Journal Publications

1. Shadman Sakib Priam and **Rehena Nasrin**, Time dependent peristaltic duct flow by Casson fluid: A finite element modeling, Mathematics and Computers in Simulation, Submitted
2. Taiba Zahid, Muhsin Qadeer, Salman Sagheer Warsi, Usman Ghafoor, Muhammad Shakeel Ahmad, **Rehena Nasrin**, A bi-objective mathematical model for the synchromodal transportation analysis on One-Belt-One-Road (OBOR) initiative, Journal of Advanced Transportation, Submitted.
3. Tarikul Islam and **R. Nasrin**, Thermal operation by nanofluids with various aspects: A comprehensive numerical appraisal, Waves in Random and Complex Media, Submitted.
4. Md. Mosharrof Hossain, Md. Hasanuzzaman, M.M. Touhid Hossain and **R. Nasrin**, Unsteady magneto-convective heat-mass transport by micropolar binary mixture passing a vertical permeable surface, Sci. and Tech. Asia, Submitted.
5. Saima Akhter Swampa and **R. Nasrin**, Hepatic tumor ablation using electric current and bioheat transfer: 3D numerical analogy, Submitted.
6. Chaity Biswas, **R. Nasrin** and Muhammad Shakeel Ahmad, Numerical analogy of bioheat transfer and microwave cancer therapy for liver tissue, Heat Transfer, Submitted.
7. Mohammad Ali, **R. Nasrin** and M.A. Alim, Axisymmetric Boundary Layer Slip Flow with Heat Transfer over An Exponentially Stretching Bullet-Shaped Object: A Numerical Assessment, Heliyon, Submitted.
8. Tarikul Islam, N. Parveen and **R. Nasrin**, Mathematical modeling of unsteady flow with uniform/non-uniform temperature and magnetic intensity in a half-moon shaped domain, Heliyon, Accepted.
9. Sayfar Rasachak, Usman Ghafoor, Laveet Kumar, Taiba Zahid, Rana Sami Ullah Khan, Jeyraj Selvaraj, **Rehena Nasrin**, Muhammad Shakeel Ahmad, Effect of tin oxide/black paint coating on absorber plate temperature for improved solar still production: A controlled indoor and outdoor investigation, International Journal of Photoenergy, International Journal of Photoenergy, Vol. 2022, 6902783, https://doi.org/10.1155/2022/6902783.
10. Shatay Khatun and **R. Nasrin**, Numerical modeling of Buongiorno's nanofluid on free convection: Thermophoresis and Brownian effects, **Journal of Naval Architecture and Marine Engineering**, Vol. 18, No. 1, pp. 11-24, 2021, https://doi.org/10.3329/jname.v18i2.54694.
11. **R. Nasrin**, S.A. Sweety and I. Zahan, Turbulent nanofluid flow analysis passing a shell and tube thermal exchanger with Kays-Crawford model, **Journal of Nanofluids**, Vol. 10, No. 4, pp. 518-537, 2021, DOI:10.1166/jon.2021.1803.
12. Shadman Sakib Priam and **Rehena Nasrin**, Oriented magneto-conjugate heat transfer and entropy generation in an inclined domain having wavy partition, **International**

Communications in Heat and Mass Transfer, Vol. 126, 105430, 2021, https://doi.org/10.1016/j.icheatmasstransfer.2021.105430.

13. M. Ali, **R. Nasrin**, M.A. Alim, Analysis of boundary layer nanofluid flow over a stretching permeable wedge-shaped surface with magnetic effect, **Journal of Naval Architecture and Marine Engineering**, Vol. 18, No. 1, pp. 11-24, 2021, http://dx.doi.org/10.3329/jname.v18i1.44458.

14. **R. Nasrin** and M. Saddam Hossain, Numerical analysis of photovoltaic power generation in different locations of Bangladesh, **Journal of Computational and Applied Research in Mechanical Engineering,** Vol. 10, No. 2, pp. 373-389, 2021, https://doi.org/10.22061/JCARME.2019.4601.1558.

    A 3D numerical system of photovoltaic (PV) module has been built up and solved applying FEM in this article. The average solar irradiation and optimum tilt angle for six divisions (Dhaka, Chittagong, Rajshahi, Khulna, Barishal, and Sylhet) in Bangladesh have been calculated. It is observed from the results that the greatest value of electrical power 15.14 W is found in Rajshahi for solar radiation 209 W/m^2. The highest electrical efficiency is found as 12.85% in Sylhet at an irradiation level of 189 W/m^2. For every 1° increase of inclination angle, electrical power and electrical efficiency level devalue by 0.06 W and 0.05%, respectively. Results also show that the efficiency level decreases from 14.66 to 11.32% due to partial shading area from 0 to 40%. PV module's electrical power; and electrical efficiency reduce approximately 0.01 W and 0.01%, respectively due to every 1°C addition of solar cell temperature.

I. Zahan and **R. Nasrin**, An introduction to fuzzy topological spaces, **Advances in Pure Mathematics**, Vol. 11, No. 5, 483-501, 2021, https://doi.org/10.4236/apm.2021.115034.

15. **R. Nasrin**, Saddam Hossain, I. Zahan, K.F.U. Ahmed and H. Fayaz, Performance analysis of hybrid nanofluid on enhancement of fluid thermal conductivity in lid-driven undulated cavity, **Heat Transfer**, Vol. 49, No. 8, pp. 4204 – 4225, 2020, https://doi.org/10.1002/htj.21823.

    This numerical study reveals the heat transfer performance of hybrid/single nanofluids inside a lid-driven sinusoidal trapezoidal shaped enclosure applying the Finite Element Method (FEM). The heat transfer rate is increased by about 15% for varying Richardson numbers from 0.1 to 10.0. Blending of two nanoparticles suspension in the base fluid has a higher heat transfer rate of approximately 5% than mono nanoparticle. Moreover, a higher average Nusselt number is obtained by 14.7% using a wavy surface than the flat surface of the enclosure. Thus, this research showed that applying hybrid nanofluid may be beneficial to obtain expected thermal performance.

16. **R. