation for the thermal conductivity was replaced by the current IAPWS equation for this property.

**Part B** contains the tables of all the properties of water and steam considered in this book. These tables were calculated from the corresponding equations of Chaps. 2 and 3 in Part A. In comparison to the second edition, the size of the tables has been reduced, sometimes significantly. The tables of the thermal conductivity and the Prandtl number that contains the thermal conductivity have been recalculated. This third edition presents eight additional tables for further properties, for example, thermal diffusivity, Joule-Thomson coefficient, and fugacity.

**Part C** of this book presents pressure-temperature diagrams with isolines of all the properties tabulated in Part B and of further properties such as the specific Gibbs free energy and a number of partial derivatives. The diagram for the thermal conductivity is recalculated due to the new equation for this property. Since the thermal conductivity is also included in the quantities Prandtl number and thermal diffusivity, these diagrams had also to be recalculated.