СПИСЪК

на представените документи на електронен носител

чл.-кор. Светозар Димитров Маргенов
кандидат в конкурс за академици на БАН в област Природоматематически науки, научно направление Математически науки

1. Творческа биография
2. Списък на всички научни трудове
3. Списък на научните трудове за участие в конкурса
4. Кратко описание на най-важните постижения
5. Списък на цитирания на научните трудове
6. Някои по-съществени цитирания

юни 2021 г.

ПРОФЕСИОНАЛНИ БИОГРАФИЧНИ ДАННИ

чл.-кор. Светозар Димитров Маргенов

Служебен адрес

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Трудов стаж

• дати (от-до)	2010 -
• работодател	БАН - ИИКТ
• заемани длъжности	директор (до 2018)/председател на НС/ръководител на секция
• дати (от-до)	1985 - 2010
• работодател	БАН - ИПОИ/ЦЛПОИ/КЦИИТ
• заемани длъжности	зам. директор/научен секретар/ръководител на секция
• дати (от-до)	1978 - 1985
• работодател	ЦТКА
• заемани длъжности	научен сътрудник/математик

Образование

- **1978 -** магистър, Факултет по математика и механика, СУ „Св. Кл. Охридски“

Научни степени и звания

- **1981** – н.с. III ст., Център по транспортна кибернетика и автоматизация (ЦТКА)
- **1983** – н.с. II ст., ЦТКА
- **1984** – кмн (д-р), БАН
- **1985** – н.с. I ст., ЦТКА
- **1990** – ст.н.с. II ст., КЦИИТ
- **2002** - доктор на математическите науки, БАН
- **2003** – ст.н.с. I ст. (професор), ИПОИ, ИИКТ

Академични звания

- **2014** – член-кореспондент на БАН

Научни области

- Научни пресмятания с голяма размерност и паралелни алгоритми.
- Числени методи за решаване на частни диференциални уравнения (метод на крайните разлики и метод на крайните елементи).
- Изчислителна линейна алгебра (итеративни методи и алгоритми, преобуславяне, разредени матрици).
- Научни пресмятания от голяма размерност за екологични задачи, биомедицински и инженерни задачи.
- Суперкомютърни приложения

Членство в редколегии на международни научни списания

- Numerical Linear Algebra with Applications
- Computational Methods in Applied Mathematics
- Annals of Data Science
- Scalable Computing: Practice and Experience
- Cybernetics and Information Technologies
- International Journal on Numerical and Analytical Methods in Engineering
- International Journal of Numerical Analysis and Modeling, Series B - до 2015

Научно организационни дейности

- Учредител и дългогодишен председател на организационния комитет на международните конференции Large-Scale Scientific Computations (LSSC) http://parallel.bas.bg/Conferences/SciCom17/index.html
- Учредител и председател на Българската секция на SIAM

Ръководство на научни и научно-приложни проекти: избрани проекти за последните 5 години

А. Договори, финансирани от външни за България източници

1. Договор по Програма Хоризонт 2020, H2020- GA-2015-664406 MMAC, Centre of Excellence for Mathematical Modeling and Advanced Computing

Б. Договори, финансирани от български източници

1. Оперативна програма „Наука и облазование за интелигентен растеж“, Център за върхови постижения по Информатика и информационни и комуникационни технологии
2. Фонд „НИ”, ДН 12/1, Числени методи и алгоритми за задачи с дробна дифузия (от 2020 г. ръководител на проекта е доц. Станислав Харизанов)
3. Национална пътна карта за научна инфраструктура, Български суперкомпютърен център: високопроизводителна инфраструктура за компютърно моделиране, симулации и изследвания с приложения в промишлеността, медицината, фармацевтика, енергетика, транспорт, финанси и околна среда
4. Национална пътна карта за научна инфраструктура, Национален център за високопроизводителни и разпределени пресмятания

В. Ръководство на международни договори по еквивалент

1. Договор по ЕБР с IGAS, Чехия, "Microstructure and multiscale modeling of bio- and geo-environment"
2. Договор по ЕБР с IGAS, Чехия, "High Performance Computing for Innovations"

Избрани научни публикации от последните 5 години

1. S. Harizanov, R. Lazarov, S. Margenov, A survey on numerical methods for spectral Space-Fractional diffusion problems, Fractional Calculus and Applied Analysis, Vol. 23 (6) (2021), 1605-1646, **IF: 3.170**
2. S. Harizanov, N. Kosturski, S. Margenov, Y. Vutov, Neumann fractional diffusion problems: BURA solution methods and algorithms, Mathematics and Computers in Simulation (2020), https://doi.org/10.1016/j.matcom.2020.07.018, **IF: 1.620**
3. S. Harizanov, R. Lazarov, S. Margenov, P. Marinov, Numerical solution of fractional diffusion–reaction problems based on BURA, Computers & Mathematics with Applications, Vol. 80 (2) (2020), 316-331, **IF: 3.370**
4. S. Harizanov, R. Lazarov, S. Margenov, P. Marinov, J. Pasciak, Analysis of numerical methods for spectral fractional elliptic equations based on the best uniform rational approximation, Journal of Computational Physics, Vol. 408 (2020), 109285, https://doi.org/10.1016/j.jcp.2020.109285, **IF: 2.985**
5. R. Čiegis, V. Starikovičius, S. Margenov, R. Kriauzienė, Scalability analysis of different parallel solvers for 3D fractional power diffusion problems, Concurrency and Computation: Practice and Experience, Vol. 31 (19) (2020), e5163, https://doi.org/10.1002/cpe.5163, **IF: 1.447**
6. S. Harizanov, R. Lazarov, P. Marinov, S. Margenov, Y. Vutov, Optimal solvers for linear systems with fractional powers of sparse SPD matrices, Numerical Linear Algebra With Applications, (2018), https://doi.org/10.1002/nla.2167, **IF: 1.424**
7. R. Čiegis, V. Starikovičius, S. Margenov, R. Kriauzienė, Parallel solvers for fractional power diffusion problems, Concurrency and Computation: Practice and Experience, Vol. 29 (4) (2017), https://doi.org/10.1002/cpe.4216, **IF: 1.133**
8. S. Stoykov, S. Margenov, Numerical methods and parallel algorithms for computation of periodic responses of plates, Journal of Computational and Applied Mathematics, Vol. 310 (2017), 200-212, **IF: 1.357**
9. S Harizanov, S Margenov, P Marinov, Y Vutov, Volume constrained 2-phase segmentation method utilizing a linear system solver based on the best uniform polynomial approximation of $x^{-1/2}$, Journal of Computational and Applied Mathematics, Vol. 310 (2017), 115-128**, IF: 1.357**
10. V. Kyovtorov, I. Georgiev, S. Margenov, D. Stoychev, F. Oliveri, D. Tarchi, New antenna design approach – 3D polymer printing and metallization experimental test at 14–18 GHz, International Journal of Electronics and Communications (AEÜ), Vol. 73 (2017) 119–128, **IF:1.147**
11. S. Stoykov, E. Manoach, S. Margenov, An efficient 3D numerical beam model based on cross sectional analysis and Ritz approximations, ZAMM-Journal of Applied Mathematics and Mechanics/Zeitschrift für Angewandte Mathematik und Mechanik, Vol. 96 (7) (2016), 791-812, **IF: 1.332**
12. J. Kraus, R. Lazarov, M. Lymbery, S. Margenov, L. Zikatanov, Preconditioning Heterogeneous H(div) Problems by Additive Schur Complement Approximation and Applications, SIAM Journal on Scientific Computing, Vol. 38 (2) (2016), A875-A898, **IF: 2.195**

