1.7. ОБЩОНАЦИОНАЛНИ И ОПЕРАТИВНИ ДЕЙНОСТИ, ОБСЛУЖВАЩИ ДЪРЖАВАТА

1.7.1. Практически дейности, свързани с работата на национални правителствени и държавни институции, индустрията, енергетиката, околната среда, селското стопанство, национални културни институции и др.

1.7.1.1. Списък на съвети, комисии и други експертни органи национални правителствени и държавни институции, индустрията, енергетиката, околната среда, селското стопанство, национални културни институции и др., в които участват учен или специалист от звеното:

Наименование на органа	Име на участника
Националната Агенция за Оценяване и Акредитация	**проф. дн Андрей Борисов Андреев**

1.7.1.2. Списък по раздели на писмено представени от служителя на звеното: концепции, програми, прогнози, експертизи, становища, консултации, рецензии и др. подобни за национални правителствени и държавни институции, индустрията, енергетиката, околната среда, селското стопанство, национални културни институции и др.

Наименование на материала	Име на автора
Рецензия по конкурс за доцент 1 бр. Рецензия по конкурс за професор 3 бр. Рецензия по конкурс за доктор на науки-те 1 бр. Рецензии на международни проекти 6 бр. Рецензии на статии за международни списания 8 бр. Рецензии на статии за международни поредици 21 бр.	**Проф. дн Иван Димов**
J. Mathematika Balkanica 1 бр. Доклади БАН 1 бр. Serdica J. 1 бр. AmiTaNS-Albena 1 бр. Int. Conf. LSSC, Sozopol, Bulgaria 1 бр. Int Conf. IMACS, Borovetz, Bulgaria 3 бр.	**Доц. д-р Пенчо Маринов**
J. of Information Science 13 бр. J. Mathematika Balkanica 1 бр. J. Science of Computer Programming 1бр. Доклади БАН 1 бр, Serdica J. 1 бр. J. Bioautomation 1 бр. Int. Conf. LSSC, Sozopol, Bulgaria 9 бр. Int. Conf. ECTA, Paris, France 2 бр. Int Conf. IMACS, Borovetz, Bulgaria 4 бр. Workshop on Computational Optimization, Poland 3 бр. Int. Conf. MIDAS, Tunisia 2 бр.	**Доц. д-р Стефка Фиданова**
Рецензии на статии за международни списания и поредици 5 бр.	**Доц. д-р Цветан Остромски**
Рецензия на докторска дисертация (Ph.D.) в Испания, февруари 2011 г.: Je-	**Д-р Антон Пензов**

sus Gumbau Portales, Techniques for improving visualization of natural scenes, Jaume I University, Dep. De Llenguatges i Sistems Informatics. Supervisor: Miguel Chover Selles.	

1.7.2. Проекти, свързани с общонационални и оперативни дейности, обслужващи държавата и обществото, финансирани от национални институции (без Фонд "Научни изследвания"), програми и от националната индустрия и пр.

Разработена е работеща в реално време система за възстановяване на профили с концентрация на електрони до геостационарна орбита (http://www.iono.noa.gr/ElectronDensity/EDProfile.php). Системата функционира на основата на модела Topside Sounder Model Profiler assisted Digisonde (TaD). Информация за него вижте на
http://www.iono.noa.gr/ElectronDensity/Documentation/Documentation.pdf.

Системата се използва за прецизно изследване на поведението на йоносферните смущения, което води до повишаване на точността на измерванията със GPS системи и надеждността на радио-връзки.

От ИИКТ-БАН в колектива, разработил модела и системата, участва доц. д-р Пенчо Маринов.

Иновационен код: iD1.

