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An existence result for a quadrature surface free boundary problem. (English) Zbl 1207.35106

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Summary: The aim of this paper is to present two different approaches in order to obtain an existence result to the so-called quadrature surface free boundary problem. The first one requires the shape derivative calculus while the second one depends strongly on the compatibility condition of the Neumann problem. A necessary and sufficient condition of existences is given in the radial case.

MSC:

35J05 Laplace operator, Helmholtz equation (reduced wave equation), Poisson equation

35A35 Theoretical approximation in context of PDEs

Cited in **3** Documents

Keywords:

Dirichlet problem; Neumann problem; quadrature surface; maximum principle, shape optimization; optimality conditions

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References:

[1] H.W. Alt and L.A. Caffarelli: "Existence and regularity for a minimum problem with free boundary", J. Reine angew. Math., Vol. 325, (1981), pp. 105-144. · Zbl 0449.35105

[2] M. Barkatou, D. Seck and I. Ly: "An existence result for a free boundary problem for the p-Laplace operator", submitted. · Zbl 1207.35106

[3] M. Barkatou: "Some geometric properties for a class of non Lipschitz-domains", New York J. of Math., Vol. 8, (2002), pp. 189-213. · Zbl 1066.35028

[4] M. Barkatou: "Existence of quadrature surfaces for a uniform density supported by a segment", submitted. · Zbl 1160.35380

[5] J.A. Bello, E. Fernandez-Cara, J. Lemoine and J. Simon: "On drag differentiability for Lipschitz domains", Control of Part. Diff. Eq. and Appl., Lec. Notes In Pure and Applied Math. Series, Vol. 174, (1995), Dekker, New York. · Zbl 0860.35093

[6] A. Beurling: "On free-boundary problems for the Laplace equation", Sem. Anal. Funct., Inst. Adv. Study Princeton, Vol. 1, (1957), pp. 248-263.

[7] D. Bucur and P. Trebeschi: "Shape Optimization Problems Governed by Nonlinear State Equations", Proc. Roy. Sc. Edinburgh, Vol. 128 A (1998), pp. 945-963. · Zbl 0918.49030

[8] D. Bucur and J.P. Zolesio: "N-dimensional shape optimization under capacitary constraints", J. Diff. Eq., Vol. 123(2), (1995), pp. 504-522. http://dx.doi.org/10.1006/jdeq.1995.1171 · Zbl 0847.49029

[9] G. Buttazzo, V. Ferone and B. Kawhol: "Minimum problems over sets of concave functions and related questions", Math. Nachr., (1995), pp. 71-89. · Zbl 0835.49001

[10] T. Carleman: "Über ein Minimumproblem der mathematischen Physik",Math. Z.,Vol. 1, (1918),pp.208-212. http://dx.doi.org/10.1007/BF01203612 · Zbl 46.0765.02

[11] D. Chenais, "On the existence of a solution in a domain identification problem", J. Math. Anal. Appl., Vol. 52, (1975), pp. 189-289. http://dx.doi.org/10.1016/0022-247X(75)90091-8

[12] R. Dautray and J.L. Lions: Analyse mathématique et calcul numérique pour les sciences et les techniques, Vol. 1, 2, Masson, Paris, 1984

[13] E. DiBendetto: " C 1+⊠ local regularity of weak solutions of degenerate elliptic equations", Nonlinear Analysis., Vol. 7, (1983), pp. 827-850. http://dx.doi.org/10.1016/0362-546X(83)90061-5

[14] K. Friedrichs: "Über ein Minimumproblem für Potentialströmungen mit freiem Rand".Math. Ann.,Vol. 109, (1934),pp.208-212.

[15] G. Gidas, Wei-Ming Ni and L. Nirenberg: "Symmetry and related properties via the maximum principle",Comm. Math. Phys., Vol. 68, (1979),pp.209-300. http://dx.doi.org/10.1007/BF01221125 · Zbl 0425.35020

[16] B. Gustafsson and H. Shahgholian: "Existence and geometric properties of solutions of a free boundary problem in potential theory", J. Reine angew. Math., Vol. 473, (1996), pp. 137-179. · Zbl 0846.31005

[17] A. Henrot: "Subsolutions and supersolutions in a free boundary problem", Arkiv för Math., Vol. 32(1), (1994), pp. 79-98. · Zbl 0809.35172

[18] H. Hosseinzadeh and H. Shahgholian: "Some qualitative aspects of a free boundary problem for the p-Laplacian", Ann. Acad. Scient. Fenn. Math., Vol. 24, (1999), pp. 109-121. · Zbl 0914.35149

[19] D. Gilbarg and N.S. Trudinger: Elliptic partial equations of second order, Springer-Verlag, 1983. · Zbl 0562.35001

[20] M.V. Keldyš: "On the solvability and the stability of the Dirichlet problem", Amer. Math. Soc. Trans., Vol. 51 (2), (1966), pp. 1-73.

[21] J.L. Lewis: "Regularity of the derivatives of solutions to certain degenerate elliptic equations", Indiana Univ. Math. J., Vol. 32, (1983), pp. 849-858. http://dx.doi.org/10.1512/iumj.1983.32.32058 · Zbl 0554.35048

[22] G.M. Lieberman: "Boundary regularity for solutions of degenerate elliptic equations", Nonlinear Analysis., Vol. 12, (1988), pp. 1203-1219. http://dx.doi.org/10.1016/0362-546X(88)90053-3

[23] V. Mikhailov: Équation aux dérivées partielles, Mir, Moscow, 1980.

[24] F. Murat and J. Simon: "Quelques résultats sur le contrôle par un domaine géométrique", Publ. du labo. d'Anal. Num., Paris VI, (1974), pp. 1-46.

[25] O. Pironneau: Optimal shape design for elliptic systems, Springer series in Computational Physics, Springer, New York, 1984.

[26] J. Serrin: "A symmetry problem in potential theory",Arch. Rat. Mech. Anal.,Vol. 43, (1971),pp.304-318. http://dx.doi.org/10.1007/BF00250468 · Zbl 0222.31007

[27] H. Shahgholian: "Quadrature surfaces as free boundaries", Arkiv för Math., Vol. 32(2), (1994), pp. 475-492. · Zbl 0827.31004

[28] J. Sokolowski and J.P. Zolesio: Introduction to shape optimization: shape sensitity analysis, Springer Series in Computational Mathematics, Vol. 10, Springer, Berlin, 1992.

[29] P. Tolksdorf: "On the Dirichlet problem for quasilinear equations in domains with conical boundary points", Comm. Partial Differential Equations, Vol. 8(7), (1983), pp. 773-817. · Zbl 0515.35024