13. S. Stoykov, S. Margenov, Scalable parallel implementation of shooting method for large-scale dynamical systems. application to bridge components, Journal of Computational and Applied Mathematics, Vol. 293 (2016), 223-231, **IF: 1.357**

Забелязани цитирания

- Общо - 703
- От тях за последните 5 години - 250

СПИСЪК НА НАУЧНИ ТРУДОВЕ

на чл.-кор. Светозар Димитров Маргенов
кандидат в конкурс за академици на БАН в област Природоматематически науки, научно направление Математически науки

2021

1. S. Margenov, N. Popivanov, I. Ugrinova, S. Harizanov, T. Hristov, Mathematical and computer modeling of COVID-19 transmission dynamics in Bulgaria by time-depended inverse SEIR model, AIP Conference Proceedings, Vol. 2333 (2021), 090024, https://doi.org/10.1063/5.0041868, **SJR**
2. S. Harizanov, S. Margenov, N. Popivanov, Spectral Fractional Laplacian with Inhomogeneous Dirichlet Data: Questions, Problems, Solutions, BGSIAM 2018, Springer Nature, SCI 961 (2021), 123–138, **SJR**
3. S. Margenov, Supercomputers and Supercomputer Applications: Opportunities and Challenges, Journal of the Bulgarian Academy of Sciences, Vol. 1 (2021), 19-24 (in Bulgarian)

2020

4. S. Harizanov, R. Lazarov, S. Margenov, A survey on numerical methods for spectral Space-Fractional diffusion problems, Fractional Calculus and Applied Analysis, Vol. 23 (6) (2021), 1605-1646, **IF**
5. D. Slavchev, S. Margenov, I.G. Georgiev, On the application of recursive bisection and nested dissection reorderings for solving fractional diffusion problems using HSS compression, AIP Conference Proceedings, Vol. 2302 (2020), 120008, https://doi.org/10.1063/5.0034506, **SJR**
6. S. Harizanov, N. Kosturski, S. Margenov, Y. Vutov, Neumann fractional diffusion problems: BURA solution methods and algorithms, Mathematics and Computers in Simulation (2020), https://doi.org/10.1016/j.matcom.2020.07.018, **IF**
7. S. Harizanov, R. Lazarov, S. Margenov, P. Marinov, Numerical solution of fractional diffusion–reaction problems based on BURA, Computers & Mathematics with Applications, Vol. 80 (2) (2020), 316-331, **IF**
8. S. Harizanov, R. Lazarov, S. Margenov, P. Marinov, J. Pasciak, Analysis of numerical methods for spectral fractional elliptic equations based on the best uniform rational approximation, Journal of Computational Physics, Vol. 408 (2020), 109285, https://doi.org/10.1016/j.jcp.2020.109285, **IF**

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9. R. Čiegis, V. Starikovičius, S. Margenov, R. Kriauzienė, Scalability analysis of different parallel solvers for 3D fractional power diffusion problems, Concurrency and Computation: Practice and Experience, Vol. 31 (19) (2020), e5163, https://doi.org/10.1002/cpe.5163, **IF**
10. S. Margenov, T. Rauber, E. Atanassov, F. Almeida, V. Blanco, R. Ciegis, A. Cabrera, N. Frasheri, S. Harizanov, R. Kriauzien, G. Rünger, P. San Segundo, V. Starikovicius, S. Szabo, B. Zavalnij, In: Applications for ultrascale systems, Ultrascale Computing Systems, IET (2019), 189-244

2018

11. S. Harizanov, R. Lazarov, P. Marinov, S. Margenov, Y. Vutov, Optimal solvers for linear systems with fractional powers of sparse SPD matrices, Numerical Linear Algebra With Applications, (2018), https://doi.org/10.1002/nla.2167, **IF**

12. D. Slavchev, S. Margenov, Performance Analysis of Intel Xeon Phi MICs and Intel Xeon CPUs for Solving Dense Systems of Linear Algebraic Equations: Case Study of Boundary Element Method for Flow Around Airfoils, Advanced Computing in Industrial Mathematics: 12th Annual Meeting of the Bulgarian Section of SIAM December 20-22, 2017, Studies in Computational Intelligence, Vol. 793 (2018), 369-382, **SJR**

13. S. Harizanov, S. Margenov, Comparison Analysis on Two Numerical Solvers for Fractional Laplace Problems, Advanced Computing in Industrial Mathematics: 12th Annual Meeting of the Bulgarian Section of SIAM December 20-22, 2017, Studies in Computational Intelligence, Vol. 793 (2018),163-176, **SJR**

14. N. Kosturski, S. Margenov, Y. Vutov, Performance Analysis of MG Preconditioning on Intel Xeon Phi: Towards Scalability for Extreme Scale Problems with Fractional Laplacians, Springer LNCS, Vol. 2017 (2018), 304-312, **SJR**

15. R. Čiegis, V. Starikovičius, S. Margenov, R. Kriauzienė, A Comparison of Accuracy and Efficiency of Parallel Solvers for Fractional Power Diffusion Problems, Springer LNCS, Vol. 10777 (2018), 79-89, **SJR**

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16. R. Čiegis, V. Starikovičius, S. Margenov, R. Kriauzienė, Parallel solvers for fractional power diffusion problems, Concurrency and Computation: Practice and Experience, Vol. 29 (4) (2017), https://doi.org/10.1002/cpe.4216, **IF**

17. S. Stoykov, S. Margenov, Numerical methods and parallel algorithms for computation of periodic responses of plates, Journal of Computational and Applied Mathematics, Vol. 310 (2017), 200-212, **IF**

18. S Harizanov, S Margenov, P Marinov, Y Vutov, Volume constrained 2-phase segmentation method utilizing a linear system solver based on the best uniform polynomial approximation of x− ½, Journal of Computational and Applied Mathematics, Vol. 310 (2017), 115-128**, IF**

19. V. Kyovtorov, I. Georgiev, S. Margenov, D. Stoychev, F. Oliveri, D. Tarchi, New antenna design approach – 3D polymer printing and metallization experimental test at 14–18 GHz, International Journal of Electronics and Communications (AEÜ), Vol. 73 (2017) 119-128, **IF**

20. R. Blaheta, I. Georgiev, K. Georgiev, O. Jakl, R. Kohut, S. Margenov, J. Starý, High Performance Computing in Micromechanics with an Application, Cybernetics and Information Technologies, Vol. 17(5) (2017), 5-16, **SJR**

2016

21. S. Stoykov, E. Manoach, S. Margenov, An efficient 3D numerical beam model based on cross sectional analysis and Ritz approximations, ZAMM-Journal of Applied Mathematics and Mechanics/Zeitschrift für Angewandte Mathematik und Mechanik, Vol. 96 (7) (2016), 791-812, **IF**

22. J. Kraus, R. Lazarov, M. Lymbery, S. Margenov, L. Zikatanov, Preconditioning Heterogeneous H(div) Problems by Additive Schur Complement Approximation and Applications, SIAM Journal on Scientific Computing, Vol. 38 (2) (2016), A875-A898, **IF**

23. S. Stoykov, S. Margenov, Scalable parallel implementation of shooting method for large-scale dynamical systems. application to bridge components, Journal of Computational and Applied Mathematics, Vol. 293 (2016), 223-231, **IF**

24. R. Blaheta, I. Georgiev, K. Georgiev, O. Jakl, R. Kohut, S. Margenov, J. Starý, Analysis of fiber-reinforced concrete: micromechanics, parameter identification, fast solvers, Proceedings of the Third International Workshop on Sustainable Ultrascale Computing Systems, Universidad Carlos III de Madrid Biblioteca e-Archivivo (2016), 31-36

25. R. Ciegis, V. Staricovicius, S. Margenov, On Parallel Numerical Algorithms for Fractional Diffusion Problems, Proceedings of the Third International Workshop on Sustainable Ultrascale Computing Systems, Universidad Carlos III de Madrid Biblioteca e-Archivivo (2016), 85-90

2015

26. R.F. Sviercoski, P. Popov, S. Margenov, An analytical coarse grid operator applied to a multiscale multigrid method, Journal of Computational and Applied Mathematics, Vol. 287 (2015), 207-219, **IF**

27. S. Harizanov, S. Margenov, L Zikatanov, Fast constrained image segmentation using optimal spanning trees, Springer LNCS, Vol. 9374 (2015), 15-29, **SJR**

28. N. Kosturski, S. Margenov, P. Popov, N. Simeonov, Y. Vutov, Performance Analysis of Block AMG Preconditioning of Poroelasticity Equations, Springer LNCS, Vol. 9374 (2015), 377-384, **SJR**

29. J. Kraus, M. Lymbery, S. Margenov, Auxiliary space multigrid method based on additive Schur complement approximation, Numerical Linear Algebra With Applications, Vol. 22 (6) (2015), 965-986, **IF**

30. I. Georgiev, E. Ivanov, S. Margenov, Y. Vutov, Numerical Homogenization of Epoxy-Clay Composite Materials, Numerical Methods and Applications, Springer LNCS, Vol. 8962 (2015), 130-137

31. N. Kosturski, I. Lirkov, S. Margenov, Y. Vutov, Thermoelectrical Tick Removal Process Modeling, Large-Scale Scientific Computing, Springer LNCS, Vol. 9374 (2015), 369-376, **SJR**

32. S. Stoykov, S. Margenov, Scalability of Shooting Method for Nonlinear Dynamical Systems, Large-Scale Scientific Computing, Springer LNCS, Vol. 9374 (2015), 401-408, **SJR**

33. S. Stoykov, C. Hofreither, S. Margenov, Isogeometric Analysis for Nonlinear Dynamics of Timoshenko Beams, Numerical Methods and Applications, Springer LNCS, Vol. 8962 (2015), 138-146, **SJR**

34. S. Stoykov, S. Harizanov, S. Margenov, Space discretization by B-Splines on discontinuous problems in structural mechanics, Proceedings of the 7th Balkan Conference on Informatics, ACM, BCI' (2015), 31:1-31:7

2014

35. I. Georgiev, S. Margenov, Semi-coarsening AMLI preconditioning of anisotropic trilinear FEM systems, Computers and Mathematics with Applications, 68 (12) (2014), 2103-2111, **IF**

36. J. Kraus, M. Lymbery, S. Margenov, Robust Multilevel Methods for Quadratic Finite Element Anisotropic Elliptic Problems, Numerical Linear Algebra With Applications, Vol. 21 (3) (2014), 375-398, **IF**

37. S. Stoykov, S. Margenov, Numerical computation of periodic responses of nonlinear large-scale systems by shooting method, Computers and Mathematics with Applications, 67 (2014), 2257-2267, **IF**

38. S. Stoykov, S. Margenov, Nonlinear vibrations of 3D laminated composite beams, Mathematical Problems in Engineering, Vol. 2014 (2014), http://dx.doi.org/10.1155/2014/892782, **IF**

39. N. Kosturski, S. Margenov, and Y. Vutov: Calibration of Parameters for Radio-Frequency Ablation Simulation, LNCS 8353 (2014), **SJR**

40. S. Margenov, S. Stoykov, Y. Vutov, Numerical Homogenization of Heterogeneous Anisotropic Linear Elastic Materials, Springer LNCS 8353 (2014), 347-354, **SJR**

41. S. Stoykov, S. Margenov, Nonlinear Forced Vibration Analysis of Elastic Structures by Using Parallel Solvers for Large-Scale Systems, Springer LNCS (2014), 405-412, **SJR**

42. J. Kraus, R. Lazarov, M. Lymbery, S. Margenov, L. Zikatanov, Robust Preconditioning of Darsy Problem for Highly Heterogeneous Media, Numerical Methods for Scientific Computations and Advanced Applications, Bansko, Bulgaris, Proceedings (2014), 65-69

43. R. Sviercoski, S. Margenov, A Multiscale Multigrid Algorithm Applied to Bone Tissue Modelling, Numerical Methods for Scientific Computations and Advanced Applications, Bansko, Bulgaris, Proceedings (2014), 107-110

44. K. Georgiev, N. Kosturski, S. Margenov and Y. Vutov: Supercomputing simulation of radio-frequency hepatic tumor ablation, Proc. of the first VAST – BAS Workshop on Science and Technology, N. Khoa Son Edt (2014), 11-18

2013

45. J. Kraus, M. Lymbery, S. Margenov, Robust Algebraic Multilevel Preconditioners for Anisotropic

Elliptic Problems, In: Numerical Solution of Partial Differential Equations: Theory, Algorithms and their Applications, Springer Proceedings in Mathematics & Statistics (2013), 217-246

46. N. Kosturski, S. Margenov, Y. Vutov, Computer simulation of RF liver ablation on an MRI scan data, AIP Conf. Proc. 1487 (2013), 120-126, **SJR**

