# Igor Tsukerman

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# Education

**1988 Ph.D., Electrical Engineering**
St. Petersburg Polytechnic, Russia
Dissertation: "*Numerical Modeling of Quasi-Static Electromagnetic Fiel*ds".

**1982 B.Sc. / M.Sc. with honors, Control Systems**
St. Petersburg Polytechnic, Russia
Thesis: "*Molecular Dynamics of Thermal Fluctuations in Solids*".

# Work Experience

## The University of Akron, Ohio (since 1995)

Department of Electrical & Computer Engineering
Professor (since 2005), Associate Professor (2000–2005), Assistant Professor (1995–2000).

**Since 1995** The University of Akron, Ohio
Department of Electrical and Computer Engineering
Professor (since 2005), Associate Professor (2000–2005), Assistant Professor (1995–2000)

**Visiting positions**

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|---|---|
| **2018** | TU of Denmark, Photonics Engineering, Visiting Professor |
| **2018** | Università degli Studi di Napoli, Italy, Electrical Engineering, Visiting Professor |
| **2018** | The University of Texas at Austin, Visiting Scholar (J. T. Oden fellowship) |
| **2017** | Northwestern University, Department of Chemistry, Visiting Scholar |
| **2017 – 2018** | Nanyang Technological University, Division of Physics, Visiting Scholar |
| **2012** | ETH Zürich, Applied Mathematics, Visiting Scholar |
| **2011** | The University of Utah, Mathematics, Visiting Scholar |
| **2010 – 2011** | ENSAM Lille, France, Electrical Engineering, Visiting Professor |
| **2010 – 2011** | Hong Kong University, Electrical Engineering, Visiting Professor |
| **2010 – 2011** | Hong Kong University of Science & Technology, Physics, Visiting Professor |
| **2010** | Università degli Studi di Napoli, Italy, Electrical Engineering, Visiting Professor |
| **2010** | The University of Southern Denmark, Physics, Visiting Professor |
| **2010** | The University of Texas at Austin, Visiting Scholar (J. T. Oden fellowship) |
| **2010** | TU Graz, Austria, Electrical Engineering, Visiting Professor |
| **2002 – 2003** | Drexel University, Philadelphia PA, Visiting Professor |
| **2002 – 2003** | NEC Europe, Bonn, Germany, Visiting Researcher |

## The University of Toronto, Canada (1990 – 1995)

Department of Electrical & Computer Engineering
Principal Research Associate

- R&D project with GE Canada on electromechanical analysis and noise reduction in electric machines.
- Finite element software package TSTEP for time-dependent fields, currents and forces.
- Fast multilevel solvers for electromagnetic problems.
- A new formulation of the coupled field-circuit-mechanical problem and an accurate method to compute electromagnetic forces.

## The Electrosila Research Institute, St. Petersburg, Russia (1982 – 1989)

Research Associate / Engineer

- Formulations, methods and software for simulation of time-varying electromagnetic fields.
- Analysis and design of superconducting generators.
- Efficient solvers for finite element systems.
- A number of finite element software packages.

### Research: applied electromagnetics and photonics, metamaterials, computational methods

- Nano-photonics: non-asymptotic and nonlocal effective medium theory; metamaterials and photonic crystals; backward waves and negative refraction; plasmon-enhanced devices.
- "Flexible Local Approximation Methods" – a new finite difference calculus with a broad range of applications.
- High-order nonreflecting boundary conditions.
- Singularity-free boundary equation methods.
- Simulation of electric machines.
- Molecular- and nanoscale simulation. Long-range electromagnetic interactions. Colloidal systems.
- Overlapping finite elements.
- Fast adaptive multigrid methods for electromagnetic applications.
- A novel theory of finite element approximation errors via the eigenvalues and singular values of stiffness and shape matrices.

### Teaching

Undergraduate: Programming for Engineers, Electromagnetic Fields, Tools for ECE, Signals and Systems, Circuits, Basis Electrical Engineering, Digital Logic Design.

Graduate: Digital Signal Processing, Random Signal Analysis, Electromagnetic Theory, Computer Simulation of Nanoscale Systems, Special problems.

