

On the Occasion of the 70th Birthday of Vladimir Maz'ya

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This volume includes a selection of lectures given at the International Workshop “Analysis, Partial Differential Equations and Applications”, held at the Mathematical Department of Sapienza University (Rome, June 30th–July 3rd, 2008), on the occasion of the 70th birthday of Vladimir Maz'ya.

Besides Italy, twenty seven countries were represented there: Belarus, Canada, China, Colombia, Croatia, Czech Republic, Finland, France, Georgia, Germany, Greece, Israel, Mexico, New Zealand, Poland, Portugal, Rumania, Russia, Saudi Arabia, South Korea, Spain, Sweden, Taiwan, The Netherlands, Turkey, United Kingdom, and United States of America.

It is not surprising that the decision of the Italian National Institute for Advanced Mathematics “F. Severi” (INDAM) to dedicate a Workshop to Vladimir Maz'ya was crowned by such great success. The scientific and human endowments of Maz'ya are well known.

He has inspired numerous researchers in Analysis and its applications, among them many in Italy. Maz'ya gladly acknowledges that this inspiration has been mutual. The Italian school of Analysis and PDEs has played an important role in his development, starting with his undergraduate years 1955–1960 and continuing to this day. As a third year student, through S. Mikhlin's lectures, he became acquainted with Tricomi's pioneering work on multi-dimensional singular integrals [37], [38], a topic of Maz'ya's keen interest in the future ([14], [21] and others). A year later, Vladimir discovered the equivalence of various Sobolev type inequalities with isoperimetric and isocapacitary inequalities, which strongly influenced functional analysis and partial differential equations in subsequent years. In particular, he found the sharp constant in the E. Gagliardo inequality between the $L_{n/(n-1)}$ norm of a function and the L_1 norm of its gradient [10]. Later Gagliardo's results on boundary traces of Sobolev functions were developed by Maz'ya and his colleagues in various directions (see, for example, [24], [33], [34]).

Following Mikhlin's recommendation, Maz'ya read the Russian translation of Carlo Miranda's “Equazioni alle Derivate Parziali di Tipo Ellittico” [36], which had appeared in 1957 in Moscow. This comprehensive survey of the Italian contribution

to the field, which at that time was undergoing a major expansion, became the first book on PDEs to be read by the young Maz'ya. Miranda's book strongly influenced the shaping of Vladimir's professional interests. An evidence to this is his first publication which appeared in [9] exactly 50 years ago.

The year 1957 saw the appearance of the seminal article by E. De Giorgi on the Hölder regularity of solutions to elliptic second-order equations with measurable bounded coefficients, which had a tremendous impact on the theory of PDEs, not least the work of Maz'ya. In the article [11] of 1961, he solved a problem posed by G. Stampacchia on an estimate of weak solutions to the equations just mentioned. One of the original traits of this short paper was a characterization of the boundary in terms of an isoperimetric function introduced by the author, which enabled him to study the sharp dependence of the regularity properties of solutions to the Neumann problem on the behaviour of the boundary. A detailed exposition of this work, containing a wealth of new ideas, was published in [18], 1969.

In [12], 1963, Maz'ya obtained his famous estimate of the continuity modulus of a solution to the Dirichlet problem near a boundary point, formulated in terms of the Wiener integral (see also [15], [16]). Later, a result of the same nature was obtained by him for nonlinear equations including the p -Laplacian [19]. It is noteworthy that the classical paper by Littman, Stampacchia and Weinberger [8] on the Wiener regularity of a boundary point was translated into Russian by Maz'ya for the Moscow collection of translations "Matematika" from a preprint, even before its publication in a journal.

Of exceptional importance were Maz'ya's counterexamples relating to the 19th and 20th Hilbert problems for higher-order elliptic equations which appeared in [17], 1968, independently of and simultaneously with analogous counterexamples of E. De Giorgi and E. Giusti–M. Miranda.

The results of L. Cesari, R. Caccioppoli and especially E. De Giorgi on generalization of the notion of the surface area on nonsmooth surfaces played an important role in the pioneering research of Maz'ya and his coauthors in the theory of harmonic potentials on nonsmooth domains as well as in the theory of spaces of functions with bounded variation [1], [13], [2], [3].