47. R.F. Sviercoski, S. Margenov, Displacement decomposition ACO based preconditioning of FEM elasticity systems, AIP Conf. Proc. 1561 (2013), 112-119, **SJR**

48. S. Stoykov, S. Margenov, Nonlinear Vibrations of Rotating 3D Tapered Beams with Arbitrary Cross Sections, Proceedings of the 4th ECCOMAS Thematic Conference on Computational Methods in Structural Dynamics and Earthquake Engineering, M. Papadrakakis, P. Papdopoulos (eds.), Kos, Greece (2013), Paper id.: 1479, 15 p

49. S. Stoykov, S. Margenov, Nonlinear Free Vibrations of 3D Composite Beams, Proceedings of the 11th International Conference on Vibration Problems, Z. Dimitrovova, J. Almeida, R. Goncalves (eds.), Lisbon, Portugal (2013), Paper id: 164, 10 p

2012

50. P. Boyanova, I. Georgiev, S. Margenov, and L. Zikatanov, Multilevel preconditioning of graph-Laplacians: Polynomial approximation of the pivot blocks inverses, Math. Comp. Simulation, Vol. 82 (10) (2012), 1964-1971, **IF**

51. Y. Efendiev, J. Galvis, R. Lazarov, S. Margenov, J. Ren, Robust Two-level Domain Decomposition Preconditioners for High-contrast Anisotropic Flows in Multiscale Media, Comput. Methods Appl. Math, Volume 12, Issue 4 (2012), 415-436 , **IF**

52. M. Lymbery, S. Margenov, Robust Semi-Coarsening Multilevel Preconditioning of Biquadratic FEM Systems, Cent. Eur. J. Math. 10(1) (2012), 357-369, **IF**

53. N. Kosturski, S. Margenov, Y. Vutov, Balancing the Communications and Computations in Parallel FEM Simulations on Unstructured Grids, PPAM'11, Springer LNCS 7204 (2012), 211-220, **SJR**

54. Kraus, J., Lymbery, M., Margenov, S.: Semi-Coarsening AMLI Preconditioning of Higher Order Elliptic Problems, AIP Conf. Proc. 1487 (2012), https://doi.org/10.1063/1.4758939, **SJR**

55. N. Kosturski, S. Margenov, and Y. Vutov, Computer simulation of RF liver ablation on an MRI scan data, AIP Conf. Proc. 1487 (2012), 120-126, **SJR**

56. N. Kosturski, S. Margenov, and Y. Vutov, Improving the Efficiency of Parallel FEM Simulations on Voxel Domains, LNCS 7116 (2012), 574-581, **SJR**

2011

57. N. Kosturski, S. Margenov, Y. Vutov, Comparison of Two Techniques for Radio-Frequency Hepatic Tumor Ablation through Numerical Simulation, AIP Conference Proceedings 1404, (2011), 431-437, **SJR**

58. P. Boyanova, S. Margenov, Robust Multilevel Methods for Elliptic and Parabolic Problems, invited chapter in: O. Axelsson, J. Karatson, Efficient Preconditioning Methods for Elliptic Partial Differential Equations, Bentham Science Publishers (2011), 3-22

59. P. Boyanova, S. Margenov, On Optimal AMLI Solvers for Incompressible Navier-Stokes Problems, AIP Conference Proceedings 1301 (2011), **SJR**

60. I. Georgiev, J. Kraus, S. Margenov, Two-level Preconditioning for DG Discretizations of Scalar Elliptic Problems with Discontinuous Coefficients, AIP Conference Proceedings 1404 (2011), 389-396, **SJR**

61. N. Kosturski, S. Margenov, Supercomputer Simulation of Radio-Frequency Hepatic Tumor Ablation, AIP Conference Proceedings, vol. 1301 (2011), 486-493, **SJR**

62. I. Georgiev, M. Limbery, S. Margenov, Analysis of the CBS Constant for Quadratic Finite Elements, LNCS 6046, Springer, Heidelberg (2011), 412-419, **SJR**

63. M. Ganzha, K. Georgiev, I. Lirkov, S. Margenov, M. Paprzycki, Highly Parallel Alternating Directions Algorithm for Time Dependent Problems, Application of Mathematics in Technical and Natural Sciences, AIP Conference Proceedings 1404, 210-217, **SJR**

64. N. Kosturski, S. Margenov, Supercomputer Simulation of Radio-Frequency Hepatic Tumor

Ablation, AIP Conference Proceedings 1301 (2011), 486-493, ISSN 0094-243
65. M. Lymbery, S. Margenov, Robust Balanced Semi-Coarsening AMLI Preconditioning of Biquadratic FEM Systems, AIP Proceedings, vol. 1404, 438-447, **SJR**
66. P. Popov, Y. Vutov, S. Margenov, O. Iliev, Finite Volume Discretization of Equations Describing Nonlinear Diffusion in Li-Ion Batteries, Numerical Methods and Applications, Springer LNCS 6046 (2011), 338-346, **SJR**
67. I. Georgiev, J. Kraus, M. Lymbery, S. Margenov, On Two-level Splittings for Quadratic FEM Anisotropic Elliptic Problems, Proceedings of 5th Annual meeting of the Bulgarian Section of SIAM, Demetra, Sofia (2011), 35-40
68. S. Margenov, Supercomputing Applications: Efficient Methods, Algorithms and Software Tools, Proceedings "Automatics and Informatics'11", John Atanasoff Society of Automatics and Informatics (2011), A-21-A-27 (in Bulgarian)

2010

69. P. Boyanova, S. Margenov, M. Neytcheva, Robust AMLI Methods for Time-dependent FEM Systems, J. Comp. Appl. Math. (2010), 380-390, **IF**
70. Kosturski, S. Margenov, Numerical Homogenization of Bone Microstructure, Large Scale Scientific Computing, Springer LNCS 5910 (2010), 140-147, **SJR**
71. P. Boyanova, S. Margenov, Numerical Study of AMLI Methods for Weighted Graph-Laplacians, Springer LNCS 5910 (2010), 84-91
72. I. Georgiev, J. Kraus, S. Margenov, Multilevel Preconditioning of Crouzeix-Raviart 3D Pure Displacement Elasticity Problems, Springer LNCS 5910 (2010), 100-107, **SJR**
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СПИСЪК НА НАУЧНИТЕ ТРУДОВЕ ЗА УЧАСТИЕ В КОНКУРСА

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КРАТКО ОПИСАНИЕ НА НАЙ-ВАЖНИ ПОСТИЖЕНИЯ

