

NONLINEAR ELLIPTIC BOUNDARY VALUE PROBLEMS FOR EQUATIONS WITH RAPIDLY (OR SLOWLY) INCREASING COEFFICIENTS

BY

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ABSTRACT. Variational boundary value problems for quasilinear elliptic systems in divergence form are studied in the case where the nonlinearities are nonpolynomial. Monotonicity methods are used to derive several existence theorems which generalize the basic results of Browder and Leray-Lions. Some features of the mappings of monotone type which arise here are that they act in nonreflexive Banach spaces, that they are unbounded and not everywhere defined, and that their inverse is also unbounded and not everywhere defined.

Introduction. This paper is concerned with the existence of solutions for variational boundary value problems for quasilinear elliptic systems in divergence form

$$(*) \quad A(u) = \sum_{|\alpha| \leq m} (-1)^{|\alpha|} D^\alpha A_\alpha(x, u, \dots, \nabla^m u)$$

on open subsets Ω of $\mathbb{R}^n$. Existence theorems for problems of this type were first obtained by Višik [34], [35] using compactness arguments and a priori estimates on $(m+1)$ st derivatives. Since 1963, these problems have been extensively studied by Browder and others in the context of the theory of mappings of monotone type from a reflexive Banach space to its dual and in the case where the coefficients A_α have polynomial growth in u and its derivatives. Basic improvements of Browder's original results [3] were given by Leray-Lions [25] where the monotonicity conditions imposed on A involve only the variation of A_α , $|\alpha| = m$, with respect to the top order derivatives $\nabla^m u$, and by Browder [7], [8] where the usual coercivity assumption is replaced either by a local a priori bound and a stronger monotonicity condition or by a global a priori bound and some oddness condition.

It is our purpose here to extend the existence theorems of [3], [25], [7], [8]

Presented to the Society, April 1, 1972 under the title *Quasilinear elliptic equations with rapidly increasing coefficients*; received by the editors December 2, 1972.

AMS (MOS) subject classifications (1970). Primary 47H05, 35K65; Secondary 46B10.

Key words and phrases. Quasilinear elliptic systems, nonpolynomial nonlinearities, existence theorems, nonlinear monotone mappings, nonlinear pseudomonotone mappings, Orlicz-Sobolev spaces, nonreflexive Banach spaces, complementary systems, noncoercive problems, local a priori bound.

Nonlinear Elliptic Boundary Value Problems And Their Applications

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