Influence of G. Cimmino's results of 1937 [4] on the Dirichlet problem with boundary data in L_p as well as G. Fichera's unified theory of elliptic-parabolic equations [5] can be traced in Maz'ya's breakthrough work on the generic degenerating oblique derivative problem [20].

One of the fundamental results in the theory of partial differential equations, the C. Miranda–Sh. Agmon maximum principle for higher-order elliptic equations, was crucially developed by Maz'ya and his collaborators in several directions: polyhedral domains [23], sharp constants [22], parabolic systems [7].

The above, by necessity a rather incomplete survey, clearly shows that the Italian school stimulated the early work of Maz'ya in spite of the iron curtain. With time the contacts became bilateral and even personal. At the moment, Maz'ya is collaborating with a number of Italian mathematicians which can be seen, for instance, in some papers included into the present volume.

It is impossible in this short article to recall all Maz'ya's important achievements. In order to give an impression of the phenomenal variety of his results and without aiming at completeness we would like only to list certain fields he contributed to:

1. Equivalence of isoperimetric and integral inequalities
2. Theory of capacities and nonlinear potentials
3. Counterexamples related to the 19th and 20th Hilbert problems
4. Boundary behaviour of solutions to elliptic equations in general domains
5. Non-elliptic singular integral and pseudodifferential operators
6. Degenerating oblique derivative problem
7. Estimates for general differential operators
8. The method of boundary integral equations
9. Linear theory of surface waves
10. The Cauchy problem for the Laplace equation
11. Theory of multipliers in spaces of differentiable functions
12. Characteristic Cauchy problem for hyperbolic equations
13. Boundary value problems in domains with piecewise smooth boundaries
14. Asymptotic theory of differential and difference equations with operator coefficients



Accademia Nazionale dei Lincei, Rome. From left to right: Ennio De Giorgi, Gaetano Fichera, Vladimir Maz'ya and Giorgio Salvini (President of the Accademia).

15. Maximum modulus principle for elliptic and parabolic systems, contractivity of semigroups
16. Iterative procedures for solving ill-posed boundary value problems
17. Asymptotic theory of singularly perturbed boundary value problems
18. “Approximate approximations” and their applications
19. Wiener test for higher-order elliptic equations
20. Spectral theory of the Schrödinger operator
21. Navier-Stokes equations
22. History of Mathematics

On the occasion of Maz’ya’s 60th birthday, two international conferences were held, at the University of Rostock in 1998 and at the École Polytechnique in Paris in 1998. We mention also the Nordic-Russian Symposium which was held in Stockholm in honor of his 70th birthday in 2008.

The initiative to dedicate an INDAM Workshop to Vladimir Maz’ya came from the authors of this paper, former students of Gaetano Fichera. Maz’ya and Fichera first met in the USSR in the early seventies. A story of their friendship and mathematical interaction was recounted in Maz’ya’s article [25]. Together they wrote an article in honor of S. Mikhlin on the occasion of his birthday in 1978 [6]. Because of Maz’ya’s ability to give complete solutions to problems which are generally considered as unsolvable, Fichera once compared Maz’ya with Santa Rita, the 14th century Italian nun who is the Patron Saint of Impossible Causes.

We are sure that Vladimir Maz’ya has kept the energy of his younger age, and after nearly thirty published volumes and more than four hundred scientific articles, he is able to deal with his “impossible” problems. During the last decade he published five new books (see [B2], [B4], [B5], [B8], [B9] in the list of Maz’ya’s books), and more than 130 papers. In particular, recently Maz’ya obtained a breakthrough necessary and sufficient condition of Wiener type for regularity of a boundary point for higher-order elliptic equations [26], he had found several deep analytic criteria in the spectral theory of second-order differential operators [27], [30], [31], and solved a long-standing Gelfand’s problem concerning the discreteness criterion for the Schrödinger operator [28]. He has also found sharp two-sided estimates for the first eigenvalue of the Laplacian formulated in terms of the capacitary interior diameter [29], obtained a new class of uniform asymptotic approximations of Green’s kernels for singularly perturbed domains [32] and proposed an ingenious method for the asymptotic treatment of boundary value problems in perforated domains [35]. A joint book with A. Soloviev on boundary integral equations in domains with peaks will be published soon by Birkhäuser [B1] and an extended version of Maz’ya’s classical monograph on Sobolev spaces will appear in Springer.