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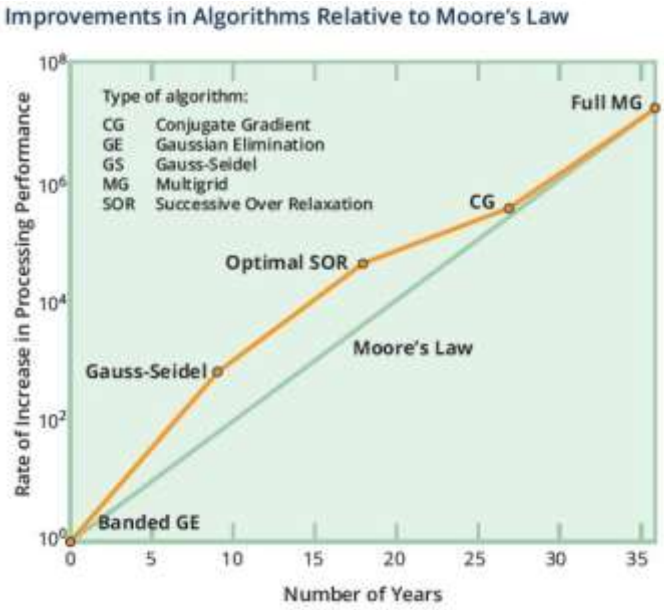
1. Научни постижения

1.1. Въведение

Числените методи и алгоритми за решаване на задачи на изчислителната линейна алгебра с разредени матрици имат определяща роля за ефективността на програмните средства за компютърно моделиране на процеси, които се описват с диференциални уравнения. Това с особена сила се проявява при задачи с голяма размерност. Понятието *голяма размерност* се променя с развитието на технологиите и при постоянно растящата производителност на изчислителната техника. И независимо от огромния прогрес в това отношение, решаващи за развитието на компютърното моделиране са постиженията в областта на числените методи и алгоритмите за тяхната реализация. На следващата фигура е показано съотношението между експоненциалния ръст на компютърната производителност (закон на Мур, 1970) и ръста на производителността на числените методи на линейната алгебра за период от 35 години.



Съвременното разбиране за задачи с голяма размерност е свързано с брой на неизвестните от порядък 10^8 - 10^{10} и дори 10^{12}. Такъв клас задачи са предмет на изследване в направлението от изчислителната математика, което следвайки възприетата в английския език терминология, наричаме *научни пресмятания за задачи с голяма размерност* (Large Scale Scientific Computing).

Нека разгледаме елиптична гранична задача и нека за нейното числено решаване е приложен метод на крайните елементи или друг подходящ мрежов числен метод. При много общи предположения, диференциалната задача се свежда до система от линейни алгебрични уравнения със симетрична, положително определена и разредена матрица **A**, която в метода на крайните елементи се нарича *матрица на коравина*. Тези свойства са в основата на ефективните итерационни методи за решаване на системи от вида **A** **u** = **b**. Съвременните итерационни методи се формулират в термините на пространства на Крилов, породени от матрицата **A**. Методът на спрегнатия градиент с преобуславяне (PCG) е най-добрият измежду известните базови методи за разглеждания клас задачи.

Представените материали по конкурса, както и основните научни и научно-приложни приноси на кандидата са свързани с конструиране, изследване и прилагане на високо ефективни методи и алгоритми за преобуславяне на разредени матрици, както и техни обобщения за нелокални задачи, когато съответните матрици са плътни. Стратегията за преобуславяне се формулира с помощта на следните условия за преобуславящата матрица **C**: а) относителното (спектрално) число на обусловеност е съществено по-малко от числото на обусловеност на изходната матрица, т.е. $\kappa(\mathbf{C}^{-1}\mathbf{A}) \ll \kappa(\mathbf{A})$; б) съществува ефективен алгоритъм за решаване на системи с преобуславящата матрица (преобусловителя) **C.**

Отправна точка при изграждане на методологията на изследване е понятието изчислителна сложност. Представените резултати имат конструктивен характер, като предложените и изследвани методи са с ясна алгоритмична структура. Това дава възможност за оценка на броя на аритметичните операции. Най-висока стойност имат методите за които са доказани оптимални оценки за скоростта на сходимост, при което изчислителната сложност е също оптимална, т.е. има асимптотика O(N), където N е размерността на дискретната задача. В доказателствата се прилагат разнообразни математически техники, като голяма част от получените оценки са точни.

От 176 работи в общия списък, за участие в конкурса са представени 62 работи, в това число 2 монографии. От тях, в издания с Impact Factor (**IF**) са 42 публикации, като други 8 са в списания или поредици с SJR Index (**SJR**). От тези 62 работи, през последните 5 години (вкл. 2021 г.) са публикувани 13.

Резултатите са представени по направления в следващите 6 секции.

1.2. Оптимални многонивови методи за конформни крайни елементи

В това направление са работи [14,15,17,18,21,25,28,32,34,43,50,54,58,60,61,62]. В тях са изследвани алгебрични многонивови методи от тип AMLI (Algebraic MultiLevel Iteration) и техни съвременни развития в контекста на методи в спомагателни подпространства. Те представляват рекурсивно обобщение на мултипликативни и адитивни алгебрични двунивови методи, където допълнението на Шур се апроксимира с локално дефинирана разредена матрица, която в случая на йерархичен базис е (или може да се интерпретира като) матрицата на коравина, съответстваща на предходното ниво на дискретизация. За постигане на оптимална скорост на сходимост се използва стабилизиращ полином, включен в апроксимацията на допълнението на Шур. Константата $\gamma \in [0,1)$ в усиленото неравенство на Коши-Буняковски-Шварц (КБШ) се дефинира в рамките на рекурсивно въведените двунивови разделяния. Тя играе фундаментална роля в анализа на скоростта на сходимост и при доказване на твърдения за оптималност на изчислителната сложност. При AMLI методите за първи път са доказани оценки за оптимална сходимост, които не изискват условия за (допълнителна) регулярност на решението на граничната задача. Такъв тип резултати са публикувани за първи път в [62], където е предложен многонивов метод без стабилизиращ матричен полином с почти оптимална оценка за броя на итерациите от вида O(log N). В статии [17,23,25,28,32,50,55,61] са доказани нови равномерни оценки за константата в усиленото неравенство на КБШ. Така например в [50] е доказано, че за линейни крайни елементи на Курант γ^2 < 0.75 при най-общи предположения за коефициентна и мрежова анизотропия, като в [60] за пръв път са получени оптимални резултати за задачи с променливо направление на доминираща ортотропия. В статия [61] е доказана оценка за константата на КБШ за системата от уравнения на Ламе (линейна теория на еластичността), която е равномерна относно коефициента на Поасон в почти несвиваемия случай. Статии [60,61] поставят началото на изследванията в областта на робастните многонивови методи, на които са посветени обзорните работи [21,43] и монографията [34]. В [25,55] е получена характеризация на многонивови методи от тип SC AMLI (Semicoarsening AMLI) за билинейни, биквадратични и бикубични крайни елементи, като са определени параметри, осигуряващи оптималност. За първи път оптимален SC AMLI за тримерни елиптични задачи е представен в [17]. Полученият в [55] SC AMLI метод за уравненията на Ламе продължава да е единственият известен резултат с оптимална изчислителна сложност и равномерни оценки, относно коефициента на Поасон в почти несвиваемия случай, при дискретизация с конформни крайни елементи. В работи [28,32] са изследвани AMLI методи за линейна комбинация на матрицата на маса и матрицата на коравина. Получените равномерни оценки дават възможност в частност за конструиране на оптимални методи за решаване на системи, възникващи при неявна дискретизация по времето на параболични задачи. Резултати от по-различен тип са представени в статия [58], където предмет на изследване е бихармоничното уравнение. Получените методи не са оптимални, но притежават висока ефективност в този клас задачи, свързани с численото решаване на стационарни уравнения на Навие-Стокс при големи числа на Рейнолдс. Ще отбележим също така статия [54], където са получени резултати за числено решаване на уравненията на Ламе, в случая на коефициентна нелинейност, където успешно са комбинирани метода на разделяне по премествания (на базата на второто неравенство на Корн) с ефективен AMLI метод за получената блочно-диагонална матрица.

