AN ELEMENTARY TREATISE ON SPHERICAL HARMONICS AND SUBJECTS CONNECTED WITH THEM

Published @ 2017 Trieste Publishing Pty Ltd

ISBN 9780649541607

An Elementary Treatise on Spherical Harmonics and Subjects Connected with Them by $\,$ N. M. Ferrers

Except for use in any review, the reproduction or utilisation of this work in whole or in part in any form by any electronic, mechanical or other means, now known or hereafter invented, including xerography, photocopying and recording, or in any information storage or retrieval system, is forbidden without the permission of the publisher, Trieste Publishing Pty Ltd, PO Box 1576 Collingwood, Victoria 3066 Australia.

All rights reserved.

Edited by Trieste Publishing Pty Ltd. Cover @ 2017

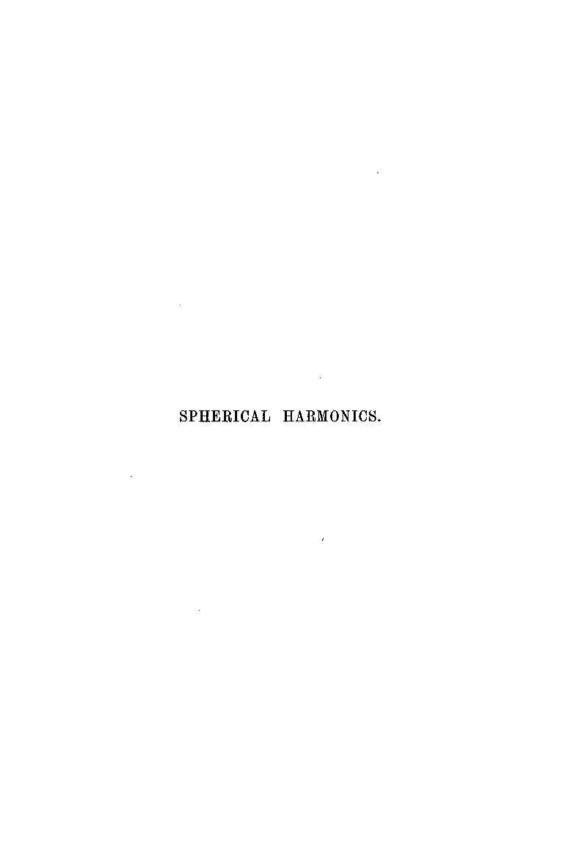
This book is sold subject to the condition that it shall not, by way of trade or otherwise, be lent, re-sold, hired out, or otherwise circulated without the publisher's prior consent in any form or binding or cover other than that in which it is published and without a similar condition including this condition being imposed on the subsequent purchaser.

www.triestepublishing.com

N. M. FERRERS

AN ELEMENTARY TREATISE ON SPHERICAL HARMONICS AND SUBJECTS CONNECTED WITH THEM





AN ELEMENTARY TREATISE

OX

SPHERICAL HARMONICS

AND SUBJECTS CONNECTED WITH THEM.

DY THE

REV. N. M. FERRERS, M.A., F.R.S., FELLOW AND TOTOE OF GONVILLE AND CAJUS COLLEGE, CAMERIDGE.

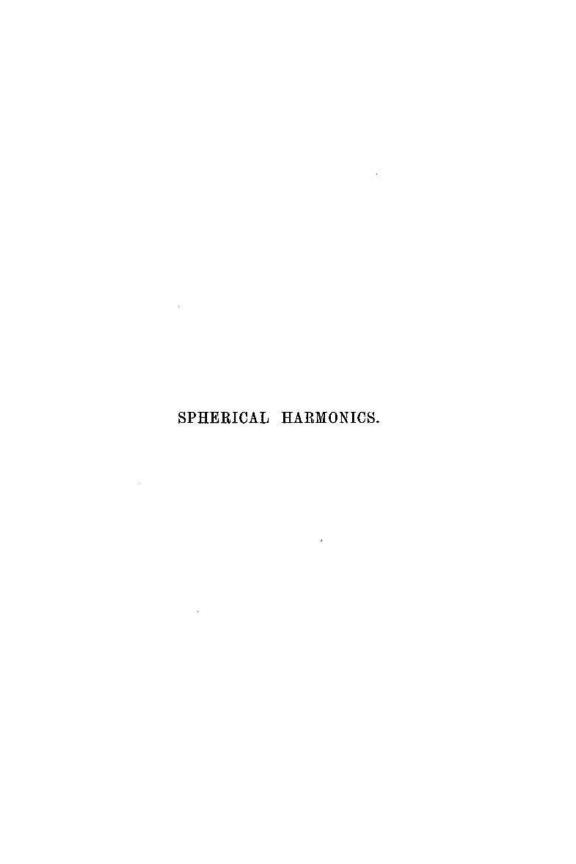


MACMILLAN AND CO.

