

# CONTENTS

|  |                 |
|--|-----------------|
| <i>List of tables</i>  | <i>page</i> vii |
| <i>Preface</i>   | xiii            |
| <b>PRELUDE</b>   | 1               |
| Pr.1. The dance of the charges   | 4               |
| Pr.2. How do we convert absorption spectra to charge-fluctuation forces? | 24              |
| Pr.3. How good are measurements? Do they really confirm theory?          | 30              |
| Pr.4. What can I expect to get from this book?                           | 37              |
| <b>LEVEL 1: INTRODUCTION</b>   | 39              |
| L1.1. The simplest case: Material A versus material B across medium $m$  | 41              |
| L1.2. The van der Waals interaction spectrum                             | 61              |
| L1.3. Layered planar bodies  | 65              |
| L1.4. Spherical geometries   | 75              |
| L1.5. Cylindrical geometries   | 95              |
| <b>LEVEL 2: PRACTICE</b>   | 99              |
| L2.1. Notation and symbols   | 101             |
| L2.1.A. Geometric quantities   | 101             |
| L2.1.B. Force and energy   | 102             |
| L2.1.C. Spherical and cylindrical bodies                                 | 102             |
| L2.1.D. Material properties  | 102             |
| L2.1.E. Variables to specify point positions                             | 104             |
| L2.1.F. Variables used for integration and summation                     | 104             |
| L2.1.G. Differences-over-sums for material properties                    | 105             |
| L2.1.H. Hamaker coefficients   | 105             |
| L2.1.I. Comparison of cgs and mks notation                               | 106             |
| L2.1.J. Unit conversions, mks-cgs  | 107             |
| L2.2. Tables of formulae   | 109             |
| L2.2.A. Tables of formulae in planar geometry                            | 110             |
| L2.2.B. Tables of formulae in spherical geometry                         | 149             |
| L2.2.C. Tables of formulae in cylindrical geometry                       | 169             |

|   |     |
|---|-----|
| <b>L2.3. Essays on formulae</b>   | 181 |
| L2.3.A. Interactions between two semi-infinite media  | 182 |
| L2.3.B. Layered systems   | 190 |
| L2.3.C. The Derjaguin transform for interactions between oppositely curved surfaces   | 204 |
| L2.3.D. Hamaker approximation: Hybridization to modern theory   | 208 |
| L2.3.E. Point particles in dilute gases and suspensions   | 214 |
| L2.3.F. Point particles and a planar substrate  | 228 |
| L2.3.G. Line particles in dilute suspension   | 232 |
| <b>L2.4. Computation</b>  | 241 |
| L2.4.A. Properties of dielectric response   | 241 |
| L2.4.B. Integration algorithms  | 261 |
| L2.4.C. Numerical conversion of full spectra into forces  | 263 |
| L2.4.D. Sample spectral parameters  | 266 |
| L2.4.E. Department of tricks, shortcuts, and desperate necessities  | 270 |
| L2.4.F. Sample programs, approximate procedures   | 271 |
| <b>LEVEL 3: FOUNDATIONS</b>   | 277 |
| <b>L3.1. Story, stance, strategy</b>  | 278 |
| <b>L3.2. Notation used in level 3 derivations</b>   | 280 |
| L3.2.A. Lifshitz result   | 280 |
| L3.2.B. Layered systems   | 281 |
| L3.2.C. Ionic-fluctuation forces  | 281 |
| L3.2.D. Anisotropic media   | 282 |
| L3.2.E. Anisotropic ionic media   | 282 |
| <b>L3.3. A heuristic derivation of Lifshitz' general result for the interaction between two semi-infinite media across a planar gap</b> | 283 |
| <b>L3.4. Derivation of van der Waals interactions in layered planar systems</b>   | 292 |
| <b>L3.5. Inhomogeneous media</b>  | 303 |
| <b>L3.6. Ionic-charge fluctuations</b>  | 313 |
| <b>L3.7. Anisotropic media</b>  | 318 |
| <i>Problem sets</i>   | 325 |
| Problem sets for Prelude  | 325 |
| Problem sets for level 1  | 332 |
| Problem sets for level 2  | 337 |
| <i>Notes</i>  | 349 |
| <i>Index</i>  | 375 |