courses in this country have not advanced as rapidly as our ordinary curriculum, and that, in spite of the good features mentioned above, this work will not help to improve the unfortunate situation.

DAVID EUGENE SMITH.

Text-book of Mechanics. By LOUIS A. MARTIN, JR. Vol. III: *Mechanics of Materials*, 1911, xiii + 229 pp. Vol. IV: *Applied Statics*, 1912, xii + 198 pp. 12mo. New York, John Wiley and Sons.

THE first two volumes of this text* deal with theoretical mechanics. The volumes under review, together with a projected volume on applied kinetics, will constitute a course in applied mechanics.

Volume III presents the usual theory of the deflection of beams by simple or compound stresses, statically indeterminate beams, struts and columns (eccentric loading, buckling, etc.), elastic failure, and envelopes. Also the principle that the external work done by the applied forces must equal the total resilience due to bending and shear is extensively used to determine deflections; and the equations of several elastic curves are very neatly found in this way. There is no treatment of curved bars, flat plates, or rotating disks, nor any mention of core sections in eccentrically loaded columns, but the problem of avoiding tension in such columns is treated briefly.

A fairly extensive range of applications is covered in the problems; but one is rather surprised at the omission of any applications to the distribution of steel in large reenforced concrete tanks, inasmuch as so many of these are now in use, at least in the west. Moreover, it might be well to include in a later edition a comparison of the various formulas for long columns as regards typical results, and also to insert a convenient collection of the most important tables and formulas. This would not hurt the book as a text and would make it more attractive for reference purposes.

The author says in the preface that he has attempted "to produce a book which will encourage the student to think and not to memorize, to do and not simply to accept something already done for him; but which still furnishes sufficient material in the way of explanation and example so that he

* Reviewed in this BULLETIN, vol. 16 (1909), pp. 144–7.

will not become discouraged." He has succeeded remarkably well. There is no tendency toward "spoon-feeding"; yet the treatment is admirably clear and simple. Principles are concisely stated; and, with scarcely any exceptions, the exposition has been carefully thought out.

It might be well to clarify the expression, "the inscribed curve to this polygon" (page 45), to explain why stresses may be regarded as constant over the surface of an infinitesimal element on page 137, while their increments had to be considered on page 135; to comment on the two apparently distinct meanings of the symbol $'M_x$ on pages 188–9; and to make the resilience formula (page 15) more general by changing the limits of integration to Δl_1 and Δl_2. Perhaps it would also be well, before asking the student to derive the equations for the elastic curve of a certain continuous beam (example 106), to suggest in some way the device of equating slopes of adjacent spans at an abutment to help determine the constants of integration.

Naturally mathematicians will object to speaking (pages 26, 32) of a discontinuity in a function or its graph at a point where the slope has a discontinuity but the graph itself is free from a break; also to the statement (concerning the vanishing of Q whenever M reaches a maximum) "as must evidently be the case from the relation $dM/dx = Q$." But let us refrain from throwing this last stone, until all of our standard texts on calculus have eliminated similar statements!

Of course, calculus is freely employed in this volume; and the method used in formulating differential relations is the usual one of considering an infinitesimal element and regarding some variable quantity as constant throughout the small element, and often incidentally dropping infinitesimals of higher orders. (To cite a simple case from volume IV, the differential of work, $dW = pdv$, is obtained by regarding p as a constant during the small change in v.) In teaching calculus to beginners this method is wholly unsatisfactory; but in making applications of the calculus it is far more convenient than any argument concerning limits, and is in almost universal use by practical men. Judging by our texts on calculus, is there not a gap right here in our teaching of the subject? Would it not be well toward the end of the calculus course to treat thoroughly this matter of formulating differential relations, with a detailed comparison of the two methods (which have been aptly called the rigorous and the vigorous), and with considerable practice on real applications? Possibly the present inadequate treatment of this matter is one cause of the difficulty which students generally have in connecting their calculus with their practical work.

But to return. Few errata have been noticed, and in most cases the correction is fairly obvious: read x^3 for x^2 (page 36, line 13); $\bar{y}$ for y (page 66, line 20); $\frac{\pi}{4}+\frac{\phi}{2}$ for $\frac{\pi}{2}+\frac{\phi}{2}$ in fig. 83 (page 160); *section* for *material* (page 177, line 23); *uniformly* for *gradually* (page 36, etc.); e for c in the answers to examples 113–116; and interchange t_1 and t_2 in the answer to example 119.

Volume IV reviews and supplements numerous sections in Volumes I, II; and carefully summarizes the theoretical mechanics presupposed for the applied work. The applications include dynamometers, expansion of steam, tractive power of locomotives, abutments, cranes, steam shovel and dipper dredge, cables, wedges, keys and cotters, sliding arms, screws, pivots, belts, journal friction, resistance to rolling, etc.

The treatment of solid statics presupposes no knowledge of the analytic geometry of space beyond the meaning of the three coordinates. (In fact it is surprising how little analytic geometry of the plane is used in many branches of applied mathematics, even where the calculus is freely employed. If we are interested in letting our students get early those tools which they will most use, it would seem desirable for us to postpone much of the analytic geometry, letting it follow an introductory course in calculus, and thus make room for early treatment of the latter subject.)

The author bases his entire treatment of the expansion of steam upon the assumption that Boyle's law applies; but he treats adiabatic expansion in the case of air. It might be well at least to remark that the indicator diagrams for steam engines often satisfy a law of the adiabatic type better than Boyle's law.

Methods of approximating plane areas are discussed; and Simpson's rules are given in their usual extended forms, rather troublesome to remember. Why not modify the statements, making the basis of each rule a formula for the area of a single strip,—e. g., $A = \frac{1}{8}(y_1 + 3y_2 + 3y_3 + y_4)l$ in the case of the three-eighths rule, where y_1 and y_4 are the bounding ordinates of the strip, and y_2 and y_3 are the ordinates trisecting the base (whose length is l). The general rule is, then, simply to divide the area into any number of strips and apply the above formula to each strip. Why bother to remember the result obtained by summing, and why base each rule upon a set of several strips and then have to remember whether the rule requires the total number of strips to be a multiple of two or three?

But this criticism, in common with several above, is directed more at current practice than at the particular volumes under review. In fact, the text is one of conspicuous merit, which not only promises to give good results, but also gives every indication of representing a course already taught with a high degree of success.

F. L. GRIFFIN.

Die angewandte Mathematik an den Deutschen mittleren Fachschulen der Maschinenindustrie. Von Dipl.-Ing. KARL OTT. Band IV, Heft 2, Internationale Mathematische Unterrichts-Kommission. Leipzig, Teubner, 1913. vi + 158 pp.

CONFESSIONS of faith are much in vogue these days with politicians, all of whom desire to be considered progressive. The author of the pamphlet under review uses considerable space, especially at the beginning, to create the proper atmosphere around the definite points of view from which the work of the particular schools on which he is reporting is to be judged. And in the confession of the principles of his faith he uses the words of Runge, of Göttingen, to express himself. Freely translated and condensed, these principles are about as given below.

The problems of applied science requiring mathematics call for quantitative results. Abstract and formal results are not sufficient. They must be correct to the proper decimal place. They should check. Accuracy and efficiency must obtain. Form and logical sequence must be seriously considered. . . . Suitable methods whether graphical, numerical, or mechanical are necessary. The province of applied mathematics is to furnish such suitable methods. And the field is not at all to be considered as apart from pure mathematics but a part of it. It is simply a question of a different state of mind handling its problems efficiently. To all of which the author adds in his own words that the engineering student must have a