considering in the product set E^n sets of the form $Z_1 \times Z_i \times Z_n$, where Z_i belongs to K, the Borel field over such sets and using the operation of projection and complementation a finite number of times. Necessary and sufficient conditions are found in terms of a special mapping of E into E^n preserving a given class of sets in E^n, for the product isomorphism in case of sets A, B in the projective class. The classical theories of Borel sets and of projective sets correspond to the case where K is the sequence of rational intervals. Many results of these theories hold for the case of a general K and thus show a purely combinatorial and not topological origin. This permits the formulation of an analogous theory in the even more general case of projective algebras (abstract 49-5-151). (Received October 22, 1943.)

37. S. E. Warschawski: *On Theodorsen's method of conformal mapping of nearly circular regions.*

The paper deals with the problem of determining the mapping function of a circle onto a nearly circular region. This problem has some practical importance in the theory of airfoils. Let C be a nearly circular closed Jordan curve: $\rho = \rho(\phi)$, $0 \leqq \phi \leqq 2\pi$, (ρ, ϕ polar coordinates) where $(1/\rho)(d\rho/d\phi)$ is continuous and $1 \leqq \rho(\phi) \leqq 1+\epsilon$ for some ϵ, $0 < \epsilon < 1$. Suppose that $w = f(z)$ ($f(0) = 0$, $f'(0) > 0$) maps the circle $|z| = |re^{i\theta}| < 1$ conformally onto the interior of C. If $\arg f(e^{i\theta}) = \phi(\theta)$, the $\log (f(z)/z)$ for $z = e^{i\theta}$ may be written as $\log \rho[\phi(\theta)] + i(\phi(\theta) - \theta)$. Hence by Fatou's formula, $\phi(\theta) - \theta = (1/2\pi)\int_0^{\pi} \{\log \rho[\phi(\theta+t)] - \log \rho[\phi(\theta-t)]\} \cot (t/2)dt \equiv H[\phi(\theta)]$, and the function $\phi(\theta)$ may thus be determined by solving this integral equation. Theodorsen (National Advisory Committee for Aeronautics, Report 411, 1932) and Theodorsen and Garrick (National Advisory Committee for Aeronautics, Report 452, 1933) developed a practical method for computing a solution of this equation by successive approximations. In the present paper the theoretical basis of this method is studied. Sufficient conditions for the curve C are established under which the approximations $\phi_0(\theta) \equiv \theta$, $\phi_n(\theta) = H[\phi_{n-1}(\theta)]$ and their derivatives $\phi_n'(\theta)$ converge to $\phi(\theta)$ and $\phi'(\theta)$ respectively, and the errors $|\phi_n(\theta) - \phi(\theta)|$ and $|\phi_n'(\theta) - \phi'(\theta)|$ are estimated. (Received October 27, 1943.)

Applied Mathematics

38. L. W. Cohen and S. M. Ulam: *On the algebra of systems of vectors and some problems in kinematics.*

The properties of equivalence for systems of vectors as postulated for the mechanics of rigid bodies are studied in linear spaces. It is proved that any finite system of vectors in n-space is equivalent to a unique system of vectors collinear with the edges of an n-simplex. It is also proved that any such system is equivalent to a system of $[n/2]+1$ vectors. Similar theorems hold for infinitely many vectors and for spaces of infinitely many dimensions. The problem of topological invariants of trajectories of systems of n points with respect to arbitrary motions of the coordinate system is formulated and results are obtained for the case of three points. (Received October 22, 1943.)

39. A. H. Copeland: *The nature of turbulence.*

There are exhibited in this paper a number of flows which consist of series of disturbances distributed temporally but unfortunately not specially at random, and which satisfy the hydrodynamic equations together with appropriate boundary con-