## CONTENTS

| Prefac | е •                  |                |        | •      | •               | •                |                   |          | •      |          |              | •                | •         | ٧   |
|--------|----------------------|----------------|--------|--------|-----------------|------------------|-------------------|----------|--------|----------|--------------|------------------|-----------|-----|
| Transl | ation Ed             | litor's        | s Pref | ace    | •               |                  | •                 |          | •      | •        |              | •                |           | vii |
| Chapte | er I. Pla            | ne W           | 'aves  | in La  | yers            |                  |                   |          |        |          |              |                  |           | 1   |
| 1.     | Plane                | wave           | s in h | omo    | gene            | ous              | unb               | oun      | ded :  | medi     | a            |                  |           | 1   |
| 2.     | Reflec               | tion a         | and r  | efrac  | ction           | of e             | elect             | rom      | agn    | etic '   | wave         | es               |           | 6   |
| 3.     | The r                | eflect<br>para |        |        | -               |                  |                   |          |        |          | an           | inter            | face      | 15  |
| 4.     | The re               | flecti<br>aves | on of  | f wav  | ves at          | t a l            | iqui              | d–se     | olid   | inter    | face         | . Sur            | face      | 28  |
| 5.     | Reflection           | tion i         | from   | a pl   | ane l           | laye             | r an<br>•         | d fi     | rom    | a sy:    | $	ext{stem}$ | of p             | lane<br>• | 44  |
| 6.     | Elastic              | e wav          | es in  | soli   | d lay           | erec             | l me              | edia     |        | •        |              |                  | •         | 61  |
| 7.     | Waves                | in fi          | nely   | laye   | red n           | nedi             | a                 |          |        |          |              |                  |           | 79  |
| .8.    | The re               | flecti         | on o   | f bot  | $\mathbf{ndec}$ | l be             | ams               |          |        |          |              |                  |           | 100 |
| 9.     | The re               | flecti         | on o   | f pul  | ses             |                  |                   |          |        |          |              |                  |           | 122 |
|        | er II. Sc<br>in Laye |                |        |        | s of t          | the <sup>-</sup> | Γhec              | ry c     | of Pla | ane V    | Vave<br>•    | Prop             | aga-      | 135 |
| 10.    | The re               | flecti         | on re  | educt  | tion o          | of o             | otica             | ıl sy    | ster   | ns       |              |                  |           | 135 |
| 11.    | Interfe              | erenc          | e ligl | ntfilt | ers             |                  |                   | •        |        | •        |              |                  |           | 148 |
| 12.    | Layere               | ed so          | und i  | insul  | ators           |                  | •                 | •        |        | •        | •            |                  | •         | 157 |
| Chapte | er III. Pl           | ane V          | Vaves  | s in L | ayere           | d-in             | hom               | oge      | neou   | s Me     | dia          |                  | •         | 168 |
| 13.    | Equation in          | ions<br>home   |        |        | _               |                  | ic a              | nd       | acoi   | ıstic    | fiel         | $\mathrm{ds}$ in | an        | 168 |
| 14.    | Wave<br>si           | refle<br>mple  |        |        | om a            | ın i             | $_{f .}^{ m nho}$ | mog<br>• | gene   | ous<br>- | laye         | r of             | the       | 172 |

X CONTENTS

| 15.    | Wave reflection from an inhomogeneous halfspace                     | 189 |
|--------|---|-----|
| 16.    | Waves in an arbitrary layered medium                                | 193 |
| 17.    | The reflection coefficient at a layer with an arbitrary law         |     |
|        | of variation of parameters  | 215 |
| Chapte | er IV. Reflection and Refraction of Spherical Waves                 | 234 |
| 18.    | Spherical waves   | 235 |
| 19.    | The reflection of a spherical wave at a plane interface $\hfill $ . | 242 |
| 20.    | The Weyl–van der Pol formula  | 261 |
| 21.    | Lateral waves   | 270 |
| 22.    | The field in the region close to the angle of total internal        |     |
|        | reflection  | 281 |
| 23.    | Refraction of spherical waves $\dots$ . $\dots$ .                   | 292 |
| 24.    | Reflection and refraction of a spherical wave at an interface       |     |
|        | between two elastic media   | 302 |
| Chapt  | er V. Wave Propagation in Layers                                    | 325 |
| 25.    | A layer with perfectly reflecting boundaries $\ . \ . \ .$          | 325 |
| 26.    | A layer with perfectly reflecting boundaries (continued) .          | 331 |
| 27.    | A layer with arbitrary boundaries                                   | 341 |
| 28.    | Application of the theory to the propagation of electro-            |     |
|        | magnetic waves in layers  | 361 |
| 29.    | The propagation of sound waves in a liquid layer $$ .               | 366 |
| 30.    | Sound propagation in a triple-layered medium $$ .                   | 385 |
| 31.    | The propagation of a sound pulse in a liquid layer                  | 390 |
| 32.    | Simplified method for the determination of the charac-              | ,   |
|        | teristics of the normal modes                                       | 404 |
| 33.    | Averaged decay laws   | 415 |
| 34.    | Wave propagation in a layer bounded by inhomogeneous media          | 426 |

| CONTENTS   |    | xi         |  |  |  |  |  |  |  |  |
|--|----|------------|--|--|--|--|--|--|--|--|
| Chapter VI. The Field of a Concentrated Source in a Layered-inhomo-  |    |            |  |  |  |  |  |  |  |  |
| geneous Medium   | •  | 446        |  |  |  |  |  |  |  |  |
| 35. Review of the existing solutions   |    | 447        |  |  |  |  |  |  |  |  |
| 36. General expressions for the field  | •  | 454        |  |  |  |  |  |  |  |  |
| 37. Waveguides in inhomogeneous media  | •  | 460        |  |  |  |  |  |  |  |  |
| 38. Ray theory of waveguide propagation in inhomogeneous   |    |            |  |  |  |  |  |  |  |  |
| $\operatorname{media}^{\cdot}. \qquad \cdot \qquad \cdot \qquad \cdot \qquad \cdot \qquad \cdot \qquad \cdot \qquad \cdot$ |    | 470        |  |  |  |  |  |  |  |  |
| 39. The underwater sound channel   |    | 497        |  |  |  |  |  |  |  |  |
| 40. Long distance radiowave propagation in the atmosphere  |    | 511        |  |  |  |  |  |  |  |  |
| 41. Wave propagation under conditions of shadow zon  | ne |            |  |  |  |  |  |  |  |  |
| formation  |    | 528        |  |  |  |  |  |  |  |  |
| References   |    | 544        |  |  |  |  |  |  |  |  |
| I. Monographs and textbooks  |    | 544        |  |  |  |  |  |  |  |  |
| II. Original works   | •  | 545        |  |  |  |  |  |  |  |  |
| Index  |    | <b>554</b> |  |  |  |  |  |  |  |  |