and beyond this explains at crucial points the reasons for certain steps which could baffle a newcomer to the field.

REFERENCES

1. Felix E. Browder (ed.), *Mathematical developments arising from Hilbert problems*, Proc. Sympos. Pure Math., vol. 28, Amer. Math. Soc., Providence, R. I., 1976.

2. G. Hamel, *Ueber die Geometrien, in denen die Geraden die Kürzesten sind*, Dissertation, Göttingen, 1901, 90 pp.

3. ______, same title, Math. Ann. **57** (1903), 231–264.

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Transformation groups and representation theory, by Tammo tom Dieck, Lecture Notes in Math., vol. 766, Springer-Verlag, Berlin and New York, 1979, viii + 300 pp., $18.00.

Let G be a topological group and X a topological space. An action of G on X is a continuous map $G \times X \to X$, written $(g, x) \to gx$ on elements, such that $1x = x$ and $g(g'x) = (gg')x$. The study of such group actions is a major and growing branch of topology.

Probably the longest established aspect of this study concerns smooth actions of compact Lie groups on differentiable manifolds. Typically, one tries to classify such actions on a given manifold or to construct particularly nice or particularly pathological examples. A recent concern, still very much in its infancy, is the analysis of the algebraic topology of G-spaces. This book is largely concerned with aspects of this new subject of equivariant homotopy theory.

While some formal theory goes through more generally, it is widely accepted that the appropriate level of generality is to restrict attention to compact Lie groups. Here there is a dichotomy. Many parts of the theory become very much simpler when one restricts further to finite groups, but one feels that one really doesn't understand the theory unless one can carry it out for all compact Lie groups.

The major computable invariants of algebraic topology are "stable". That is, with a shift of indexing, they are the same for a based space X and for its suspensions $\Sigma^n X = X \wedge S^n$. Here the smash product $X \wedge Y$ is the quotient of $X \times Y$ by the wedge, or 1-point union, $X \vee Y$. In equivariant algebraic topology, this description will not do. It makes little sense to restrict attention to spheres with trivial G-action. Since it would be unmanageable to allow spheres with arbitrary G-action, it is best to understand G-spheres to be 1-point compactifications SV of representations V. Here V is a finite-dimensional real inner product space with G acting through isometries. With basepoints fixed under the action of G, "stable" invariants of based G-spaces should be the same for X and for $\Sigma^V X = X \wedge SV$, where G acts diagonally