We congratulate Vladimir Maz’ya with his birthday and wish him every joy, happiness and great fulfillment in the years to come.

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References

- [1] Yu.D. Burago, V.G. Maz'ya, V.D. Sapožnikova, *On the double layer potential for nonregular domains*. (Russian) Dokl. Akad. Nauk SSSR **147**, 1962, 523–525.
- [2] Ju.D. Burago, V.G. Maz'ya, V.D. Sapožnikova, *On the theory of potentials of a double and a simple layer for regions with irregular boundaries*. (Russian) 1966 Problems Math. Anal. Boundary Value Problems Integr. Equations 3–34, 1966.
- [3] Yu.D. Burago, V.G. Maz'ya, *Certain Questions of Potential Theory and Function Theory for Regions with Irregular Boundaries*. (Russian) Zap. Naučn. Sem. Leningrad. Otdel. Mat. Inst. Steklov. (LOMI) **3**, 1967, 152 pp; English translation: Potential Theory and Function Theory for Irregular Regions. Translated from Russian. Seminars in Mathematics, V.A. Steklov Mathematical Institute, Leningrad, Vol. 3 Consultants Bureau, New York 1969 vii+68 pp.
- [4] G. Cimmino, *Nuovo tipo di condizioni al contorno e nuovo metodo di trattazione per il problema generalizzato di Dirichlet*, Rend. Circ. Mat. Palermo, **61**, 1937, 117–221.
- [5] G. Fichera, *On a unified theory of boundary value problems for elliptic-parabolic equations of second order*, Comm. Pure Appl. Math. **13**, 1960, 457–468.
- [6] G. Fichera, V.G. Maz'ya, *In honor of Professor Solomon G. Mikhlin on the occasion of his seventieth birthday*, Applicable Analysis, **7**, 1978, 167–170.
- [7] G.I. Kresin, V.G. Maz'ya, *On the maximum modulus principle for linear parabolic systems with zero boundary data*. Functional Differential Equations **5**:1–2, 1998, 165–181.
- [8] W. Littman, G. Stampacchia, H.F. Weinberger, *Regular points for elliptic equations with discontinuous coefficients*, Ann. Scuola Norm. Sup. Pisa (3) **17**, 1963, 43–77.
- [9] V.G. Maz'ya, *Solution of Dirichlet's problem for an equation of elliptic type*. Dokl. Akad. Nauk SSSR **129**, 1959, 257–260.
- [10] V.G. Maz'ya, *Classes of domains and imbedding theorems for function spaces*. Soviet Math. Dokl. **133**:1, 1960, 882–885.