1877

[All Rights reserved.]





CONTENTS.

18.		PAGE
	Expression of P_i in a series of cosines of multiples of θ	. 2
19.	Value of $\int_0^\pi P_i \cos m\theta \sin \theta d\theta$. it
20.	Expression of cos me in a series of zonal harmonics	3
21.	Development of $\sin \theta$ in an infinite series of zonal harmonics	. 3
22.	Value of $rac{dP_1}{d\mu}$ in a series of zonal harmonies	. 3
24.	Value of $\int_{\mu}^{1} P_{i} P_{\mu} d\mu$. 8
25,	26. Expression of Zonal Harmonics by Definite Integrals .	. 8
27.	Geometrical investigation of the equality of these definit	io.
	integrals	. 4.
28.	Expression of P_i in terms of $\cos \theta$ and $\sin \theta$. 4
	CHAPTER III.	
API	PLICATION OF ZONAL HARMONICS TO THE THEORY OF A	LTTRAC
API	PLICATION OF ZONAL HARMONICS TO THE THEORY OF A	
API		
APF	TION. REPRESENTATION OF DISCONTINUOUS FUNCTION	ONE BI
570.0	TION. REPRESENTATION OF DISCONTINUOUS FUNCTIONS.	. 44
1.	TION. REPEESENTATION OF DISCONTINUOUS FUNCTIONS. Potential of an uniform circular wire	. 44
1. 2.	TION. REPRESENTATION OF DISCONTINUOUS FUNCTIONS. Potential of an uniform circular wire. Potential of a surface of revolution.	. 44 . 44
1. 2. 8.	TION. REPRESENTATION OF DISCONTINUOUS FUNCTIONS. Potential of an uniform circular wire	. 44 . 44 . 45
1. 2. 8. 4.	TION. REPRESENTATION OF DISCONTINUOUS FUNCTIONS. Potential of an uniform circular wire	. 44 . 44 . 45
1. 2. 8. 4.	TION. REFERSENTATION OF DISCONTINUOUS FUNCTIONS. Potential of an uniform circular wire	. 44 . 44 . 45 . 51
1. 2. 8. 4. 5.	TION. REFERSENTATION OF DISCONTINUOUS FUNCTION SERIES OF ZONAL HARMONICS. Potential of an uniform circular wire. Potential of a surface of revolution Solid angle subtended by a circle at any point. Potential of an uniform circular lamina. Potential of a sphere whose density varies as R-> Belation between density and potential for a spherical surface.	. 44 . 44 . 45 . 51 e 54
1. 2. 8. 4. 5. 6,	TION. REPRESENTATION OF DISCONTINUOUS FUNCTIONS. Potential of an uniform circular wire. Potential of a surface of revolution Solid angle subtended by a circle at any point. Potential of a uniform circular lamina. Potential of a sphere whose density varies as R ⁻⁵ 9. Relation between density and potential for a spherical surface Potential of a spherical shell of finite thickness. Expression of certain discontinuous functions by an infinit series of zonal harmonics.	. 44 . 46 . 45 . 51 . 54 . 54 . 56 . 68
1. 2. 8. 4. 5. 6.; 10.	TION. REFERSENTATION OF DISCONTINUOUS FUNCTIONS. Potential of an uniform circular wire. Potential of a surface of revolution Solid angle subtended by a circle at any point. Potential of an uniform circular lamina. Potential of a sphere whose density varies as R ⁻⁵ 9. Relation between density and potential for a spherical surface potential of a spherical shell of finite thickness. Expression of certain discontinuous functions by an infinit spries of zonal harmonics.	. 44. 45. 45. 51. 58. 61. 58. 61. 65. 65. 65.

CHAPTER IV.

SPHERICAL HARMONICS IN GENERAL, TESSERAL AND SECTORIAL HARMONICS. ZONAL HARMONICS WITH THEIR AXES IN ANY POSITION. POTENTIAL OF A SOLID NEARLY SPHERICAL IN FORM.

ABT.	, g	PAGE
1.	Spherical Harmonics in general	69
2.	Relation between the potentials of a spherical shell at an internal and an external point	ib.
8.	Relation between the density and the potential of a spherical shell	70
4.	The spherical harmonic of the degree i will involve 2i+1 arbitrary constants	72
5.	Derivation of successive harmonics from the zonal harmonic by differentiation	ib,
6.	Tesseral and sectorial harmonics	74
7.	Expression of tesseral and sectorial harmonics in a completely developed form	75
8.	Circles represented by tesseral and sectorial harmonics	77
9.	New view of tesseral harmonics	78
10.	Proof that $\int_{-1}^{1} \int_{0}^{2\pi} Y_{i} Y_{n} d\mu d\phi = 0$.	80
11.	If a function of μ and ϕ can be developed in a series of surface harmonics, such development is possible in only one way	82
12.	Proof that $\int_{-2\pi}^{2\pi} Y_i d\phi = 2\pi Y_i(1) P_i(\mu)$	
	and $\int_{-1}^{1} \int_{0}^{2\pi} P_{\epsilon} Y_{\epsilon} d\mu d\phi = \frac{4\pi}{2i+1} Y_{\epsilon}(1)$	83
13.	Investigation of the value of $\int_{-1}^{1} \int_{0}^{2\pi} Y_{i}Z_{i}d\mu d\phi$	84
14.	Zonal harmonic with its axis in any position. Laplace's co-	87
15.	Expression of a rational function by a finite series of spherical	
	barmonics	90

