(L) p. 322. It is shown that the Čech and Vietoris homology groups over a discrete group G are isomorphic. Special finite coverings of a topological space by closed sets whose interiors are disjunct, called *gratings*, lead to a net which is a spectrum and whose net homology theory is the same as the Kurosch homology theory by finite closed coverings. The projective theory of this spectrum is the homology theory of Alexander-Kolmogoroff. In Chapter VIII the topological space is specialized to be a polyhedral or simplicial complex K and the covering to be by barycentric stars of the derived (that is, regularly subdivided) complexes of K. A proof of the topological invariance of the algebraic homology groups of K then quickly results from the Čech theory. The manifold, intersection and fixed point theories given earlier are specialized to this case and a discussion of the singular chains which played such a large part in (L) and of continuous chains is included. Finally differentiable complexes and group manifolds are discussed. Hopf by generalizing simplicial group manifolds (group not necessarily abelian) defined a Γ-manifold. Lefschetz further generalizes to obtain a Γ-complex and proves Hopf's theorems for it: the rational homology groups and ring of a Γ-complex are isomorphic with those of a finite product of odd-dimensional spheres; and every finite product of odd-dimensional spheres is a Γ-manifold.

In Appendix A by S. Eilenberg and Saunders MacLane are proved for infinite complexes results on universal coefficient groups similar to those of Chapter III for finite complexes. The group of group extensions of a given group by another is the algebraic tool used. In Appendix B, P. A. Smith describes his application of algebraic topology to the study of the fixed points of a periodic homeomorphism T of a topological space R into itself. His technique is first worked out for R a simplicial complex and T a simplicial homeomorphism. The algebra is that of special homology groups defined by means of T. Then by the Čech method it is extended to compact spaces, particularly those having the homology groups of the n-sphere, and there yields topological results. Some unsolved problems are described at the end of this appendix.

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Principles of mechanics. By J. L. Synge and B. A. Griffith. New York and London, McGraw-Hill, 1942. 12+514 pp. $4.50.

In their preface the authors state that mechanics stands out as a model of clarity among all the theories of deductive science, and they have succeeded very well in support of that statement in the production of this book. The notation and the arrangement are good, and the scope of material covered exhibits well the methods and limitations of modern mechanics.

The book is divided into two parts, the first being entitled Plane Mechanics and the second Mechanics in Space. There is, however, in Part I considerable three-dimensional notation, the policy of the authors being to include the three-dimensional generality when undue complexity does not arise.

Vector methods are used throughout Part II as the fundamental mode of approach both to theory and to problems. They are also used in Part I, although in many of the problems of plane mechanics there is not scope for the full advantage of vector notation, and scalars are used a great deal instead.

The arrangements in the two parts to a large extent parallel each other. In each case statics precedes dynamics. The force concept is taken as the primitive one, rather than mass, and the principles of statics are developed through the principle of virtual work. Then in each case there follow chapters on the methods of dynamics and their applications. In Part II these are followed by a chapter on Lagrange's equations, and one on the special theory of relativity. These last two chapters are well adapted to the purpose of providing the student with an indication of what lies beyond the methods which have been given, and of the limitations of the postulates on which the theoretical structure of Newtonian mechanics rests.

The first chapter of Part I is entitled Foundations of Mechanics. It deals with the fundamental concepts and postulates of mechanics, but to appreciate it adequately the student needs a considerable degree of experience and maturity concerning things physical. The mass idea is illustrated by an analogy, but the amount of definite physical basis suggested for the idea is meager. In fact, the emphasis of the book is not on the development of an understanding of the fundamental concepts and postulates; a working knowledge of the fundamental ideas is presented in condensed form, chiefly in this first chapter, and then the development of the logical structure of mechanics is proceeded with. That, of course, is a legitimate choice, for it makes possible the inclusion of a greater body of theory and method in a single volume of moderate size. It makes the text unsuitable for a beginners' course, but it provides a valuable body of material for more advanced work.

There are, however, some aspects of the book to which the reviewer takes exception. A vector is defined (p. 18) as a directed segment, or any physical quantity which can be represented by a directed segment. The parallelogram law is regarded as giving the mathematical sum of two vectors, irrespective of whether it gives their equivalent when they represent physical quantities, but the theory of vectors developed is applied to physical problems. A finite rotation is explicitly classed as a vector, although it is admitted that it does not obey the parallelogram law. That forces obey the parallelogram law is regarded as an axiom, but there is no mention as to whether other specific quantities obey it. The general statement is made (p. 20) that almost all physical vectors do obey the parallelogram law but there is no justification given for the statement. This seems to be a logical weakness.

On p. 88 there is an erroneous statement, namely that "μ (the coefficient of static friction) is always less than unity." This would mean that no body or material could repose on a plane inclined to the horizontal at an angle greater than 45°, which is obviously not true.

Then in the chapters on impulsive motion there is introduced some artificial and unsatisfactory terminology. It is true that there is eminent precedent for what is done (see, for example, Lamb's *Hydrodynamics*, p. 11), but nevertheless it is open to objection. In the momentum-impulse equation

$$\Delta(m\dot{x}) = \int_{t_0}^{t_1} X dt,$$

t_1 is allowed to approach t_0 and X to become infinite, the integral remaining constant. There is the statement (p. 226) that "in this limiting case of 'an infinite force acting for an infinitesimal time' there is an instantaneous change in velocity but no change in position." Later, on the same page: "no force, however large, can produce an instantaneous change in momentum." Then: "To place our new ideas on a secure foundation, we admit the concept of an *impulsive force.*" This impulsive force has a component $\hat{X}$ given by

$$\hat{X} = \lim_{t_1 \to t_0} \int_{t_0}^{t_1} X dt,$$

and then it is stated that the impulsive force causes an instantaneous change in momentum given by

$$\Delta(m\dot{x}) = \hat{X}.$$

But the calling of $\hat{X}$ an impulsive force is unsatisfactory. This quantity is not a special kind of *force*; it is a different kind of physical quantity. The loose use of terms on this topic is conducive to confusion of ideas, and is in contrast with the general quality of the book.

At the end of the book there is a well written appendix on the theory of dimensions, but it seems unfortunate that the principles of it are not more in evidence throughout the text. There is one reference in it to the principle of significant figures. The latter is referred to as the physical way of thinking, in contrast with the mathematical way. That may be, but the main object of mechanics is to develop a theoretical structure which will describe certain aspects of nature, and the principle of significant figures has broader application than the rounding off of digits in a numerical calculation. It is a principle that is of frequent use in assessing relative values.

Thus, on p. 17 the authors express a preference for the tension of a spring rather than the weight of a body as a basis for the definition of force measurement, since the former is constant while the latter is variable. They state: "If the weight of a body is measured by means of a calibrated spring at two different latitudes, the results are not the same." But they are probably referring to an ideal calibrated spring, for it is doubtful if the best calibrated spring in use in any laboratory would detect a difference. To a beginner the testing of this statement by experiment would not be very convincing. Practice and theory with regard to the gravitational and absolute measure of force are justified with clarity by the principle of significant figures.

The momentum impulse equation is best interpreted by the same principle. The time interval does not *reach* the limit zero to make the change of momentum instantaneous, and the displacement is not zero but negligible.

In spite of these defects the general organization of the book is good, in both material and presentation. The printing is well done, and is remarkably free from typographical errors.

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