

Zeitschrift: L'Enseignement Mathématique
Herausgeber: Commission Internationale de l'Enseignement Mathématique
Band: 25 (1979)
Heft: 1-2: L'ENSEIGNEMENT MATHÉMATIQUE

Artikel: RECENT PROGRESS IN THE THEORY OF MINIMAL SURFACES
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Kapitel: I. Introduction
DOI: <https://doi.org/10.5169/seals-50368>

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RECENT PROGRESS IN THE THEORY OF MINIMAL SURFACES ¹

by E. BOMBIERI

I. INTRODUCTION

In this talk I will report on some recent results in the theory of minimal surfaces. Many of them belong to the theory of higher dimensional minimal varieties and all of them are related to the point of view of Geometric Measure Theory and the Calculus of Variations. The important approach to the various aspects of the 2-dimensional Plateau problem provided by harmonic maps and the Hilbert space setting, will not be treated here. I should also stress the fact that this report is not and does not intend to be a survey of all important achievements of the last years, but rather its purpose is to present a few recent results connected with the central problems of the theory, namely existence, uniqueness and regularity of solutions to the Plateau problem from the point of view of the Calculus of Variations.

II. CURRENTS AND VARIFOLDS

Let U be an open set of \mathbf{R}^n and let T be a distribution on smooth differential m -forms φ with compact support in U . The boundary of T is the distribution defined by $(\partial T)(\psi) = T(d\psi)$ where d is the exterior differential; clearly ∂T is a distribution on $(m-1)$ -forms. If T and ∂T are continuous with respect to the L^∞ topology on forms, one says that T is locally normal, and if in addition T has compact support in U one says that T is normal. Normal currents form a Banach space in the following way. Let $M(\varphi)$ be a norm on m -forms, and let $M(T)$ be the dual norm

$$M(T) = \sup \{T(\varphi); M(\varphi) \leq 1\};$$

then $N(T) = M(T) + M(\partial T)$ is a norm in the space of normal currents. There is a very special norm on forms, called comass, such that the dual norm, called mass, coincides with m -dimensional area in case T is integra-

¹) This article has already been published in *Contributions to Analysis*, papers communicated to an international Symposium in honour of A. Pfluger, ETH Zürich, April 1978. Monographie de l'Ens. Math. N° 27, Genève 1979.