

pal normal, binormal, curvature, torsion, osculating circle, osculating helix, in the case of twisted curves; and in the case of surfaces we find the definitions and more important properties of principal radii of curvature, mean and total curvature, ruled, developable, and minimal surfaces, lines of curvature, etc., subjects, many of them, that an American student of engineering never hears anything about. The book also contains a large number of formulas, which are made easily accessible by means of a good index.

The treatment of some of the subjects could easily be criticised on the score of rigor and some of the propositions appear to be stated with too much generality; but the niceties of modern rigor must not be insisted upon in such an elementary and one might almost say popular exposition, and the inaccuracies we have noted may well be pardoned in view of the general excellence of the whole. The typographical errors that we have noticed are few, and all of such an evident character, that it is quite unnecessary to enumerate them. We believe that M. Pionchon is to be congratulated on writing a thoroughly serviceable and very readable book.

J. W. YOUNG.

*Étude sur les Quantités mathématiques. Grandeurs dirigées. Quaternions.* CLARO CORNELIO DASSEN. Paris, A. Hermann, 1903. vi + 133 pp.

M. DASSEN tells us in the introduction that it has been his object in writing this book, to "clear up and popularize the notions which lie at the foundations of pure mathematics." The author takes the extreme utilitarian view, and will admit into the science no "play of definitions and symbols" which cannot be put to "some practical use," lest he be beguiled into a realm of mere cabalistic hocus-pocus. He admits, however, that some intrinsically useless investigations may have a certain indirect value, and then gives us a hint on the breadth of his mathematical learning as follows: "The so-called non-euclidean geometry, for example, though useless in itself, because it does not correspond to experience, has nevertheless shown itself indirectly useful in proving that the euclidean geometry, the only one that does correspond to experience, is not apodictically true and has hence served to refute the arguments of Kant on the a-priority of the concept of space" (page 2).