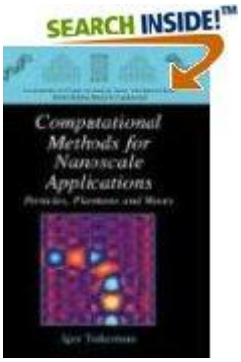
# Publications

Over 200 refereed publications, two books, six book chapters, Editor-in-Chief of a five-volume book set. Numerous conference papers. A list of publications appears below and is also available at http://blogs.uakron.edu/tsukerman

# List of Publications

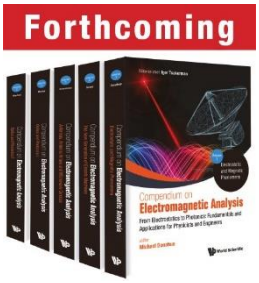
(Reprints of most papers available upon request)

## Books

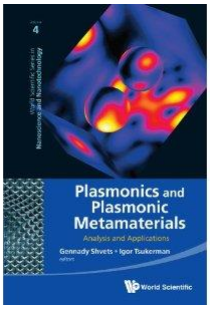



Igor Tsukerman, *Computational Methods for Nanoscale Applications: Particles, Plasmons, and Waves*. Springer, Nanostructure Science and Technology series, 2007.

[Second edition to be published in 2020.]




Compendium on Electromagnetic Analysis. From Electrostatics to Photonics: Fundamentals and Applications for Physicists and Engineers (in 5 Volumes). December 2019. Editor-in-chief: Igor Tsukerman




Plasmonics and Plasmonic Metamaterials: Analysis and Applications. Gennady Shvets, Igor Tsukerman (Eds.). World Scientific Publishing Company, 2011.

## Book Chapters

1. Fritz Kretzschmar, Sascha M. Schnepp, Herbert Egger, Farzad Ahmadi, Nabil Nowak, Vadim A. Markel, Igor Tsukerman,. The power of Trefftz approximations: Finite difference, boundary difference and discontinuous Galerkin methods; nonreflecting conditions and non-asymptotic homogenization. Lecture Notes in Computer Science, v. 9045, pp. 50-61, 2015.
2. Gennady Shvets, Igor Tsukerman, Preface to *Plasmonics and Plasmonic Metamaterials: Analysis and Applications*, World Scientific Publishing Co., 2011, pp. xiii–xvii.
3. Masha Sosonkina and Igor Tsukerman, Parallel solvers for flexible approximation schemes in multiparticle simulation, *Lecture Notes in Computer Science*, Springer: Berlin / Heidelberg, vol. 3991 (eds. Vassil N. Alexandrov, Geert Dick van Albada, Peter M.A. Sloot, Jack Dongarra), pp. 54−62, 2006. ISBN: 3-540-34379-2, ISSN: 0302-9743, DOI: 10.1007/11758501_12.
4. Achim Basermann, Igor Tsukerman, Parallel Generalized Finite Element Method for Magnetic Multiparticle Problems, *Springer Series: Lecture Notes in Computational Science and Engineering*, LNCS 3402, M. Daydé et al. (Eds.), pp. 325–339, 2005. http://www.springerlink.com/index/10.1007/11403937_26

5. Igor Tsukerman, Toward Generalized Finite Element Difference Methods for Electro- and Magnetostatics, *Springer Series: Mathematics in Industry*, Vol. 4, W.H.A. Schilders, Jan W. ter Maten, S.H.M.J. Houben, (Eds.), pp. 58−77, 2004. ISBN: 3-540-21372-4.
6. Th. Apel, M. Berzins, P.K. Jimack, G. Kunert, Alexander Plaks, Igor Tsukerman, M. Walkley, Mesh Shape and Anisotropic Elements: Theory and Practice, in *The Mathematics of Finite Elements and Applications X*, J.R. Whiteman (ed.), Elsevier: Amsterdam, 2000, pp. 367-376.
7. Adalbert Konrad, I.A. Tsukerman, Applications of Integral and Differential Methods to Electromagnetic Field Problems, in: *Finite Elements, Electromagnetics and Design*, S.R.H. Hoole (ed.), Elsevier: Amsterdam, 1995.

## Book Review

8. Igor Tsukerman, Book review: A. Bondeson, T. Rylander and P. Ingelström, Computational Electromagnetics, Springer, 2005. *SIAM Review*, vol. 49, No. 1, pp. 173–175, 2007.

