EKATERINA MARKUS, Ph.D.

Postdoctoral Researcher at CERTEC, UPC

Contact Information:
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Personal Information:
Female, 27 years old
Barcelona, Spain
Valid Spain residence and work permit

Research Interests:
Combustion and heat transfer, computational fluid dynamics, fire safety science and engineering, CFD flame spread modeling, Fire Dynamics Simulator, material flammability, pyrolysis, wildland fires, fire tracking using image processing, etc.

Education

2016 – 2020 PhD in Thermal Physics
(area of specialization Thermophysics and Theoretical Thermal Engineering)
Peter the Great St. Petersburg Polytechnic University, Russia
Title: "Spread of Turbulent Buoyant Flame over the Surface of Solid Combustible Materials "
Supervised by Prof. Alexander Snegirev

2014 – 2016 MSc in Applied Mathematics and Physics
Peter the Great St. Petersburg Polytechnic University, Russia
Title: "CFD Flame Spread Simulations Coupled with Pyrolysis of Combustible Materials"
Supervised by Prof. Alexander Snegirev. Graduated with honors

2010 – 2014 BTech in Technical Physics
Peter the Great St. Petersburg Polytechnic University, Russia
Title: "Coupled Simulations of Pyrolysis of Combustible Materials and Turbulent Burning of Gasification Products"
Supervised by Prof. Alexander Snegirev. Graduated with honors

Working Experience

2021 – … Postdoctoral Researcher
Universitat Politècnica de Catalunya,
CERTEC - Centre for Technological Risk Studies, certec.upc.edu/en

2015 – 2020 Research Engineer, Junior Research Fellow, Assistant Professor
Peter the Great St. Petersburg Polytechnic University, english.spbstu.ru
Department of Applied Mathematics and Computational Physics
Institute of Applied Mathematics and Mechanics

Main Research Projects

2020 – 2021 Dynamics and limits of sustainability of laminar diffusion flame in zero and normal gravity. Space experiment "Flamenco"
Research grant 20-08-00478. Russian Foundation for Basic Research.
Co-Investigator

2018 – 2020 NASA-Roscosmos space experiment “Burning Rate Emulator” (BRE-Flamenco)
Jointly with the University of Maryland, College Park (US)
Co-Investigator, Russian team

2018 – 2020 Simulations of high rack storage fires.
Gefest group (St.-Petersburg, Russia).
Principal investigator/Consultant

2015 - 2019 Modeling and simulations of material flammability. Evaluation and Modification of Fluent-Pyropolis Software
Series of investigations
The Boeing Company, BR&T Support to IRC & Payload Technologies (USA)
Co-Investigator

2016 – 2018 Experimental study and numerical modeling of polymers' pyrolysis and burning for the prediction of flame spread behavior under fire growth
Research grant MHK-DST 16-49-02017. Russian Science Foundation.
Co-Investigator

2013 – 2014 Oxidation kinetics of fuel pyrolysis volatiles and its use to advance fire suppression models
Research grant by British Petroleum in Russia
Co-Investigator

Teaching Experience

Peter the Great St. Petersburg Polytechnic University

2016 – 2020 Fire Modeling using FDS
15+ undergraduate students every year for one semester. Lectures and practice. Developed and delivered. Teaching materials are about to be published.

2016 – 2020 Theory of Combustion
Managing course work of 10+ graduate students every year for one semester.

2020 – 2021 Student supervision: BSc thesis project
Title: “FDS simulations of downward laminar flame spread”

2020 – 2021 Student supervision: MSc thesis project
Title: “FDS simulations of opposed-flow horizontal turbulent flame spread”

2020 Student supervision: undergraduate student summer project
Title: “Design fire simulation using FDS”

2019 Student supervision: BSc thesis project
Title: “Simulations of ignition and burning of polymer materials”

Qualifications

2020 Research Teaching Fellow
Peter the Great St. Petersburg Polytechnic University, Russia
Postgraduate Diploma

2019 2nd Summer School in Fire Modeling
Forschungszentrum Jülich GmbH, Germany
Topics: CFD, Turbulence models, Combustion, Thermal radiation, Pyrolysis, Parallel processing (Profs. Simo Hostikka, Bjarne Husted, Susan Kilian, Randall McDermott, Marcos Vanella, Lukas Arnold)

2017 Tsinghua-Princeton-Combustion Institute Summer School on Combustion
Center for Combustion Energy, Tsinghua University, Beijing, China
Courses: Theory of Combustion (Prof. Heinz Pitsch); Computational Turbulent Combustion (Prof. Thierry Poinsot)

2013 – 2015 Russian-English Translation
Peter the Great St. Petersburg Polytechnic University, Russia
Diploma on Professional Retraining based on BSc degree