В края на този раздел ще разгледаме получените принципно нови резултати за задачи със силно нееднородни коефициенти, скоковете на които не са съгласувани с интерфейсите на началната мрежа на дискретизация. В този случай не е приложим подхода на йерархични базиси (подпространства). В [14] е изследван мултигрид метод с аналитично представяне на оператора върху окрупнената мража. В [16,17] са получени качествено нови резултати, които се основават на локални апроксимации на допълнението на Шур, като в [16] е публикувана обща теория на този клас методи. Такъв тип резултати в завършен вид са представени в [12]. Те включват робастна оценка на грешката при дискретизация със смесен метод на крайните елементи. Конструираният адитивен преобусловител за системата със седлова точка е на базата на AMLI метод с локална апроксимация на допълнението на Шур в пространства H(div).

1.3. Оптимални многонивови методи за неконформни крайни елементи

Към това направление се отнасят публикации [21,23,24,28,29,30,32,34,38,39,41, 45,47,48,52]. Интересът към неконформните крайни елементи се определя от техните преимущества, като средство за числено решаване на лошо обусловени задачи, зависещи от *малък параметър*. Така например, известно е че стандартните конформни елементи не са подходящи за апроксимация на решението при силно нееднородни среди с големи скокове на коефициентите. Тук ролята на неконформните елементи на Крозе-Равиа се определя от факта, че те са еквивалентни на смесен метод на крайните елементи при устойчива (локално консервативна) апроксимация в пространство на Равиа-Тома. В същото време, конструирането на многонивови преобусловители в неконформния случай е затруднено от факта, че крайноелементните пространства, съответстващи на вложени мрежи (триангулации), не са вложени. В значителна степен, теорията на AMLI методите за линейни неконформни елементи е изградена в работи [41,47,48]. Доказани са оценки за константата в усиленото неравенство на КБШ, оценки за локално конструирани апроксимации на водещия блок в рекурсивно дефинираните йерархични двунивови матрици, както и характеризация (наредба) на класове от методи за агрегиране. Както в случая на конформни крайни елементи, оценките са равномерни относно мрежовата и/или коефициентна анизотропия. Следваща стъпка в това направление са получените в [38,39] оптимални резултати за неконформни крайни елементи на Ранахер-Турек. Тъй като тези елементи са завъртени билинейни/трилинейни, при конструирането на йерархичен базис са преодолени нов тип проблеми, като са намерени условия за участващите параметри, при които възникващите нелинейни уравнения имат решение. В статии [28,32] са изследвани AMLI методи за параболични задачи. Получени са нови робастни резултати за силно анизотропни задачи, като са доказани преимущества на неконформните елементи на Крозе-Равиа. Тези резултати, в комбинация с предложените в [45] AMLI методи за граф-Лапласиани са използвани в [23,29], където са получени оптимални многонивови методи за нестационарното уравнение на Навие-Стокс. Приближаването на скоростите с неконформни линейни елементи осигурява локално консервативна апроксимация на дискретизация, което в комбинация с оптималните AMLI методи води до оптималност и робастност при големи числа на Рейнолдс, както на метода на крайните елементи, така и на итерационните методи за решаване на възникващите системи от линейни алгебрични уравнения. В същия дух е и работа [52], където робастната апроксимация с елементи на Крозе-Равиа на уравненията на Ламе при гранични условия на Дирихле се съчетава с оптимален двунивов преобусловител. Тук робастност означава, че оценките са равномерни относно коефициента на Поасон в критичния, както за теорията, така и за изчислителната практика почти несвиваем случай. В края на този параграф ще отбележим работа [30], където са получени за първи път принципно нови резултати за задачи в екстремно хетерогенни среди с големи скокове на коефициентите (*висока честота и голям контраст*) при дискретизация с помощта на прекъснат метод на Гальоркин.

Голяма част от резултатите в първите две направления са систематично представени в монографии [34,42], което в особено висока степен се отнася за първата от тях, както и в обзорните статии [18,43].

1.4. Методи използващи непълна факторизация или точна факторизация на специални класове матрици

Преките методи за решаване на системи от линейни алгебрични уравнения (включително метода на Гаус) се свеждат до **LU** факторизация на матрицата на системата. В общия случай, разредеността на матрицата не се запазва в процеса на факторизация. Идеята на методите, използващи непълна факторизация, се свежда до намиране на приближения на множителите **L** и **U**, които също са разредени. Така получената матрица се използва в качеството на преобусловител. Към този клас причисляваме резултатите публикувани в [35,37,42,44,51,55]. Класическите методи за непълна факторизация се прилагат успешно в случая на М-матрици. Такива матрици се получават например при дискретизация на изотропни елиптични гранични задачи с линейни триъгълни крайни елементи върху триангулации, в които няма тъпи ъгли. Една възможност за тяхното използване при по-общи предположения е с помощта на спомагателна М-матрица, която е спектрално еквивалентна на дадената. Този подход е изследван в [35,37,42,44,51]. В [35] са получени точни локално оптимални оценки за случая на неконформни елементи на Ранахер-Турек, като в [41] непълната факторизация за уравненията Ламе е комбинирана с метод на декомпозиция по премествания. Ще отбележим също така работа [44], където е изследвана елиптична гранична задача, дискретизирана с линейни неконформни елементи. Принципно различен подход на конструкция и анализ е приложен в [56], където е изследван метод от тип BSR BILU. Тук непълната факторизация е блочна, като приближения на обратните матрици на съответните допълнения на Шур се получават, като се решават системи, съответстващи на мрежи със съществено по-малка размерност (Block Size Reduction).

В работи [42,57,59] се прилага алтернативен подход, където за преобусловител се използват спомагателни матрици, за които съществува подходяща точна факторизация. Предложен е и е изследван метод на циркулантна блочна факторизация. Специално внимание заслужава конструираният в [55] почти оптимален метод, при който се използва периодично продължение на изходната гранична задача на Дирихле.

