THURSDAY, SEPTEMBER 26, 1918.

APPLIED OPTICS.

Applied Optics: The Computation of Optical Systems. Being the "Handbuch der angewandten Optik" of Dr. Adolph Steinheil and Dr. Ernest Voit. Translated and edited by J. Weir French. Vol. i. Pp. xvii + 170. (London: Blackie and Son, Ltd., 1918.) Price 12*s.* 6*d.* net.

THE first volume of Steinheil's handbook appeared twenty-eight years ago, and the promised second and third volumes of the work never materialised, probably owing to the first meeting with insufficient appreciation. The book before us is a translation of the first half of Steinheil's first volume, and the fact that a prominent member of one of our foremost optical firms (Barr and Stroud) considered it worthy of this labour is eloquent proof of the truth of a statement by the late Prof. Silvanus P. Thompson in a noted outburst:—

"The simple reason of the badness of almost all recent British text-books of optics is that . . . they are written, not to teach the reader real optics, but to enable him to pass examinations set by non-optical examiners. The examination-curse lies over them all."

Steinheil's book certainly does not belong to this category; it is severely practical and almost crude in its empiricism. Scarcely any of the numerous formulæ given in the book are proved; the reader must either accept them and mechanically follow the scheme of the numerous numerical examples, or he must discover the proofs by his own effort. In the case of the complicated Seidel-formulæ for rays not proceeding in a plane containing the optical axis, a student unfamiliar with modern spherical trigonometry is not likely to succeed in this, and the proof of these formulæ, together with a clear explanation of the adopted method of astronomical computation with angles up to 360°, should certainly have been included in this first volume of the translation instead of being relegated to the promised second volume.

The Steinheil system of symbols is safe, but cumbersome, on account of the multitude of suffixes; the use of precisely the same symbols for paraxial and for marginal rays is, however, likely to cause confusion. The sign-conventions agree in all ordinary cases with those almost universally adopted by practical computers; the only defect in them is that all the signs are made to depend on the direction in which the light travels through the system; hence if the latter includes reflecting surfaces—a case expressly and necessarily included in the scheme—the signs of all the angles and intersection-lengths must be reversed before proceeding to the following surface. This complication is entirely avoided if the direction of the light is ignored and axial intercepts are given the sign usual in analytical geometry, and if the acute angles between the optical axis and the ray are called positive when corresponding with a clockwise turn.

The worst feature of the book is to be found in the definitions of the various aberrations, which are not only loose, but also frequently positively incorrect. Thus on p. 45 the important sine-condition is merely implied—and only in the form which it takes for systems applied to infinitely distant objects. The condition is correctly stated in its general form on p. 57, but the statement is immediately vitiated by the assertion that it is fulfilled "when the system has the same true focal length for any portion of the whole aperture"—*i.e.* when it is fulfilled for infinitely distant objects. With rare exceptions, in the case of certain systems having great thickness or wide separations, the exact contrary is true: A system fulfilling the sine-condition for objects at infinity does *not* fulfil it for objects at finite distances.

The worst confusion of this kind occurs in the case of distortion. On p. 44 this is correctly, although loosely, defined in its accepted meaning. Throughout the rest of the book the term is used for the defect universally known as coma, simply because the latter, by diffusing the rays over a certain area, necessarily causes most of them to fall away from the position of the ideal image-point. Steinheil thus ignores the fact that true distortion may exist in an otherwise perfect image, and that it causes a linear displacement of any image-point which is proportional to the third power of its distance from the optical axis, whilst the coma-displacement is proportional directly to the distance of an image-point from the optical axis, and also to the square of the aperture of the image-forming cone—which latter has no effect at all on true distortion.

On p. 56 coma is described as "spherical aberration out of the axis," which, again, is wrong; true spherical aberration may exist in oblique pencils independently of that on the optical axis, but it is a fifth-order aberration which has nothing to do with coma.

There are many other cases of a type similar to the above examples.

The book is beautifully printed on paper of extraordinary thickness, and the translator and editor may be congratulated on the excellence of his part of the work. A. E. C.

THE MEGALITHIC CULTURE OF INDONESIA.

The Megalithic Culture of Indonesia. By W. J. Perry. Pp. xiii + 198. (Manchester: At the University Press; London: Longmans, Green, and Co., 1918.) Price 12*s.* 6*d.* net.

IN his presidential address to Section H (see NATURE, vol. lxxxvii., p. 356), at the meeting of the British Association at Portsmouth in 1911, Dr. Rivers explained how he had been led to reject the popular dogma of "spontaneous generation" in ethnology, which is wrongly claimed to be "evolution," and to realise the vast importance