Awards and Honors

2019 Scholarship of the Government of the Russian Federation
For young scientists and post-graduate students carrying out advanced research in the priority fields of the Russian economy and technology modernization

2018 Best oral presentation award (sponsored by IAFSS)
3rd European Symposium on Fire Safety Science, Nancy, France
"Application of a simplified pyrolysis model to predict fire development in rack storage facilities"

2018 – 2020 Scholarship of the President of the Russian Federation
For young scientists and post-graduate students carrying out advanced research in the priority fields of the Russian economy modernization.
"Regimes and mechanisms of flame spread"

2017 Best poster presentation award
21th Leontiev' seminar, St. Petersburg, Russia
"Regimes of Flame Spread over Combustible Materials"

2016 Best Student Paper Award (sponsored by FM Global, USA)
8th International Seminar on fire and Explosion Hazards, Hefei, China
"CFD Fire Modelling with General-Purpose Commercial Software"

2014 - 2017 St. Petersburg City Government Scholarship and Grants
For students and young scientists

2013 - 2015, 2017 Best presentation award
Week of Science of St. Petersburg Polytechnic University, Russia

2015 - 2016 Russian Federation Government Educational Scholarship

Membership in Organizations and Contribution to the Community

- Member of the Combustion Institute (Russian Section)
- Member of the Local Organizing Committee of the Ninth International Seminar on Fire and Explosion Hazards (ISFEH9), St. Petersburg, Russia, 21-26 April 2019 isfeh9.org
- Member of the International Symposium on Fire Safety Science
- Peer reviewing for professional journals and conference proceedings (Fire Safety Journal, Fire and Materials, Magazine of Civil Engineering, Proceedings of ISFEH9).

Skills

- CFD Fire Modelling: FDS (professionally), Fluent (basic)
- Academic knowledge of Combustion Theory and Fire Science
- Basic Programming Skills (Fortran 90, Python, C#)
- Simulations with supercomputers

- Languages: Russian (native speaker), English (fluent), Spanish (A2, actively learning)

Publications in Journals (Scopus H-index =2)

1. A. Snegirev, E. Kuznetsov, E. Markus, P. Dehghani, P. Sunderland. Transient dynamics of radiative extinction in low-momentum microgravity diffusion flames. Proceedings of the Combustion Institute (2020) (In press). https://doi.org/10.1016/j.proci.2020.06.110
2. E.A. Kuznetsov, A.Yu. Snegirev, E.S. Markus, Radiative Extinction of Laminar Diffusion Flame above the Flat Porous Burner in Microgravity: a Computational Study. Combustion, Explosion, and Shock Waves, 56 , 394-411 (2020). https://doi.org/10.1134/S0010508220040036
3. E.S. Markus, A.Yu. Snegirev, E.A. Kuznetsov, L.T. Tanklevskiy, A.V. Arakcheev. Simulation of flame spread over discrete fire load. Pozharovzryvobezopasnost/Fire and Explosion Safety 28 (4) (2019), 29-41. (In Russ.) https://doi.org/10.18322/PVB.2019.28.04.29-41
4. E. Markus, A. Snegirev, E. Kuznetsov, L. Tanklevskiy, Application of the thermal pyrolysis model to predict flame spread over continuous and discrete fire load, Fire Saf. J. 108 (2019). https://doi.org/10.1016/j.firesaf.2019.102825.
5. A.Y. Snegirev, E. Kuznetsov, E. Markus, J. Harris, B. Moravec, A.Y. Snegirev, J. Harris, E. Kuznetsov, E. Markus, Performance and calibration of two subgrid extinction models for turbulent diffusion combustion in an under-ventilated enclosure fire, J. Phys. Conf. Ser. 1107 (2018) 042011. https://doi.org/10.1088/1742-6596/1107/4/042011.
6. E. Markus, A.Y. Snegirev, E. Kuznetsov, L. Tanklevskiy, Application of a simplified pyrolysis model to predict fire development in rack storage facilities, J. Phys. Conf. Ser. 1107 (2018). https://doi.org/10.1088/1742-6596/1107/4/042012.
7. E. Markus, A. Snegirev, E. Kuznetsov. Buoyant turbulent diffusion flame near a vertical surface. Combustion, Explosion and Shock Waves 54 (3) (2018), 284-293 https://doi.org/10.1134/S0010508218030048
8. A. Snegirev, E. Markus, E. Kuznetsov, J. Harris, T. Wu, On soot and radiation modeling in buoyant turbulent diffusion flames, Heat Mass Transf. 54 (2018) 2275–2293. https://doi.org/10.1007/s00231-017-2198-x.
9. A. Snegirev, E. Kuznetsov, E. Markus, Coupled analytical approach to predict piloted flaming ignition of non-charring polymers, Fire Saf. J. 93 (2017) 74–83. https://doi.org/10.1016/j.firesaf.2017.08.006.
10. A. Snegirev, E. Kokovina[1], A. Tsoy, J. Harris, T. Wu, The effect of soot modeling on thermal radiation in buoyant turbulent diffusion flames, J. Phys. Conf. Ser. 745 (2016) 032028. https://doi.org/10.1088/1742-6596/745/3/032028.