2. РЕЗУЛТАТИ ОТ НАУЧНАТА ДЕЙНОСТ ПРЕЗ 2011 г.:

2.1. Моля, опишете ЕДНО най-важно и ярко научно постижение

„ЕФЕКТИВНИ МОНТЕ КАРЛО АЛГОРИТМИ ЗА АНАЛИЗ НА ЧУВСТВИТЕЛНОСТТА"

Разработени са и са изследвани нови ефективни методи Монте Карло за пресмятане на интеграли и решаване на интегрални уравнения с големи размерности. Получени са оптимални по порядък оценки за грешката за важни за приложенията класове функции. Разработена е процедура за Монте Карло анализ на чувствителността за решаване на екологични задачи. Направено е числено изследване на няколко подхода за анализ на чувствителността, като са приложени нови алгоритми Монте Карло за многомерно интегриране. Разработен е клас от Монте Карло методи, базиран на рандомизация на ЛП$_\tau$ - редици на Собол. Разработени са нови техники и алгоритми за моделиране и реконструкция на медицински изображения в компютърната томография (PET – Positron Emission Tomography) чрез прецизно третиране на транспорта на гама фотоните и компенсиране на допълнителните грешки внасяни от дедектора.

Методът на мравките е Монте Карло метод за решаване на комбинаторни оптимизационни задачи. Методът на мравките е приложен и към телекомуникационни задачи, възникващи при построяването на безжични сензорни мрежи. Разработените алгоритми са реализирани на IBM BlueGene/P суперкомпютър. Разработен е алгоритъм на основата на метода на мравките за намиране на оптималните параметри при управление на процеси в биореактор.
Основните резултати в това направление са публикувани в следните специализирани международни списания и поредици: а) International Journal of Environment and Pollution; б) J. of

Monte Carlo Methods and Applications; в) Reliability Engineering & System Safety; г) Springer, Lecture Notes in Computer Science.

По темата са публикувани и глави в две монографии по методи Монте Карло.

Учените от секцията работят по редица проекти или работни пакети, фокусирани върху провеждане на анализ на чувствителността на математически модели с важно значение.

Ръководител на разработката е проф. дн Иван Димов.

2.2. Моля, опишете **ЕДНО най-важно и ярко научно-приложно постижение**

„МОДЕЛИРАНЕ НА КИНЕТИКАТА НА ТОКОВИ НОСИТЕЛИ В ПОЛУПРОВОДНИКОВИ ПРИБОРИ"

Разработен е нов модел за анализ на слаб сигнал, който изразява реакцията на физическата система, като Болцманова еволюция. На базата на общ подход са изведени четири Монте Карло алгоритъма, два от които обобщават съществуващи такива. Научно-приложните приноси са свързани с получаване на релаксацията на физични параметри, изследване на ефекти, както и на влиянието на принципа на Паули върху електронната кинетика. Преформулирано е нехомогенното стационарно уравнение за Болцманов транспорт, като е изведено спрегнатото уравнение и съответните гранични условия. Изведени са основните феноменологични едночастични алгоритми, като с помощта на Монте Карло анализ е доказана тяхната ергодичност. Доказано е, че решението на стационарната задача е инвариантно по отношение на избора на алтернативна граница.

Получена е йерархия от квантово-кинетични модели, които описват в различна степен на приближение включването на вибрациите на решетката във Вигнеровата формулировка на квантовата механика на системата електрон-потенциал. При най-общи предположения е изведен модел, наречен уравнение на Вигнер-Болцман. При специален избор на физическата система то се свежда до уравнението на Левинсон за хомогенен полупроводник или до неговото обобщение за случая на квантова жица. За този случай е изведено и уравнение на Баркер-Фери. Научно-приложните резултати включват анализ на решения за квантови ефекти, като "ултрабърз транспорт в пространството" и нарушаване на закона за запазване на енергията.

Граничната задача за уравнение на Вигнер-Болцман е преформулирана в термините на изведеното спрегнато уравнение. Получени са и са анализирани два алгоритъма за квантови частици. При първия е показано, че теглата растат експоненциално. За втория, базиран на генерация и анихилация на частици, е получена интерпретация за взаимодействието електрон-потенциал.