## Refereed Journal Publications

9. Igor Tsukerman, Shampy Mansha, Y. D. Chong, V. A. Markel. Trefftz approximations in complex media: Accuracy and applications. Computers & Math with Appl 77(6), pp. 1770-1785, 2019.
10. Burak Tekgun, Yilmaz Sozer, Igor Tsukerman, Parag Upadhyay, Steven Englebretson. Core loss estimation in electric machines with flux-controlled core loss tester. IEEE Trans Industry Appl 55(2), pp. 1299-1308, 2019.
11. Igor Tsukerman, Classical and non-classical effective medium theories: New perspectives, *Physics Letters A* 381(19), 1635–1640, 2017.
12. Burak Tekgun, Yilmaz Sozer, Igor Tsukerman. Measurement of core losses in electrical steel in the saturation region under DC bias conditions, *IEEE Transactions on Industry Applications* 53(1), 88–96, 2017.
13. Vadim A. Markel and Igor Tsukerman, Applicability of effective medium description to photonic crystals in higher bands: Theory and numerical analysis. *Phys. Rev. B* 93, 224202, 2016.
14. Igor Tsukerman and Vadim A. Markel. Nonasymptotic homogenization of periodic electromagnetic structures: Uncertainty principles, *Phys Rev B* 93, 024418, 2016.
15. A. Paganini, L. Scarabosio, R. Hiptmair, I. Tsukerman. Trefftz approximations: a new framework for nonreflecting boundary conditions, *IEEE Trans on Magn.* 52(3), 7201604, 2016.
16. Burak Tekgun, Yilmaz Sozer, and Igor Tsukerman. Modeling and parameter estimation of split-phase induction motors, *IEEE Trans on Industry Applications*, 52(2), pp. 1431–1440, 2016.
17. Herbert Egger, Fritz Kretzschmar, Sascha M. Schnepp, Igor Tsukerman, Thomas Weiland. Transparent boundary conditions for a discontinuous Galerkin Trefftz method. *Applied Mathematics and Computation* 267, pp. 42–55, September 15, 2015.
18. Igor Tsukerman and Vadim A. Markel. A nonasymptotic homogenization theory for periodic electromagnetic structures, *Proc Royal Society A*, vol. 470, 2014.0245, 2014.
19. Fritz Kretzschmar, Sascha M. Schnepp, Igor Tsukerman, Thomas Weiland. Discontinuous Galerkin methods with Trefftz approximations, *J Comp & Applied Math*, vol. 270, pp. 211–222, 2014.
20. V. A. Markel and I. Tsukerman, Current-driven homogenization and effective medium parameters for finite samples, *Phys Rev B*, vol. 88, No. 12, article 125131, 2013.