- [11] V.G. Maz'ya, *Some estimates of solutions of second-order elliptic equations*. Dokl. Akad. Nauk SSSR **137**, 1961, 1057–1059.
- [12] V.G. Maz'ya, *On the boundary regularity of solutions of elliptic equations and of a conformal mapping*. Dokl. Akad. Nauk SSSR **152**, 1963, 1297–1300.
- [13] V.G. Maz'ya, V.D. Sapozhnikova, *Solution of the Dirichlet and Neumann problems for irregular domains by potential-theoretic methods*. Dokl. Akad. Nauk SSSR **159**, 1964, 1221–1223.
- [14] V.G. Maz'ya, B.A. Plamenevskii, *On singular equations with a vanishing symbol*. Dokl. Akad. Nauk SSSR **160**, 1965, 1250–1253.
- [15] V.G. Maz'ya, *On the modulus of continuity of a solution of the Dirichlet problem near an irregular boundary*. 1966 Problems Math. Anal. Boundary Value Problems Integr. Equations, pp. 45–58 Izdat. Leningrad. Univ., Leningrad.
- [16] V.G. Maz'ya, *The behavior near the boundary of the solution of the Dirichlet problem for an elliptic equation of the second order in divergence form*. Mat. Zametki **2**, 209–220.
- [17] V.G. Maz'ya, *Examples of nonregular solutions of quasilinear elliptic equations with analytic coefficients*. Funkcional. Anal. i Priložen. **2**:3, 1968, 53–57.
- [18] V.G. Maz'ya, *Weak solutions of the Dirichlet and Neumann problems*. Trudy Moskov. Mat. Obšč. **20**, 1969, 137–172.
- [19] V.G. Maz'ya, *The continuity at a boundary point of the solutions of quasi-linear elliptic equations*. Vestnik Leningrad. Univ. **25**:13, 1970, 42–55; English translation: Vestnik Leningrad. Univ. Math. **3**, 1976, 225–242.
- [20] V.G. Maz'ya, *The degenerate problem with an oblique derivative*. Mat. Sb. (N.S.) **87** (129), 1972, 417–454.
- [21] V.G. Maz'ya, B. Paneyah, *Degenerate elliptic pseudo-differential operators and the problem with oblique derivative*. Collection of articles dedicated to the memory of Ivan Georgievich Petrovskii. Trudy Moskov. Mat. Obšč. **31**, 1974, 237–295.
- [22] V.G. Maz'ya, G.I. Kresin, *The maximum principle for second-order strongly elliptic and parabolic systems with constant coefficients*. Mat. Sb. (N.S.) **125**(167):4, 1984, 458–480.
- [23] V.G. Maz'ya, J. Rossmann, *On the Agmon-Miranda maximum principle for solutions of elliptic equations in polyhedral and polygonal domains*. Ann. Global Anal. Geom. **9**:3, 1991, 253–303.
- [24] V.G. Maz'ya, S. Poborchi, *Differentiable Functions on Bad Domains*. World Scientific, 1997.
- [25] V. Maz'ya, *In memory of Gaetano Fichera*. Problemi Attuali dell'Analisi e della Fisica Matematica, 1–4, 2000, Aracne.
- [26] V. Maz'ya, *The Wiener test for higher-order elliptic equations*, Duke Mathematical Journal, **115**:3, 2002, 479–512.
- [27] V. Maz'ya, I. Verbitsky, *The Schrödinger operator on the energy space: boundedness and compactness criteria*, Acta Mathematica, **188**, 2002, 263–302.
- [28] V. Maz'ya, M. Shubin, *Discreteness of spectrum and positivity criteria for Schrödinger operators*, Annals of Mathematics, **162**, 2005, 1–24.
- [29] V. Maz'ya, M. Shubin, *Can one see the fundamental frequency of a drum?*, Letters in Mathematical Physics, **74**, no. 2, 2005, 135–151.

- [30] V. Maz'ya, I. Verbitsky, *Infinitesimal form boundedness and Trudingers subordination for the Schrödinger operator*, *Inventiones Mathematicae*, **161**, 2005, 81–136.
- [31] V. Maz'ya, *Analytic criteria in the qualitative spectral analysis of the Schrödinger operator*, *Spectral theory and mathematical physics: a Festschrift in honor of Barry Simons 60th birthday*, *Proc. Sympos. Pure Math.*, Part 1, Amer. Math. Soc., Providence, RI, 76, pp. 257–288, 2007.
- [32] V. Maz'ya, A. Movchan, *Uniform asymptotics of Greens kernels for mixed and Neumann problems in domains with small holes and inclusions*, *Sobolev Spaces in Mathematics III. Applications in Mathematical Physics*, pp. 277–316, Springer, 2008.
- [33] V. Maz'ya, T. Shaposhnikova, *Theory of Sobolev Multipliers with Applications to Differential and Integral Operators*, *Grundlehren der Mathematischen Wissenschaften*, vol. 337, Springer, 2008.
- [34] V. Maz'ya, M. Mitrea, T. Shaposhnikova, *The Dirichlet problem in Lipschitz domains with boundary data in Besov spaces for higher-order elliptic systems with rough coefficients*, *Journal de Mathématiques Pures et Appliquées*, 2009, to appear.
- [35] V. Maz'ya, A. Movchan, *Asymptotic treatment of perforated domains without homogenization*, *Math. Nachr.* 2009, to appear.
- [36] C. Miranda, *Equazioni alle Derivate Parziali di Tipo Ellittico*, Springer, 1955.
- [37] F.G. Tricomi, *Formula d'inversione dell'ordine di due integrazioni doppie "con asterisco"*, *Rend. Lincei*, **3:6**, 1926, 535–539.
- [38] F.G. Tricomi, *Equazioni integrali contenenti il valor principale di un integrale doppio*, *Math. Zeitschrift*, **27**, 1927, 87–133.

