
Contents

Foreword	vii
Preface	xi
Notations	xv
Chapter 1. The Compressibility of Liquids and Tait's Equation-of-State	1
1.1. Introduction	2
1.2. Concepts of compressibility	3
1.3. The first instruments to measure the compressibility of liquids	5
1.4. The piezometers used onboard the Challenger	21
1.5. Sources of pressure measurement errors	24
1.5.1. Apparent compressibility of water and mercury	24
1.5.2. Apparent compressibility of liquid and piezometer	27
1.6. Compressibility of fresh and salt water	32
1.6.1. Results on fresh water compressibility	34
1.6.2. Results on seawater compressibility	38
1.6.3. Results on the compressibility of saline solutions	40
1.6.4. Equilibrium of a water column	42
Chapter 2. Interpretations of the Parameters of Tait's Equation	45
2.1. Introduction	46
2.2. Comparison and analogy with the Boyle–Mariotte equation-of-state	46
2.3. Comparison and analogy with the Hirn equation-of-state	54

2.4. Comparison and analogy with the van der Waals equation-of-state	84
2.4.1. The molecular motion model	88
2.4.2. Establishing the van der Waals equation	94
2.4.3. The different expressions and interpretations of covolume	111
Chapter 3. Tait–Tammann–Gibson Equations-of-State	147
3.1. Introduction	148
3.2. Examples of compressibility equations-of-state.	150
3.3. Evolution of the parameters of the mixed modulus.	155
3.3.1. Application in the case of fresh water.	160
3.3.2. Application in the case of standard seawater	168
3.3.3. Application in the case of helium-4	179
3.3.4. Application in the case of helium-3	192
3.3.5. Density anomalies	199
3.3.6. Compressibility anomalies	201
3.4. Discussion and conclusion	207
Chapter 4. The Modified Tait Equation	245
4.1. Introduction	246
4.2. Development of a complete equation-of-state.	249
4.3. Study of the adiabatic elastic modulus.	255
4.3.1. Application in the case of fresh water.	255
4.3.2. Application in the case of helium-3	264
4.3.3. Application in the case of helium-4	271
Conclusion	279
Appendices	283
Appendix A. Compressibility of a Straight Tube	285
Appendix B. Virial Theorem.	291
References	335
Index	343
Summary of Volume 1	347
Summary of Volume 2	351