В някои от последните работи [16,28], посветени на многонивови преобусловители, ключово място играят конструираните и изследвани локални непълни факторизации на водещите диагонални блокове в AMLI метода.

1.5. Методи и алгоритми с оптимална изчислителна сложност за елиптични задачи с дробна степен на дифузионния оператор

В това направление са публикации [1,2,3,4,5,6,7,9]. Известни са бележки посветени на пресмятане на $D^{1/2}u(x)$ още че в кореспонденция на Лайбниц до Бернули и Лопитал от 1695 г. Развитието на теорията на дробните производни е свързано също така с имената на Ойлер, Лиувил и Риман. В наши дни, интересът към задачи с дробна степен на дифузионния оператор (дробна дифузия) е свързан с изследвания на нелокални математически модели. Така например, дробният Лапласиан на степен $0<\alpha<1$ описва процес на супер-дифузия.

Представените в това направление работи са посветени на методи за решаване на многомерни задачи ($d>1$) при най-общи предположения за геометрията на областта. Първи резултати от този клас са публикувани след 2014 г. Известни са три различни подхода, при прилагането на които нелокалната d-мерна задача се свежда до еквивалентна локална задача (където степента на диференциалния оператор е $\alpha=1$) в $d+1$-мерно пространство. В [6] е предложен алтернативен метод, основаващ се на най-добра равномерна рационална апроксимация (Best Uniform Rational Approximation – BURA) на функцията $t^{\beta-\alpha}$ в интервала [0,1], където β е малко цяло положително число. Изследвани са апроксимационните свойства и матричната реализация на BURA – функцията. Доказано е, че този клас BURA – алгоритми имат изчислителна сложност, която превъзхожда сложността на известните до момента методи за важни класове задачи.

Съществени нови резултати, свързани с развитие на идеята за конструиране на методи използващи най-добра равномерна рационална апроксимация са публикувани в статии [1,2,3,4]. Така например, в [4] е анализиран BURA – метод на базата на апроксимация на функцията t^{α} в интервала [0,1], който е робастен относно числото на обусловеност на дискретния елиптичен оператор **A**. Доказана е подобрена оценка за изчислителната сложност във вида $O(N(\log N)^2)$. В [1] е показано, че BURA – методите имат по-добра скорост на сходимост и изчислителна сложност от останалите числени методи за решаване на разглеждания клас задачи. В статии [2,3] са направени съществени обобщения на BURA – методите са задачи с Нойманови гранични условия, както и за уравнения от тип дробна дифузия с реакция.

Работа [9] е посветена на сегментация на двуфазни вокселни изображения, удовлетворяващи условие за запазване на обема на твърдата фаза. Предложеният метод включва решаване на система с матрица от вида $\mathbf{A}^{1/2}$, където **A** е граф-Лапласиан със специални свойства. За числено решаване на тази система е разработев метод използващ най-добро равномерно полиномиално приближение на функцията $t^{-1/2}$ в интервала $[\delta,1]$, където $\delta>0$.

Изчислителната ефективност на представените методи за задачи с дробна дифузия се основава на използване на оптимални итерационни метод за системи с разредени, симетрични и положително определени матрици от типа разгледани в Раздели 1.2 и 1.3.

1.6. Паралелни методи и алгоритми

В статии [26,40,46,49,53] са представени методи и алгоритми, за които е изследвана паралелната ефективност и са проведени числени експерименти върху различни класове паралелни компютърни архитектури. Изходните задачи са силно свързани, което означава, че за ефективна паралелна реализация са необходими специално разработени средства. Теоретичните резултати включват асимптотични оценки на ускорението и ефективността. За програмната реализация са използвани среди за паралелно програмиране MPI и Open MP. Представени са резултати върху паралелни системи с разпределена и обща памет. В по-ранния период от работата в тази област, съществена част от експериментите са провеждани в рамките на партньорство с водещи центрове в Европа и САЩ. В представените научни резултати от последните 13 години активно са използвани и български суперкомпютри. От 2015 г. това е суперкомпютър Авитохол (част от Националния център за високопроизводителни и разпределени изчисления, ИИКТ-БАН), виж [5,6,7,8,13]. Така например, в [43] е изследвана паралелната реализация на блочно-циркулантни методи за тримерни задачи. В основата на този клас алгоритми е прилагането на право и обратно преобразование на Фурие. В резултат се получава факторизирано представяне със специална блочна структура, даваща възможност за намаляване на комуникациите. Принципно различен подход е приложен в [40,46,49]. За оригиналната матрица на коравина се построява локално модифицирана апроксимация, която има структура, даваща възможност за ефективна паралелна непълна факторизация от тип MIC(0). Доказано е, че спомагателната матрица удовлетворява условията за устойчива MIC(0) факторизация. Значението на този тип резултати за развитието на паралелни числени методи за решаване на частни диференциални уравнения се определя от: а) избягване на необходимостта от вложен итерационен процес, което е типично за методите, използващи разделяне на областта на подобласти; б) възможност за естествено обобщение в тримерния случай. Изследванията са насочени към балансиране на паралелните изчисления и комуникациите и балансиране на локалните и глобални комуникации [26]. Получени са резултати с висока ефективност при много общи предположения, включващи неструктурирани тетраедрални мрежи с локално сгъстяване. Специален фокус на изследванията през последните години са елиптични уравненията с дробна степен на дифузия [1,2,3,4,5,6,7,9]. Този клас нелокални задачи има изчислителна сложност, която по естествен начин води до необходимостта от суперкомпютърна производителност. В частност, това е без алтернатива при тримерни задачи по пространството в изчислителна област със сложна геометрия. Създадени са нови алгоритми с оптимална паралелна ефективност.

1.7. Математическо моделиране

В работи [8,10,11,13,15,19,20,22,26,27,31,33,36,54] са представени резултати, които използват и развиват авангардни числени методи и алгоритми за решаване на важни приложни задачи на математическото и компютърно моделиране. Така например, работа [54] е посветена на моделиране на пилотни фундаменти в нелинейна многослойна среда. За ефективно решаване на задачата в тримерна постановка е приложено многонивово локално сгъстяване в зоната под челото на пилота. В статия [36] е разработен интегриран компютърен модел на процесите на вакуумно-замръзително сушене. За възникващата силно нелинейна параболична задача е приложена неявна дискретизация по времето с адаптивни стъпки по времето и итерационен метод с MIC(0) преобуславяне. В [33] е реализиран метод за числена хомогенизация на микроструктурата на трабекуларна костна тъкан. За целта е използвана вокселна информация за геометрията на твърдата фаза. Цел на изследването е характеризация на биомеханичните свойства на костни тъкани при изразен процес на развитие на остеопороза. В статии [22,26,27,31] са изследвани процеси на радиочестотна чернодробна туморна аблация.

