assert their inspiration lies in physics, few of them face up to the fact that physics is an experimental science so that theories are of maximal use confronting numbers experimentalists observe in the laboratory. For a long while, mathematicians have restricted their interest in numbers to statements such as: there exist no nonvanishing vector fields on spheres of even dimension or that the set of isomorphism classes of k-dimensional vector bundles over a paracompact space B has a natural bijective correspondence with the set of homotopy classes of mappings of B into the Grassmann manifold of k-dimensional subspaces of an infinite dimensional space. We have passed the art of computation along to computerologists–selling both ourselves and the world out.

REFERENCES

1. Serge Lang, $\mathbf{SL_2(R)}$, Addison-Wesley, Reading, Mass., 1975.

2. V. S. Varadarajan, *Lie groups, Lie algebras, and their representations*, Prentice-Hall, Englewood Cliffs, N. J., 1974.

3. Garth Warner, *Harmonic analysis on semi-simple Lie groups*. Vols. I, II, Springer-Verlag, New York, 1972.

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Vector measures and control systems, by Igor Kluvanek and Greg Knowles, North-Holland Mathematics Studies, vol. 20, North-Holland / American Elsevier, Amsterdam/New York, 1975, ix + 180 pp., $13.50.

The theory of vector measures has been under increasingly heavy study for the last decade. By the early seventies coherent bodies of knowledge had solidified in the areas of vector measure theory that grew from either the Orlicz-Pettis theorem or the Dunford-Pettis Radon-Nikodým theorem for the Bochner integral. But as late as 1974 the range of a vector measure was still an object of some mystery.

At that time the two main theorems about the range of a vector measure were Liapunov's convexity theorem (the range of a nonatomic vector measure with values in a finite dimensional space is compact and convex) and the Bartle-Dunford-Schwartz theorems (a vector measure with values in a Banach space has a relatively weakly compact range and is absolutely continuous with respect to a scalar measure). The infinite dimensional version of Liapunov's theorem remained a particular enigma; Liapunov had shown, by example, that his convexity theorem failed for vector measures with values in the sequence spaces l_p $(1 \leqslant p \leqslant \infty)$. The very scope of Liapunov's example served to block serious research into the infinite dimensional version of Liapunov's convexity theorem. This, in turn, held up the understanding of the bang-bang principle for control systems with infinitely many degrees of freedom (e.g. a control system governed by a partial differential equation).

Also in the early seventies it became clear that a sharpened form of the Bartle-Dunford-Schwartz theorem was needed. It was realized that the range