21. X. Y. Z. Xiong, L. J. Jiang, V. A. Markel and I. Tsukerman. Surface waves in three-dimensional electromagnetic composites and their effect on homogenization, *Opt Express*, vol. 21, No. 9, pp. 10412–10421, 2013.
22. O. Alkhateeb, I. Tsukerman, A boundary difference method for electromagnetic scattering problems with perfect conductors and corners, *IEEE Trans on Antennas and Propagation*, vol. 61, No. 10, pp. 5117–5126, 2013.
23. D. H. Mac, S. Clenet, J. C. Mipo, I. Tsukerman, A priori error indicator in the transformation method for problems with geometric uncertainties, *IEEE Trans on Magn.*, vol. 49, No. 5, pp. 1597–1600, 2013.
24. Igor Tsukerman. Nonlocal homogenization of metamaterials by dual interpolation of fields. *JOSA B*, vol. 28, No. 12, pp. 2956–2965, 2011.
25. Anders Pors, Igor Tsukerman, and Sergey I. Bozhevolnyi. Effective constitutive parameters of plasmonic metamaterials: Homogenization by dual field interpolation. *Phys. Rev. E*, vol. 84, 016609 2011.
26. Igor Tsukerman, Effective parameters of metamaterials: a rigorous homogenization theory via Whitney interpolation, *J. Opt. Soc. Am. B*, vol. 28, 2011.
27. Jianhua Dai, Helder Pinheiro, J.P. Webb, Igor Tsukerman, Flexible approximation schemes with numerical and semi-analytical bases, *COMPEL*, vol. 30, No. 2, pp. 552–573, 2011.
28. Igor Tsukerman, A singularity-free boundary equation method for wave scattering, *IEEE Trans on Antennas and Propagation*, vol. 59, No. 2, pp. 555–562, 2011.
29. Guillaume Krebs, Stephane Clenet, Igor Tsukerman, Overlapping finite elements for arbitrary surfaces in 3-D, *IEEE Trans Magn*, vol. 46, No. 8, pp. 3473–3476, 2010.
30. Igor Tsukerman, Trefftz difference schemes on irregular stencils, *Journal of Computational Physics* 229, pp. 2948–2963, 2010.
31. Igor Tsukerman, Superfocusing by nanoshells, *Optics Lett*, vol. 34, No. 8, pp. 1057–1059, 2009.
32. Igor Tsukerman, Quasi-homogeneous backward-wave plasmonic structures: theory and accurate simulation, *J of Optics A: Pure and Applied Optics*, vol. 11, No 11, 114025, 2009.
33. Igor Tsukerman, František Čajko, Jianhua Dai, Electrodynamic analysis of plasmonic enhancement (*invited paper*), *NanoBiotechnology*. Published online: 30 January 2009. http://dx.doi.org/10.1007/s12030-008-9016-y
34. M. Brehm, A. Schliesser, F. Cajko, I. Tsukerman, and F. Keilmann, Antenna-mediated back-scattering efficiency in infrared near-field microscopy, *Opt. Express*, vol. 16, pp. 11203−11215, 2008.
35. Igor Tsukerman, Negative refraction and the minimum lattice cell size, *J. Opt. Soc. Am. B*, vol. 25, pp. 927−936, 2008.
36. František Čajko and Igor Tsukerman, Flexible approximation schemes for wave refraction in negative index materials, *IEEE Trans. Magn.*, vol. 44, No. 6, pp. 1378−1381, June 2008.
37. Igor Tsukerman and František Čajko, Photonic band structure computation using FLAME, *IEEE Trans. Magn.*, vol. 44, No. 6, pp. 1382−1385, June 2008.
38. Jianhua Dai, Igor Tsukerman, Flexible approximation schemes with adaptive grid refinement, *IEEE Trans. Magn.*, vol. 44, No. 6, pp. 1206−1209, June 2008.
39. Jianhua Dai, Igor Tsukerman, František Čajko, and Mark I. Stockman, Electrodynamic effects in plasmonic nanolenses, *Phys. Rev. B*, 77, 115419, 2008.

40. J. Dai, I. Tsukerman, A. Rubinstein, S. Sherman, New computational models for electrostatics of macromolecules in solvents, *IEEE Trans. Magn.*, Vol. 43, No. 4, pp. 1217−1220, 2007.
41. H. Pinheiro, J.P. Webb, I. Tsukerman, Flexible local approximation models for wave scattering in photonic crystal devices, *IEEE Trans. Magn.*, Vol. 43, No. 4, pp. 1321−1324, 2007.
42. Igor Tsukerman, A class of difference schemes with flexible local approximation, *The Journal of Computational Physics*, vol. 211, No. 2, pp. 659−699, 2006.
43. D. Mehtani, N. Lee, R.D. Hartschuh, A. Kisliuk, M.D. Foster, A.P. Sokolov, F. Čajko and I. Tsukerman, Optical properties and enhancement factors of the tips for apertureless near-field optics, *Journal of Optics A: Pure and Applied Optics*, vol. 8, S183−S190, 2006.
44. Igor Tsukerman, Electromagnetic applications of a new finite-difference calculus, *IEEE Trans. Magn.*, vol. 41, No. 7, pp. 2206−2225, 2005.
45. Igor Tsukerman, Flexible local approximation method for electro- and magnetostatics, *IEEE Trans. Magn.*, v. 40, No. 2, pp. 941–944, 2004.
46. Igor Tsukerman, Efficient computation of long-range electromagnetic interactions without Fourier Transforms, *IEEE Trans. Magn.*, v. 40, No. 4, pp. 2158–2160, 2004.
47. Derek Halverson, Gary Friedman, Igor Tsukerman, Local approximation matching for open boundary problems, *IEEE Trans. Magn.*, v. 40, No. 4, pp. 2152−2154, 2004.
48. Igor Tsukerman, Spurious numerical solutions in electromagnetic resonance problems, *IEEE Trans. Magn.*, vol. 39, No. 3, pp. 1405–1408, 2003.
49. Igor Tsukerman, Symbolic algebra as a tool for understanding edge elements, *IEEE Trans. Magn.*, vol. 39, No. 3, pp.1111–1114, 2003.
50. Igor Tsukerman, General tangentially continuous vector elements, *IEEE Trans. Magn.*, vol. 39, No. 3, pp. 1215–1218, 2003.
51. Alexander Plaks, Igor Tsukerman, Gary Friedman, Benjamin Yellen, Generalized Finite Element Method for magnetized nanoparticles, *IEEE Trans. Magn.*, vol. 39, No. 3, pp. 1436–1439, 2003.
52. Igor Tsukerman, Finite element differential-algebraic systems for eddy current problems, *Numerical Algorithms*, vol. 31, pp.319–335, 2002.
53. Leonid Proekt, Igor Tsukerman, Method of overlapping patches for electromagnetic computation, *IEEE Trans. Magn.*, vol. 38, No. 2, pp.741−744, 2002.
54. Leonid Proekt, Sergey Yuferev, Igor Tsukerman, Nathan Ida, Method of overlapping patches for electromagnetic computation near imperfectly conducting cusps and edges, *IEEE Trans. Magn.*, vol. 38, No. 2, pp.649−652, 2002.
55. I.A. Tsukerman, V.V. Dombrovski, Finite element simulation of time-dependent electromagnetic fields in the end zone of superconducting motors, *IEEE Trans. Magn.*, vol. 38, No. 2, pp.1265−1268, 2002.
56. Leonid B. Proekt and Igor Tsukerman, Accuracy of the finite element solution of a wave problem with a curved perfectly matched layer, *IEEE Trans. Magn.*, vol. 37, No. 5, Part 1, pp. 3246–3250, 2001.
57. Alexander Plaks, Igor Tsukerman, S. Painchaud, and L. Tabarovsky, Multigrid methods for open boundary problems in geophysics, *IEEE Trans. Magn.*, vol. 36, No. 4, p.633−636, 2000.
58. Igor Tsukerman and Alexander Plaks, Hierarchical basis multilevel preconditioners for 3D magnetostatic problems, *IEEE Trans. Magn.*, vol. 35, No.3, pp.1143−1146, 1999.

