methods. These arise for example in plate bending problems where energy has a form similar to (3). The standard approximation thus requires that admissible displacements have square integrable second derivatives, and this can cause practical problems for piecewise polynomial functions in many cases. In the nonconforming approach one, in essence, ignores this continuity constraint thereby obtaining a space U^h which is not a subset of U. This will of course not work in general, and the approach required a careful and systematic analysis. Ciarlet has done exactly this, and his treatment of this subject is unequaled.

The only disappointing chapter is the one on mixed methods. The latter are based on variational principles where solutions emerge as stationary points rather than minima as in (2). The author's error analysis uses a generalized Lax-Milgram approach. Invariably continuity requirements of the latter lead to unusual norms that obscure important structural properties of the error (e.g., optimality or suboptimality of the rate of convergence in L_2). This, however, should not be regarded as a major defect of this book since the chapter is short and since the author in the preface acknowledges that he did not wish to stress mixed methods.

The following quotation from P. R. Halmos precedes Chapter I. "A mathematician's nightmare is a sequence n_ϵ that tends to 0 as ϵ becomes infinite." Ciarlet has heeded the message here for his choice of notation is excellent and apparently carefully planned to aid the reader through the more technical material. There are a few misprints but they are minor and do not detract. Finally the notes concluding each chapter are balanced and very informative.

In short, this is an excellent, well written, and, for the most part, carefully planned book that deserves study by anyone working in the general area of finite element methods.

References

1. L. V. Kantorovich and V. I. Krylou, *Approximate methods of higher analysis*, Interscience Publishers, New York, 1958.

2. S. G. Mikhlen, *Variational methods in mathematical physics*, Pergamon Press, New York, 1964.

3. R. Courant, *Variational methods for the solution of problems of equilibrium and vibrations*, Bull. Amer. Math. Soc. **49** (1943), 1–23.

4. J. L. Synge, *The hypercircle in mathematical physics*, Cambridge Univ. Press, New York, 1957.

5. Proceedings of the First Conference on Matrix Methods in Structural Mechanics, Wright-Patterson AFB Ohio, 1965.

6. J. L. Lions and E. Magenes, *Problèmes aux limites non homogènes et applications*, Dunod, Paris, 1968.

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Non-Archimedean functional analysis, by A. C. M. Van Rooij, Pure and Applied Math., vol. 51, Marcel Dekker, New York, 1978, ix + 404 pp., $29.50.

There are fields that are complete, locally compact, have a nontrivial