Conference Papers and Posters

1. E. Kuznetsov, E. Markus, A. Snegirev. Performance of Two Subgrid Extinction Models in the Simulations of Highly Strained Flames, 15th International Conference and Exhibition on Fire Science and Engineering, INTERFLAM, Egham, UK, 2019.
2. A. Snegirev, E. Kuznetsov, E. Markus. Fluent-Based Framework for Modeling Flaming Ignition and Burning of Combustible Materials, 15th International Conference and Exhibition on Fire Science and Engineering, INTERFLAM, Egham, UK, 2019.
3. E. Kuznetsov, E. Markus, A. Snegirev. Dynamic Determination of the Mean Radiation Path Length in the Simulations of Transient Flame Development, 15th International Conference and Exhibition on Fire Science and Engineering, INTERFLAM, Egham, UK, 2019
4. E. Markus, A. Snegirev, E. Kuznetsov, L. Tanklevskiy. Fire Growth in a High-rack Storage. Proceedings of the Ninth International Seminar on Fire and Explosion Hazards, St. Petersburg, Russia, Peter the Great St. Petersburg Polytechnic University, 2019, Vol. 2, pp. 796-807 http://doi.org/10.18720/spbpu/2/k19-70.
5. E. Kuznetsov, A. Snegirev, E. Markus, Radiative Extinction of a Diffusion Flame in Microgravity. Proceedings of the Ninth International Seminar on Fire and Explosion Hazards, St. Petersburg, Russia, Peter the Great St. Petersburg Polytechnic University, 2019, Vol. 1, pp. 214-224. http://doi.org/10.18720/spbpu/2/k19-73

6. E.S. Markus, A.Yu. Snegirev, E.A. Kuznetsov, L.T. Tanklevskiy, A.V. Arackcheev, I.A. Babikov. Flame spread over discrete set of combustible objects. High-rack storage fire development. Proceedings of the Seventh Russian National Conference on Heat Transfer: in 3 volumes (October 22-26, 2018, Moscow), V. 1., p. 425 - 428 (In Russian).
7. E.A. Kuznetsov, E.S. Markus, A.Yu. Snegirev. Extinction of turbulent diffusion flame under under-ventilated conditions. Proceedings of the Seventh Russian National Conference on Heat Transfer: in 3 volumes (October 22-26, 2018, Moscow), V. 1., p. 413 - 416 (In Russian).
8. Kokovina, E. Kuznetsov, A. Snegirev Numerical simulation of flame spread over vertical and inclined combustible surfaces. Proceedings of 9th International Seminar on Flame Structure, Novosibirsk, (2017) p. 56
9. A. Snegirev, E. Kuznetsov, E. Markus, A. Markan, J. Quintiere, P. Sunderland, J. De Ris, H. Baum. Simulations of laminar diffusion flames at normal and microgravity. BRE-Flamenco project. Work in progress session, 3rd European symposium on fire safety sciences (ESFSS2018), Nancy, France, 12-14 September 2018, Poster 217947.
10. A. Snegirev, E. Kokovina[1], A. Tsoy, P. Popov, J. Harris, T. Wu. CFD Fire Modeling with General-Purpose Commercial Software, the Effect of Soot Model. Proceedings of the Eighth International Seminar on Fire and Explosion Hazards, Hefei, China, 2016, USTC Press, 2017, pp. 182-194 https://doi.org/10.20285/c.sklfs.8thISFEH.018.
11. A. Snegirev, E. Kokovina[1], A. Tsoy. Coupled simulations of turbulent flame and pyrolysis of combustible material. Proceedings of the 7th European Combustion Meeting, Budapest, Hungary, 2015, Paper P4.
12. A.Yu. Snegirev, E.S.Kokovina[1], A.S. Tsoy, V.A. Talalov, V.V. Stepanov. Integration of models of turbulent flame and pyrolysis of combustible material: combustion of thermoplastics. Proceedings of the XXXI Siberian Thermophysical Seminar (November 17-19, 2014, Kutateladze Institute of Thermophysics, SB RAS), Novosibirsk, (2014) p. 226-233. (In Russian)

Handbook

E.S. Markus, A.Yu. Snegirev, E.A. Kuznetsov. Numerical Fire Simulations using FDS. Handbook (Teaching Material). St. Petersburg, Polytechnic University Press, 2021, 175 p. (In Russian).

Recommendations

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Department of Applied Mathematics and Computational Physics
Institute of Applied Mathematics and Mechanics

[1] E. Markus