59. Igor Tsukerman and Alexander Plaks, Refinement strategies and approximation errors for tetrahedral elements, *IEEE Trans. Magn.*, vol. 35, No. 3, pp.1342−1345, 1999.

60. I.A.Tsukerman, Alexander Plaks, H.N. Bertram, Multigrid methods for computation of magnetostatic fields in magnetic recording problems, *J. Applied Phys.*, vol. 83, No. 11, pp.6344−6346, 1998.

61. I.A. Tsukerman, Alexander Plaks, Comparison of accuracy criteria for approximation of conservative fields on tetrahedra, *IEEE Trans. Magn.*, vol. 34, pp. 3252−3255, 1998.

62. I.A. Tsukerman, A general accuracy criterion for finite element approximation, *IEEE Trans. Magn.*, vol. 34, pp. 2425−2428, 1998.

63. I.A. Tsukerman, Approximation of conservative fields and the element 'edge shape matrix', *IEEE Trans. Magn.*, vol. 34, pp. 3248−3251, 1998.

64. I.A. Tsukerman, Stability of the moment method in electromagnetic problems, *IEEE Trans. Magn.*, vol. 33, No. 2, pp. 1402−1405, 1997.

65. I.A. Tsukerman, Accurate computation of 'ripple solutions' on moving finite element meshes, *IEEE Trans. Magn.*, vol. 31, No. 3, pp. 1472-1475, 1995.

66. I.A. Tsukerman, A stability paradox for time-stepping schemes in coupled field-circuit problems, *IEEE Trans. Magn.*, vol. 31, No. 3, pp. 1857−1860, 1995.

67. I.A. Tsukerman, J.D. Lavers, A. Konrad, Using complementary formulations for accurate computations of magnetostatic fields and forces in a synchronous motor, *IEEE Trans. Magn.*, vol. 30, No. 5, pp. 3479−3482, 1994.

68. I.A. Tsukerman, Application of multilevel preconditioners to finite element magnetostatic problems, *IEEE Trans. Magn.*, vol. 30, No. 5, pp. 3562−3565, 1994.

69. I.A. Tsukerman, Fast finite element solvers for problems with magnetic materials, *IEEE Trans. Magn.*, vol. 29, No. 6, pp. 2365−2367, 1993.

70. I.A. Tsukerman, Node and edge element approximation of discontinuous fields and potentials, *IEEE Trans. Magn.*, vol. 29, No. 6, pp.2368−2370, 1993.

