DYNAMICS OF ROTATION: AN ELEMENTARY INTRODUCTION TO RIGID DYNAMICS

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PREFACE TO THE FIRST EDITION

MANY students of Physics or Engineering, who from want either of mathematical aptitude, or of sufficient training in the methods of analytical solid geometry, are unable to follow the works of mathematical writers on Rigid Dynamics, must have felt disappointed, after mastering so much of the Dynamics of a Particle as is given in the excellent and widely-used text-books of Loney, or Garnett, or Lock, to find that they have been obliged, after all, to stop short of the point at which their knowledge could be of appreciable practical use to them, and that the explanation of any of the phenomena exhibited by rotating or oscillating rigid bodies, so interesting and obviously important, was still beyond their reach.

The aim of this little book is to help such students to make the most of what they have already learnt, and to carry their instruction to the point of practical utility.

As a matter of fact, any one who is interested and observant in mechanical matters, and who has mastered the relations between force, mass, and acceleration of velocity of translation, will find no difficulty in apprehending the corresponding relations between couples, moments of inertia, and angular accelerations, in a rigid

body rotating about a fixed axle, or in understanding the principle of the Conservation of Angular Momentum.

Instead of following the usual course of first developing the laws of the subject as mathematical consequences of D'Alembert's Principle, or the extended interpretation of Newton's Second and Third Laws of Motion, and then appealing to the experimental phenomena for verification, I have adopted the opposite plan, and have endeavoured, by reference to the simplest experiments that I could think of, to secure that the student shall at each point gain his *first* ideas of the dynamical relations from the phenomena themselves, rather than from mathematical expressions, being myself convinced, not only that this is the best way of bringing the subject vividly and without vagueness before the learner, but that such a course may be strongly defended on other grounds.

These considerations have determined the arrangement of the chapters and the limitations of the work, which makes no pretence at being a complete or advanced treatise.

My best thanks are due to those friends and pupils who have assisted me in the revision of the proof-sheets and in the working of examples, but especially to my colleague, Mr. W. Larden, for very many valuable suggestions and corrections.

A. M. W.

DEVONPORT, 31*st Oct.* 1891.

PREFACE TO THE SIXTH EDITION

THE demand for successive editions of this book has afforded opportunities for considerable improvements since its first issue. Errors and omissions kindly pointed out by readers and friendly critics have been rectified, while the continued use of the book as a text-book with my own students has enabled me to detect and alter ambiguous phrases, and in some places to improve the arrangement of the argument.

The use of the Inertia-Skeleton, introduced on p. 64, has proved so satisfactory a simplification for non-mathematical students, to whom a momental ellipsoid would be only a stumbling-block, and could be used so readily for further extensions, in the manner indicated on pp. 122 and 123, that I hope I may be pardoned for calling attention to it.

Experiments with a gyroscope, made by the students themselves with Chapter XIII. as guide, have proved very satisfactory and interesting, and may usefully include a deduction of the rate of spin from an observation of the rate of precession, after the moment of inertia of the wheel has been determined by means of the oscillating table figured on p. 80.

In the interests of clear teaching, the convention (which I am glad to see has been adopted in America) has been adhered to throughout, of using the word 'pound' when a force is meant, and 'lb.' when a mass is meant, and I have ventured to give the name of a 'slug to the British Engineer's Unit of Mass, *i.e.* to the mass in which an acceleration of one foot-per-sec.-per-sec. is produced by a force of one pound.

A. M. W.

DEVONPORT, 11*th June* 1906.

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