Introduction au Calcul Tensoriel et au Calcul Différentiel Absolu. By G. Juvet, with a preface by J. Hadamard. Paris, A. Blanchard, 1922. ii + 101 pp.

This small volume contains a very intelligible account of the so-called "Tensor Theory" which has come to the front with the Einstein relativity. The author starts in with elementary notions of vectors and their linear transformations, then defines tensors algebraically and in connection with bilinear forms, then geometrically. Some consideration of the elementary analysis follows, closing with an exposition of the "parallel displacement" of Levi-Civita, and a general discussion of tensors in a Riemann continuum. There is a good bibliography at the end.

The general point of view is set forth in the interesting preface of Hadamard. His thought reverts back to Poincaré, who said: "The physicist proposes problems to us whose solution he expects. But in making the proposal he pays for the most part in advance for our services. . . . There is an infinite multitude of combinations that may be formed of numbers and symbols. How should one select from this multitude those worthy of attention? Should we be guided by caprice? Such caprice would no doubt alienate our interests far and we would soon cease to understand one another. . . . But there is another side to the matter. . . . Physics not only prevents us from getting lost, but it prevents us from a more serious danger: that of wandering around in a circle."

This situation, Hadamard intimates, had actually arisen in infinitesimal geometry. In fact a crisis had arisen, which fortunately the relativity theory has resolved, through its stimulation of the study of methods already in existence, but mostly ignored, dating back to the absolute geometry of Ricci and Levi-Civita (MATHEMATISCHE ANNALEN, vol. 54).

It is a matter of satisfaction to those of us who have been interested in so-called vector methods, for some time, that they are finally coming into their own. The essential basis of such methods is not the avoidance of coordinates but the development of formulas which are intrinsically given. The present work is open to the criticism to which practically all these investigations are subject, namely that while expressions are produced which are invariant under transformations of the coordinates, there should be no use made of coordinates at all. A proper use of vectors makes the study of absolute geometry not only much simpler and almost obvious, but these same expressions may be translated directly into any desirable system of coordinates with little trouble. The invariancy is a direct consequence of the method. The author remarks in his introduction: "Systems of coordinates are not rejected, and in place of being foreign to the things studied, actually form their structure." Such a point of view is the common one, it is freely admitted, but it is to the detriment of the things studied. It merely shows the path of least resistance taken by the minds of the investigators. When a new generation think as readily in general vectors as many now do in ordinary vectors of three-dimensional space, instead of long demonstrations of invariant and covariant forms, occupying many pages, there will be a few pages of direct statements,