71. Adalbert Konrad and I.A. Tsukerman, Comparison of high- and low-frequency electromagnetic field analysis, *J. Phys. III France*, vol. 3, pp.363−371, 1993.

72. I.A. Tsukerman, A. Konrad, G. Bedrosian and M.V.K. Chari, A survey of numerical methods for transient eddy current problems, *IEEE Trans. Magn.*, vol. 29, No. 2, pp.1711−1716, 1993.

73. I.A. Tsukerman, A. Konrad, G. Meunier and J.C. Sabonnadiere, Coupled field-circuit problems: trends and accomplishments, *IEEE Trans. Magn.*, vol. 29, No. 2, pp.1701−1704, 1993.

74. I.A. Tsukerman, Overlapping finite elements for problems with movement, *IEEE Trans. Magn.*, vol. 28, No. 5, pp.2247−2249, 1992.

75. I.A. Tsukerman, A. Konrad, J.D. Lavers, A method for circuit connections in time-dependent eddy current problems, *IEEE Trans. Magn.*, vol. 28, No. 2, pp. 1299−1302, 1992.

76. I.A. Tsukerman, Error estimation for finite element solutions of the eddy currents problem, *COMPEL*, 9 (2), pp.83−98, 1990.

77. S.P. Voskoboinikov, Yu.B. Senichenkov, I.A. Tsukerman, The rate of convergence of the two-step gradient descent method, *USSR Comp. Maths. and Math. Phys.*, vol. 23, No. 5, pp.131−133, 1983.

78. G.M. Khutoretskii, V.D. Varshavskii, I.A. Zuckermann, Computation and analysis of high-power cryogenic turbogenerator rotor heating conditions, *Electric Technology U.S.S.R.* No.2, pp.69−75, 1985.

79. Yu.V. Rakitskii, E.D. Shchukin, V.S. Yushchenko, I.A. Tsukerman, Yu.B. Suris, A.I. Slutsker, Mechanism of the formation of energy fluctuation and a method for studying it, *Doklady. Physical chemistry: Proceedings of the Academy of Sciences of the USSR*, vol. 285, No. 4, pp.1204−1207, 1985. ISSN: 0012-5016.

80. Yu.V. Rakitskii, E.B. Belopol'skaya, Yu.P. Kizimovich, I.A. Tsukerman, Some iterative methods for solution of variational-difference analogs of steady-state field equations, *Power Engineering (USSR Academy of Sciences),* vol. 24, No. 1, pp.67−76, 1986.

81. G.M. Khutoretsky, V.D. Varshavsky, I.A. Tsukerman, Computer modelling of rotor thermal field in large cryoturbogenerator, *Power Engineering (USSR Academy of Sciences),* vol. 24, No. 1, pp.151−155, 1986.

82. G.M.Khutoretsky, V.D. Varshavsky, I.A. Tsukerman, Computer simulation and analysis of electromagnetic processes when designing turbine generators with non-magnetic rotors, *Elektrotekhnika,* No.10, pp.46−50, 1987. [in Russian].

83. L.P. Boriskina, V.D. Varshavsky, L.A. Efimenko, I.A. Tsukerman, Application of the finite element method to the computation of the external magnetic field of electric machines, *Elektrichestvo,* No.9, pp.56−59, 1987 [in Russian].

84. Yu.P. Kizimovich, I.A. Tsukerman, Mathematical modelling of a quasi-steady electromagnetic field, *Power Engineering (USSR Academy of Sciences),* vol. 25, No. 2, pp.55−66, 1987.

85. Yu.P. Kizimovich, I.A. Tsukerman, Mathematical modelling of a three-dimensional quasisteady electromagnetic field in steady-state and transient regimes by means of the scalar magnetic potential, *Power Engineering (USSR Academy of Sciences),* vol. 26, No. 4, pp.153−158, 1988.

86. I.A. Tsukerman, Finite-element approximation of the two-component vector function in the scalar magnetic potential method, *Power Engineering (USSR Academy of Sciences),* vol. 26, No. 2, pp.22−31,1988.

87. K.S. Demirchyan, Yu.V. Rakitskii, Yu.P. Kizimovich, I.A. Tsukerman, Calculation of three-dimensional electromagnetic fields by the scalar magnetic potential method: numerical techniques and software, *Power Engineering (USSR Academy of Sciences),* vol. 26, No. 4, pp.146−152, 1988.