Books by Vladimir Maz'ya

- [B1] *Boundary Integral Equations on Contours with Peaks*, (with A. Soloviev), to appear in Birkhäuser.
- [B2] *Theory of Sobolev Multipliers with Applications to Differential and Integral Operators*, (with T. Shaposhnikova) *Grundlehren der Mathematischen Wissenschaften*, vol. 337, Springer, 2009.
- [B3] *Jacques Hadamard, Legend of Mathematics* (with T. Shaposhnikova). MCNMO Publishers, Moscow, 2008 (revised, extended, and authorized translation from English to Russian).
- [B4] *Approximate Approximations* (with G. Schmidt), American Mathematical Society, 2007.
- [B5] *Sharp Real-Part Theorems. A Unified approach* (with G. Kresin), *Lecture Notes in Mathematics*, No. 1903, Springer, 2007.
- [B6] *Imbedding and Extension Theorems for Functions in Non-Lipschitz Domains* (with S. Poborchi), St. Petersburg University Publishers, 2007.
- [B7] *Jacques Hadamard, un Mathématicien Universel* (with T. Shaposhnikova), *EDP Sciences*, Paris, 2005 (revised and extended translation from English).
- [B8] *Linear Water Waves. A Mathematical Approach* (with N. Kuznetsov and B. Vainberg), Cambridge University Press, 2002.
- [B9] *Spectral Problems Associated with Corner Singularities of Solutions to Elliptic Equations* (with V. Kozlov and J. Rossmann), *Mathematical Surveys and Monographs*, vol. 85, American Mathematical Society, 2000.

- [B10] Asymptotic Theory of Elliptic Boundary Value Problems in Singularly Perturbed Domains, vol. 2 (with S. Nazarov and B. Plamenevskij), Operator Theory. Advances and Applications, vol. 112, XXIII+323, Birkhäuser, 2000.
- [B11] Asymptotic Theory of Elliptic Boundary Value Problems in Singularly Perturbed Domains, vol. 1 (with S. Nazarov and B. Plamenevskij), Operator Theory. Advances and Applications, vol. 111, XXIII+435, Birkhäuser, 2000.
- [B12] Differential Equations with Operator Coefficients (with V. Kozlov), Springer Monographs in Mathematics, Springer-Verlag, 1999.
- [B13] Asymptotic Analysis of Fields in Multistructures (with V. Kozlov and A. Movchan), Oxford Science Publications, 1999.
- [B14] Jacques Hadamard, a Universal Mathematician (with T. Shaposhnikova), American Mathematical Society and London Mathematical Society, 1998.
- [B15] Differentiable Functions on Bad Domains (with S. Poborchi), World Scientific, 1997.
- [B16] Theory of a Higher-order Sturm-Liouville Equation (with V. Kozlov), Springer-Verlag, Lecture Notes in Mathematics, 1997.
- [B17] Elliptic Boundary Value Problems in Domains with Point Singularities (with V. Kozlov and J. Rossmann), American Mathematical Society, 1997.
- [B18] Asymptotische Theorie Elliptischer Randwertaufgaben in Singulär Gestörten Gebieten II (with S. Nazarov and B. Plamenevskii), Berlin, Akademie Verlag, Bd. 2, 1992.
- [B19] Asymptotische Theorie Elliptischer Randwertaufgaben in Singulär Gestörten Gebieten I (with S. Nazarov and B. Plamenevskii), Berlin, Akademie Verlag, 1991.
- [B20] Elliptic Boundary Value Problems (with N. Morozov, B. Plamenevskii, L. Stupyalis), American Mathematical Society Translations, Ser. 2, Vol. 123, 1984, AMS.
- [B21] Encyclopaedia of Mathematical Sciences, Vol. 27, Analysis IV, Linear and Boundary Integral Equations, V.G. Maz'ya, S.M. Nikol'skii (Eds.), Contributors: V.G. Maz'ya, S. Prössdorf, Springer-Verlag, 1991, V.G. Maz'ya: Boundary Integral Equations.
- [B22] Encyclopaedia of Mathematical Sciences, Vol. 26, Analysis III, Spaces of Differentiable Functions, S.M. Nikol'skii (Ed.), Contributors: L.D. Kudryavtsev, V.G. Maz'ya, S.M. Nikol'skii, Springer-Verlag, 1990, V.G. Maz'ya: Classes of Domains, Measures and Capacities in the Theory of Differentiable Functions.
- [B23] Theory of Multipliers in Spaces of Differentiable Functions (with T. Shaposhnikova), Pitman, 1985 (Russian version: Leningrad University Press, 1986).
- [B24] Sobolev Spaces, Springer-Verlag, 1985 (Russian version: Leningrad University Press, 1985).
- [B25] Abschätzungen für Differentialoperatoren im Halbraum (with I. Gelman), Berlin, Akademie Verlag, 1981; Birkhäuser, 1982.
- [B26] Zur Theorie Sobolewsche Räume, Series: Teubner-Texte zur Mathematik BSB B.G. Teubner Verlagsgesellschaft, Leipzig, 1981.
- [B27] Einbettungssätze für Sobolewsche Räume, Teil 2, Series: Teubner-Texte zur Mathematik, Band 28, BSB B.G. Teubner Verlagsgesellschaft, Leipzig, 1980.
- [B28] Einbettungssätze für Sobolewsche Räume, Teil 1, Series: Teubner-Texte zur Mathematik BSB B.G. Teubner Verlagsgesellschaft, Leipzig, 1979.