По това научно постижение са публикувани 4 статии и е защитена дисертация за научната степен „Доктор на науките" по научната специалност 01.01.13 „Математическо моделиране и приближение ма математиката".

Ръководител на разработката е доц. дн Михаил Недялков.

7.   ДАННИ ЗА ПУБЛИКАЦИОННАТА ДЕЙНОСТ НА ЗВЕНОТО

- Списък на публикации, които са реферирани и индексирани в световна система за рефериране, индексиране и оценяване (в световни вторични литературни източници)

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1. **I. T. Dimov, R. Georgieva**, Monte Carlo Method for Numerical Integration based on Sobol' Sequences. – In: *Proceedings of Numerical Methods and Applications 2010, LNCS 6046, Springer, Germany*, 2011, 50–59. ISSN: 0302-9743. SJR (2011): 0.034.

2. **Fidanova S.**, Atanassov K., **Marinov P.**, Start Strategies of ACO Applied on Subset Problems. - In: *Proceedings of Numerical Methods and Applications 2010, LNCS 6046, Springer, Germany*, 2011, 248 – 255. ISSN 0302-9743. SJR (2011): 0.034.

3. **Fidanova S.**, **Marinov P.**, Atanassov K.**,** Sensitivity Analysis of ACO Start Strategies for Subset Problems. - In: *Proceedings of Numerical Methods and Applications 2010, LNCS 6046, Springer, Germany*, 2011, 256 - 263. ISSN: 0302-9743. SJR (2011): 0.034.

4. M. Magdics, L. Szirmay-Kalos, B. Tóth, Á. Csendesi, **A. Penzov**, Scatter Estimation for PET Reconstruction. - In: *Proceedings of Numerical Methods and Applications 2010, LNCS 6046, Springer, Germany*, 2011, 77-86. ISSN: 0302-9743; ISBN: 9783-642-18465-9. Doi: 10.1007/978-3-642-18466-6_8. SJR (2011): 0.034.

5. **M. Nedjalkov**, S. Selberherr, **I. T. Dimov**, Stochastic Algorithm for Solving the Wigner-Boltzmann Correction Equation. - In: *Proceedings of Numerical Methods and Applications 2010, LNCS 6046, Springer, Germany*, 2011, 95-102, ISSN: 0302-9743. SJR (2011): 0.034.

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3. **A. B. Andreev**, M. Racheva, Quadratic Finite Element Approximation of a Contact Eigenvalue Problem. - In: *Proceedings of Large-Scale Scientific Computations 2011, LNCS 7116, Springer*, 2012, 531-538. ISSN 0302-9743. SJR (2011): 0.034.

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13. P. Schwaha, **M. Nedjalkov**, S. Selberherr, **I.T. Dimov**, Phonon-Induced Decoherence in Electron Evolution. - In: *Proceedings of Large-Scale Scientific Computations 2011, LNCS 7116, Springer.* ISSN: 0302-9743. SJR (2011): 0.034.

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15. Z. Zlatev, **I. T. Dimov**, I. Faragó, K. Georgiev, Á. Havasi, Tz. Ostromsky, Solving Advection Equations by Applying the Crank-Nicolson Scheme Combined with the Richardson Extrapolation, *International Journal of Differential Equations*, vol. 2011, Hindawi, Article ID 520840, 16 pages. ISSN: 1687-9643. Doi:10.1155/2011/520840.

- Списък на публикациите, които са включени в издания с импакт фактор IF (Web of Science) или импакт ранг SJR (SCOPUS) – те са част от горния списък

излезли от печат

1. **I. T. Dimov, R. Georgieva**, Monte Carlo Method for Numerical Integration based on Sobol' Sequences. − In: *Proceedings of Numerical Methods and Applications 2010, LNCS 6046, Springer, Germany*, 2011, 50–59. ISSN: 0302-9743. SJR (2011): 0.034.