x	CONTENTS.
ART	
16.	Property and a contract of the property of the contract of the
17.	
18.	Examples of this process
19.	Potential of homogeneous solid nearly spherical in form 97
20.	Potential of a solid composed of homogeneous spherical strats . 99
34	\$) W
	6
	T 68 N 7 T 700 A 200 T 1 + 100 T 1 + 100 T 1
	CHAPTER V.
	ADDITION OF THE PARTY OF THE PA
	SPHERICAL HARMONICS OF THE SECOND KIND.
1.	Definition of these harmonics
2	and 8. Expressions in a converging series 102
4.	Expression for the differential coefficient of Q 105
Б.	Tesseral Harmonics of the second kind 106
	CHAPTER VI.
٠	CHAPTER VI. ELLIPSOIDAL AND SPHEROIDAL HARMONICS.
	CHAPTER VI. ELLIPSOIDAL AND SPHEROIDAL HARMONICS. Introduction of Ellipsoidal Harmonics
2.	CHAPTER VI. ELLIPSOIDAL AND SPHEROIDAL HARMONICS. Introduction of Ellipsoidal Harmonics
2. 8.	CHAPTER VI. ELLIPSOIDAL AND SPHEROIDAL HARMONICS. Introduction of Ellipsoidal Harmonies . 108 Definition of Elliptic Co-ordinates
2. 8. 4.	CHAPTER VI. ELLIPSOIDAL AND SPHEROIDAL HARMONICS. Introduction of Elliptic Co-ordinates
2. 8. 4. 5.	CHAPTER VI. ELLIPSOIDAL AND SPHEROIDAL HARMONICS. Introduction of Elliptic Co-ordinates
2. 8. 4. 5.	CHAPTER VI. ELLIPSOIDAL AND SPHEROIDAL HARMONICS. Introduction of Elliptic Co-ordinates
2. 8. 4. 5. 6.	CHAPTER VI. ELLIPSOIDAL AND SPHEROIDAL HARMONICS. Introduction of Ellipsoidal Harmonies 108 Definition of Elliptic Co-ordinates ib . Transformation of the fundamental equation 109 Further transformation 110 Introduction of the quantities E , H 113 7. Number of values of E of the degree n ib . Number of values of the degree $n+\frac{1}{2}$ 117
2. 3. 4. 5. 6. 8.	CHAPTER VI. ELLIPSOIDAL AND SPHEROIDAL HARMONICS. Introduction of Elliptic Co-ordinates
2. 3. 4. 5. 6. 8. 9.	CHAPTER VI. ELLIPSOIDAL AND SPHEROIDAL HARMONICS. Introduction of Ellipsoidal Harmonies 108 Definition of Elliptic Co-ordinates ib . Transformation of the fundamental equation 109 Further transformation 110 Introduction of the quantities E , H 113 7. Number of values of E of the degree n ib . Number of values of the degree $n+\frac{1}{2}$ 117 10, 11. Expression of EHH' in terms of x,y,z ib .
2. 3. 4. 5. 6, 8. 9, 12.	CHAPTER VI. ELLIPSOIDAL AND SPHEROIDAL HARMONICS. Introduction of Ellipsoidal Harmonies 108 Definition of Elliptic Co-ordinates ib . Transformation of the fundamental equation 109 Further transformation 110 Introduction of the quantities E, H 113 7. Number of values of E of the degree n ib . Number of values of the degree $n+\frac{1}{2}$ 117 10, 11. Expression of EHH' in terms of x,y,z ib . Potential for an external point 121
2. 8. 4. 5. 6, 8. 9, 12, 13,	CHAPTER VI. ELLIPSOIDAL AND SPHEROIDAL HARMONICS. Introduction of Ellipsoidal Harmonics 108 Definition of Elliptic Co-ordinates ib . Transformation of the fundamental equation 109 Further transformation 110 Introduction of the quantities E, H 113 7. Number of values of E of the degree n ib . Number of values of the degree $n+\frac{1}{2}$ 117 10, 11. Expression of EHH' in terms of x, y, z ib . Potential for an external point 121 Law of density 123