are quasilinear hyperbolic systems. There L^2-type estimates have to be used, making the assumptions less natural and general than for nonlinear elliptic equations in the Hölder space setting. A confrontation of these two cases would have been very enlightening for the student.

J. J. DUISTERMAAT

BULLETIN (New Series) OF THE
AMERICAN MATHEMATICAL SOCIETY
Volume 7, Number 1, July 1982

0273-0979/82/0000-0162/$01.25

K-theory of forms, by Anthony Bak, Annals of Mathematics Studies, vol. no. 98, Princeton Univ. Press, Princeton, N. J., 1981, viii + 268, Cloth $20.00, paperback $8.50.

The study of quadratic forms over general rings is a recent phenomenon. Until the mid 1960s only quadratic forms over rings of arithmetic type were considered, and the subject was a branch of number theory. All this changed with the development of algebraic K-theory and its application to the topology of manifolds at the hands of the surgery obstruction theory of Wall [5]. The surgery obstruction groups $L_*(\pi) = L_*(\mathbf{Z}[\pi])$ consist of stable isomorphism classes of quadratic forms over the integral group ring $\mathbf{Z}[\pi]$ of a group π, and also of the stable unitary groups of automorphisms of such forms. For finite π the computation of $L_*(\pi)$ is just about possible, and Bak has been one of the leading researchers in the field. The computations of all authors are based on the localization-completion "arithmetic square" of a finite group ring $\mathbf{Z}[\pi]$

$$\begin{array}{ccc} \mathbf{Z}[\pi] & \rightarrow & \mathbf{Q}[\pi] \\ \downarrow & & \downarrow \\ \hat{\mathbf{Z}}[\pi] & \rightarrow & \hat{\mathbf{Q}}[\pi] \end{array}$$

in which the other rings are quite close to being of arithmetic type, and for which there is an algebraic Mayer-Vietoris sequence in the L-groups of the type

$$\cdots \rightarrow L_n(\mathbf{Z}[\pi]) \rightarrow L_n(\mathbf{Q}[\pi]) \oplus L_n(\hat{\mathbf{Z}}[\pi]) \rightarrow L_n(\hat{\mathbf{Q}}[\pi]) \rightarrow L_{n-1}(\mathbf{Z}[\pi]) \rightarrow \cdots$$

generalizing the classical Hasse-Minkowski local to global principle in the unstable classification of quadratic forms over global fields.

The book under consideration is a collection of all the definitions and general theorems in the algebraic K-theory of forms which are required for the author's computations, and as such it is very welcome. Unfortunately, I doubt if the reader who is not interested in the background of Bak's computations will get much out of this book. So many different types of unitary K-groups are defined (the index lists 40) that it is practically impossible to keep track of them, especially as there are no examples given of any kind to show that they are distinct and nonzero. The absence of feeling for the history of the subject also makes the book hard to read. For example, it would help if the motivation in §1.D for the introduction of "form parameters" not only mentioned the work of Bass and Wall on reduction in the K- and L-theory of complete local rings but also explained the connections with Hensel's lemma in number theory and the relevant step in the computation of $L_*(\pi)$ for π finite (namely, that $\hat{\mathbf{Z}}[\pi] = \prod_{p\,\text{prime}} \hat{\mathbf{Z}}_p[\pi]$ is a product of complete semilocal rings). The whole book is written in the style of Bass [**2**], so that the witty comment of Adams [**1**] applies here also: "This is algebra in blinkers...it is like the three wise monkeys: see no geometry, hear no number theory and speak no topology". The books of Milnor [**3**] and Milnor-Husemoller [**4**] should also have been used as models.

REFERENCES

1. J. F. Adams, *Review of "Algebraic K-theory" by H. Bass*, Bull. London Math. Soc. **2** (1970), 233–238.

2. H. Bass, *Algebraic K-theory*, Benjamin, New York, 1968.

3. J. Milnor, *Introduction to algebraic K-theory*, Ann. of Math. Studies, No. 72, Princeton Univ. Press, Princeton, N. J., 1972.

4. J. Milnor and D. Husemoller, *Symmetric bilinear forms*, Ergebnisse der Mathematik und ihrer Grenzgebiete, Band 73, Springer-Verlag, Berlin and New York, 1973.

5. C. T. C. Wall, *Surgery on compact manifolds*, Academic Press, New York, 1970.

ANDREW A. RANICKI

BULLETIN (New Series) OF THE
AMERICAN MATHEMATICAL SOCIETY
Volume 7, Number 1, July 1982

0273-0979/82/0000-0163/$01.75

The geometry of biological time, by Arthur T. Winfree, Biomathematics, vol. 8, Springer-Verlag, New York, Heidelberg and Berlin, 1980, xiii + 530 pp., $32.00.

This book views biological periodicities through the lens of topology. It describes experiments on biological and biochemical rhythms. It interprets them in the light of topological constraints on continuous mappings between manifolds. It states only one theorem and very few equations.

A central example will illustrate the book's thrust.

A fruitfly of the species *Drosophila pseudoobscura* starts life as a fertilized egg. It develops into a larva, which eats until it matures into a pupa. The pupa acquires a hard outer cuticle, the pupal case. Within the pupal case, larval organs metamorphose into adult organs. When all is ready, a winged adult ecloses from the pupal case. The duration of eclosion is so short compared to the durations of the pupal and adult stages before and after it that eclosion is considered to occur at a discrete epoch in time.

If a population of pupae is reared under constant conditions that include bright light, eclosion times are distributed over the 24-hour day. Suppose the pupae are reared in constant bright light for some time, and then suddenly plunged into darkness. Call the epoch of this transition from light to darkness $T = 0$ hours. Within an interval of one and a half hours around $T = 17$ hours, there will be a burst of eclosion. This peak of eclosions will be followed by no