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4. M. Magdics, L. Szirmay-Kalos, B. Tóth, Á. Csendesi, **A. Penzov**, Scatter Estimation for PET Reconstruction. - In: *Proceedings of Numerical Methods and Applications 2010, LNCS 6046,*

Springer, Germany, 2011, 77-86. ISSN: 0302-9743; ISBN: 9783-642-18465-9. DOI: 10.1007/978-3-642-18466-6_8. SJR (2011): 0.034.

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5. K. Georgiev, **Tz. Ostromsky**, Z. Zlatev, New Parallel Implementation of an Air Pollution Computer Model – Performance Study on an IBM Blue Gene/P Computer. - In: *Proceedings of Large-Scale Scientific Computations 2011, LNCS 7116, Springer*, 2012, 277 – 284. ISSN: 0302-9743. SJR (2011): 0.034.

6. **Tz. Ostromsky, I. T. Dimov, R. Georgieva**, Z. Zlatev, Parallel Computation of Sensitivity Analysis Data for the Danish Eulerian Model. - In: *Proceedings of Large-Scale Scientific Computations 2011, LNCS 7116, Springer*, 2012, 301 – 309. ISSN: 0302-9743. SJR (2011): 0.034.

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- Списък на публикации **без** рефериране и индексиране в световната система за рефериране, индексиране и оценяване.

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Участие през 2011 г. в научни форуми с доклади или съавторство

Дата на провеждане		Място на провеждане (*град, държава*)	Наименование на конференцията	Наименование и Автори на доклада
Ден	**Месец**			
25 – 28	януари	Szeged, Hungary	*KÉPAF 2011 - 8th Conference of the Hungarian Association for Image Processing and Pattern Recognition*	*Detector Modeling with 4D Filtering in PET*, Tóth B., Szirmay-Kalos L., Magdics M., **A. Penzov**
16 – 17	март	Alcala, Spain	*COST ES0803 workshop "Assessment and validation of space weather models"*	*Validation of the TaD electron density reconstruction model*, Belehaki A., I. Tsagouri, I. Kutiev, **P. Marinov, S. Fidanova**
16 – 17	март	Alcala, Spain	*COST ES0803 workshop "Assessment and validation of space weather models"*	*GPS-TEC data improved accuracy of TaD electron density reconstruction model*, Kutiev I., **P. Marinov, S. Fidanova**, A. Belehaki, I. Tsagouri
11 – 12	май	Бургас, България	*Int. Conf on Intuitionistic fuzzy sets*	*Intuitionistic Fuzzy Estimation of the Ant Colony Optimization Starting Points: Part 2*, **Stefka Fidanova**, Krassimir Atanassov, **Pencho Marinov**
17 – 19	май	Alexandria, Virginia, USA	*13-th International Ionospheric Effects Symposium*	*An improved model for operational specification of the electron density structure up to GNSS orbits assisted by Digisonde data*, Belehaki A., I. Tsagouri, I. Kutiev, **P. Marinov, S. Fidanova**
17 – 19	май	Alexandria, Virginia, USA	*13-th International Ionospheric Effects Symposium*	*On the real time reconstruction of the ionospheric electron density profile based on concurrent measurements from collocated digital ionosinde and GNSS receiver*, S. Stankov S., K.Stegen, P. Muhtarov, **P. Marinov**, R. Warnant
20 – 22	май	Хисаря, България	*Workshop on Supercomputer Applications*	*Monte Carlo Sensitivity Analysis of an Eulerian Large-scale Air Pollution Model*, **I. Dimov, R. Georgieva**
20 – 22	май	Хисаря, България	*Workshop on Supercomputer Applications*	*Parallel Computation of Sensitivity Analysis Data for the Danish Eulerian Model on the IBM BlueGene/P supercomputer*, **Tz. Ostromsky**
27 – 28	май	София, България	*Int. Conf. Of Information Systems and Grid Technologies*	*Optimal Sensor Layout using Multi-Objective Metaheuristic*, **Fidanova S., Shindarov M., Marinov P.**
06 – 10	юни	Sozopol, Bulgaria	*Large-Scale Scientific Computing 2011 (организиране на специална сесия)*	*Intuitionistic Fuzzy Estimation of the Ant Colony Optimization Starting Points*, **Fidanova S.**, Atanassov K., **Marinov P.**
06 – 10	юни	Sozopol, Bulgaria	*Large-Scale Scientific Computing 2011*	*A generalized net with an ACO-algorithm optimization component*, Atanassova V., **Fidanova S.**, Chountas P., Atanassov K.
06 – 10	юни	Sozopol, Bulgaria	*Large-Scale Scientific Computing 2011*	*Properties and Estimates of an Integral Type Nonconforming Finite Element*, **A. Andreev**, M. Racheva
06 – 10	юни	Sozopol, Bulgaria	*Large-Scale Scientific Computing 2011*	*Quadratic Finite Element Approximation of a Contact Eigenvalue Problem*, **A. Andreev**, M. Racheva
06 – 10	юни	Sozopol, Bulgaria	*Large-Scale Scientific Computing 2011*	*Parallel Computation of Sensitivity Analysis Data for the Danish Eulerian Model*, **Tz. Ostromsky, I. Dimov, R. Georgieva**, Z. Zlatev