Математическият модел се описва със свързана нелинейна нестационарна система от частни диференциални уравнения. За дискретизация по времето е използван неявен метод, като за възникващите системи от линейни уравнения е приложен алгебричен мултигрид метод. В [8,11,13] са разработени специализирани числени методи за нелинейни задачи от динамика на конструкциите. Те включват както робастност на дискретизацията и бифуркационен анализ, така и анализ на изчислителната сложност и ефективна алгоритмична и програмна реализация. В работи [11,12,22,26,27,31,33] се получават дискретни задачи, които достигат стотици милиони степени на свобода (неизвестни) по пространствените променливи. Решаването на такива задачи е възможно с помощта на високопроизводителни изчислителни системи с паралелна архитектура.

2. Постижения свързани с работа по научни и научно-приложни проекти

В този раздел са представени дейности и резултати, свързани с работа по научни и научно-приложни проекти.

През последните години особено важна роля за развитие на приоритетни научни области и укрепване на научния потенциал имат центровете за върхови постижения. Този тип проекти са определящи за изграждане и развитие на съвременна научна инфраструктура, като в същото време стимулират формирането на научни мрежи и нови научни направления.

Тук ще отбележа специално два такива проекта, на които съм ръководител.

Първият е финансираният от Фонд „Научни изследвания“ проект ДЦВП 02/1 за създаване и развитие на Център за върхови научни постижения по “Суперкомпютърни приложения”. Колективът включва математици, информатици, механици, физици, химици, инженери и фармацевти. Провеждат се съвместни изследвания на екипи от Института по информационни и комуникационни технологии – БАН, Института по механика – БАН, Националния институт по геофизика, геология и география – БАН, Факултета по математика и информатика – СУ, Факултета по физика – СУ, Факултета по компютърни системи и управление – ТУ София и Факултета по фармация – МУ София. Изследванията включват: суперкомпютърни архитектури; компютърно моделиране на микроструктурата на хетерогенни среди; анализ на чувствителността на сложни математически модели; оценка на потенциала на възобновяеми източници на енергия и качеството на въздуха; изчислителна динамика на флуидите; компютърно моделиране на биологични молекули и системи; квантови симулации; *in silico* проектиране на лекарства.

През 2018 г. стартира договор BG05M2OP001-1.001-0003: „Център за върхови постижения по Информатика и информационни и комуникационни технологии“, финансира по Оперативна програма „Наука и образование за интелигентен растеж“ 2014-2020. Центърът се изгражда от консорциум, включващ: Институт по информационни и комуникационни технологии – БАН (водеща организация); Институт по математика и информатика – БАН; Институт по механика – БАН; Национален институт по геофизика, геодезия и география – БАН; Пловдивски университет „Паисий Хилендарски“; Медицински университет – София; Университет по библиотекознание и информационни технологии. Целите на проекта включват: Изграждане на модерна електронна инфраструктура: компютърни системи, ресурси за съхранение на данни и услуги с отворен достъп за изследователите в България; Интегриране на отделните слоеве на е-инфраструктура със стандартизирани и специфични за отделните научни общности услуги, с цел създаване на виртуална изследователска среда; Осигуряване на функции, позволяващи управление на данни за научните общности; Осигуряване на програми за подпомагане и обучение за потребителите в България; Създаване на условия за провеждане на научни изследвания в съответствие с най-добрите световни стандарти при стимулиране работата в интердисциплинарни екипи.

Важен резултат от съвместната работа по тези проекти е създаването на критична маса от млади учени с възможности за технологични пробиви на базата най-съвременни научни постижения.

В представените документи по конкурса е включен списък на ръководените от мен през последните 5 годи 9 проекта, както следва: А. Финансирани от външни за България източници - 3; Б. Финансирани от български източници – 4; В. Международни договори по еквивалент – 2. Привлечените по тези договори финансови средства възлизат на над 31 милиона лева, като над 95% от тях са за БАН.

Работата ми, като ръководител на научни и научно-приложни проекти пряко допринася за утвърждаване на лидерската позиция БАН и на България в Югоизточна Европа в областта на високопроизводителните пресмятания.

Водещ приоритет в тези дейности през последните години е синергията между суперкомпютърни методи, алгоритми и приложения в среда на големи данни.

Постиженията, свързани с работа ми по научни и научно-приложни проекти са отразени в голям брой медийни и публични изяви. Те имат пряк принос за популяризиране на ролята на БАН в развитието на такива обществено-значими области, като научна подкрепа за цифровата трансформация и нейната роля за подпомагане изграждането на по-ефективна и по-зелена икономика.

София, юни 2021 г.

СПИСЪК НА ЦИТИРАНИЯ НА НАУЧНИТЕ ТРУДОВЕ

юни 2021 г.

чл.-кор. Светозар Димитров Маргенов
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София
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НЯКОИ ПО-СЪЩЕСТВЕНИ ЦИТИРАНИЯ

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Избраните цитирания са в статии публикувани в списания, които са в ТОП10% в класаиите на Thompson Reuters WoS. Такива в частност са SIAM Review, Numerical Linear Algebra with Applications, SIAM Journal on Matrix Analysis and Applications, SIAM Journal on Scientific Computing, SIAM Journal on Numerical Analysis, SIAM Journal on Multiscale Modeling and Simulation, Mathematics of Computation, Computers & Mathematics with Applications. Съавтори в цитиращите статии са световни лидери в съответните научни направления.

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    *"Typically, the commonly used governing principles fall in the realm of multiphase flow in porous media [7, 9, **10**, 11, 12, 16, 17] in which the subsurface flow and transport of multiple components are governed by coupled differential equations of different type: an elliptic equation for pressure and a sequence of hyperbolic equations for component concentrations. Further complication*

arises from the heterogeneous and multiscale nature presented in the permeability field. Reliable numerical simulators are desired to handle these physical features accurately and robustly."

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"A quite different approach has been proposed by Harizanov, Lazarov, Margenov, Marinov and Vutov [11] based on best uniform rational approximations (BURA). It is observed that, on the discrete level, the fractional diffusion problem may be viewed as taking a fractional matrix power of a standard stiffness matrix. In order to approximate the negative power −s of a matrix, a rational function approximating the mapping $z \to z^{-s}$ is constructed via a modified Remez algorithm. This rational function is then decomposed into partial fractions, which allows the computation of the approximate matrix power based only on inversions of spectrally equivalent shifted versions of the original (sparse) stiffness matrix."

- **R. Čiegis, P.N. Vabishchevich, Two-level schemes of Cauchy problem method for solving fractional powers of elliptic operators, Computers & Mathematics with Applications (2019), https://doi.org/10.1016/j.camwa.2019.08.012**

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*“We mention also methods based on the best uniform rational approximation (BURA). Such methods enable users to get a sufficient accuracy of approximations, while keeping the computational complexity of BURA methods much smaller than for other popular methods. It should be noted that BURA methods are well fitted in cases of solutions of lower regularity when the right hand side f(x) for example is piecewise constant [16], [**17**].”*

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