- [B29] Potential Theory and Function Theory for Irregular Regions (with Yu. Burago) Seminars in Mathematics, Steklov Institute, Leningrad, Vol. 3, Consultants Bureau, New York, 1969 (Russian version: 1967).

Books and articles in honor of Vladimir Maz'ya

- [H1] Two volumes of "The Maz'ya Anniversary Collection", edited by Rossmann, J., Takač, P., Wildenhain, Birkhäuser, 1999 (Vol. 1: On Maz'ya's Work in Functional Analysis, Partial Differential Equations and Applications; Vol. 2: Rostock Conference on Functional Analysis, Partial Differential Equations and Applications).
- [H2] Mathematical Aspects of Boundary Element Methods, dedicated to Vladimir Maz'ya on the occasion of his 60th birthday, edited by M. Bonnet, A.M. Sändig and W. Wendland, Chapman & Hall/CRC Research Notes in Mathematics, London, 1999.
- [H3] Perspectives in Partial Differential Equations, Harmonic Analysis and Applications: A Volume in Honor of Vladimir G. Maz'ya's 70th Birthday, edited by D. Mitrea and M. Mitrea, Proc. of Symposia in pure mathematics, Vol. 79, Amer. Math. Soc., Providence (R.I.), 2008.
- [H4] D. Eidus, A. Khvoles, G. Kresin, E. Merzbach, S. Pröbldorf, T. Shaposhnikova, P. Sobolevskii, *Mathematical work of Vladimir Maz'ya (on the occasion of his 60th birthday)*, Funct. Differ. Equ. 4 (1997), no. 1–2, pp. 3–11.
- [H5] M.S. Agranovich, Yu.D. Burago, V.P. Khavin, V.A. Kondratiev, V.P. Maslov, S.M. Nikol'skii, Yu.G. Reshetnyak, M.A. Shubin, B.R. Vainberg, M.I. Vishik, L.R. Volevich, *Vladimir G. Maz'ya, On the occasion of his 65th birthday*, Russian Journal of Mathematical Physics, Vol. 10, No. 3, 2003, pp. 239–244.
- [H6] M.S. Agranovich, Yu.D. Burago, B.R. Vainberg, M.I. Vishik, S.G. Gindikin, V.A. Kondrat'ev, V.P. Maslov, S.V. Poborchii, Yu.G. Reshetnyak, V.P. Khavin, M.A. Shubin, *Vladimir Gilelevich Maz'ya (on his 70th birthday)*, Russian Math. Surveys 63:1(2008), 189–196.
- [H7] Journal Vestnik St. Petersburg University: Mathematics 41:4, 2008.

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