06 – 10	юни	Sozopol, Bulgaria	***Large-Scale Scientific Computing 2011***	*Monte Carlo Algorithms for Variance-Based Sensitivity Studies*, **I. Dimov, R. Georgieva, Tz. Ostromsky**, Z. Zlatev
14-15	юни	Paris, France	***Int. Conf. on Swarm Intelligence***	*Optimal Wireless Sensor Network Coverage with Ant Colony Optimization*, **Fidanova S., Marinov P.**
20-25	юни	Албена	***Third International Conference AMiTaNS'11***	*Advanced Sensitivity Analysis of the Danish Eulerian Model in Parallel and Grid Environment*, **Tz. Ostromsky, I. Dimov, R. Georgieva, P. Marinov**, Z. Zlatev
29.08.-02.09.	септември	Borovetz, Bulgaria	***IMACS International Conference 2011***	*Wireless Sensor Network Layout,* **S. Fidanova, P. Marinov**, E. Alba
29.08.-02.09.	септември	Borovetz, Bulgaria	***IMACS International Conference 2011***	*Game-Method for Modelling and WRF-Fire Model Working Together*, Dobrinkova N., **Fidanova S., Dimov I.**, Atanassov K., Mandel J.
29.08.-02.09.	септември	Borovetz, Bulgaria	***IMACS International Conference 2011***	*Generalized nets, ACO-algorithms and genetic algorithm*, Atanassova V., **Fidanova S.**, Popchev I, Chountas P.
29.08.-02.09.	септември	Borovetz, Bulgaria	***IMACS International Conference 2011***	*Sensitivity Analysis Study of a Large-scale Air Pollution Model – Computational Problems and High Performance Solutions*, **Tz. Ostromsky, I. Dimov, P. Marinov, R. Georgieva**, Z. Zlatev
29.08.-02.09.	септември	Borovetz, Bulgaria	***IMACS International Conference 2011***	*A Monte Carlo Method Based on Sobol's Sequences*, **I. T. Dimov, R. Georgieva**
29.08.-02.09.	септември	Borovetz, Bulgaria	***IMACS International Conference 2011***	*Sensitivity Analysis of Compact Models in Nanodevice Modeling*, A. Asenov, B. Cheng, **I. Dimov, R. Georgieva**, U. Kovac, C. Millar
21-22	декември	София, България	***Sixth Annual Meeting of the Bulgarian Section of SIAM***	*Visualization Tool of Sensitivity Studies Results,* **R. Georgieva, S. Ivanovska**