88. I.A. Tsukerman, On the accuracy of numerical calculation of eddy currents, *Izvestiya Akad. Nauk SSSR. Energetika i transport,* No.5, pp. 83−93, 1989 [in Russian].

## Papers in Refereed Conference Proceedings

89. (Invited plenary talk.) Igor Tsukerman. Trefftz approximations in electromagnetic analysis: Homogenization, difference schemes, random matrices. Mathematics of Wave Phenomena, Karlsruhe, Germany, July 2018.

90. (Invited plenary talk.) Igor Tsukerman. Periodic and non-periodic structures: Homogenization, Trefftz functions, random matrices. Waves in Complex Photonic Media, Anacapri, Italy, June 2018.

91. (Invited plenary talk.) Igor Tsukerman. The power of Trefftz approximations: applications in electromagnetic analysis. EMF'2018, Darmstadt, Germany, April 2018.

92. Shampy Mansha, Osama Alkhateeb, Igor Tsukerman, and Y. D. Chong. Trefftz-based methods for electromagnetic wave scattering in aperiodic slabs. EMF'2018, Darmstadt, Germany, April 2018.

93. S. Mansha, Y.D. Chong, and I. Tsukerman. The FLAME-slab method for electromagnetic wave scattering in slab structures. PIERS, Singapore, November 2017.

94. Igor Tsukerman and Vadim A. Markel. Nonasymptotic and Nonlocal Homogenization of Electromagnetic Metamaterials. 7th International Conference on Advanced Computational Methods in Engineering (ACOMEN), Ghent, Belgium, September 2017.

95. K. Hollaus, M. Schoebinger, I. Tsukerman. Homogenization of laminated magnetic cores and the role of surface charges. IEEE-ICEAA, Verona, Italy, September 2017.

96. I. Tsukerman, V. A. Markel. Nonasymptotic and nonlocal homogenization of electromagnetic metamaterials. IEEE-ICEAA, Verona, Italy, September 2017.

97. S. Mansha,Y. D. Chong, I. Tsukerman. Photonic devices with slab geometries: Numerical models with Trefftz approximations, IEEE-ICEAA, Verona, Italy, September 2017.

98. Igor Tsukerman and Vadim A. Markel. Nonasymptotic and nonlocal homogenization of electromagnetic metamaterials: Theories based on Trefftz approximations. Metamaterials'2017 and the European School on Metamaterials, Marseille, France, August-September 2017.

99. Burak Tekgun, Yilmaz Sozer, Igor Tsukerman. Core loss estimation in electric machines with flux controlled core loss tester. IEEE Energy Conversion Congress and Exposition (ECCE). Milwaukee, WI, September 2016.

100. (Invited plenary talk.) Igor Tsukerman and Vadim Markel. Effective medium theories from the 19th to the 21st century: finite samples, interface boundaries, non-asymptotic and nonlocal approximations. AmiTans, Albena, Bulgaria, June 2016.

101. Z. Bučková, I. Tsukerman, M. Ehrhardt. Traditional vs. Trefftz difference schemes for the Black-Scholes equation, AmiTans, Albena, Bulgaria, June 2016.

102. Igor Tsukerman and Vadim A. Markel. Homogenization of electromagnetic metamaterials: uncertainty principles and a fresh look at nonlocality. Advanced Concepts in Wave Physics: Topology and Parity-time Symmetries, Hong Kong, January 2016.

103. Vadim A. Markel and Igor Tsukerman, Perturbative analysis of electromagnetic homogenization near the Γ-point in higher bands, IEEE APS-URSI, Vancouver, July 2015.

104. Igor Tsukerman and Ralf Hiptmair, New nonreflecting boundary conditions based on Trefftz approximations, IEEE APS-URSI, Vancouver, July 2015.

105. Igor Tsukerman and Vadim A. Markel, An uncertainty principle in electromagnetic homogenization, IEEE APS-URSI, Vancouver, July 2015.

106. Igor Tsukerman and Vadim A. Markel, Electromagnetic homogenization: the uncertainty principle and its numerical verification, Compumag, Montreal, June 2015.

107. Igor Tsukerman, Ralf Hiptmair. Trefftz approximations: a new framework for nonreflecting boundary conditions, Compumag, Montreal, June 2015.

108. Igor Tsukerman and Vadim A. Markel, Homogenization of periodic electromagnetic structures: An uncertainty principle, PIERS Prague, July 2015.

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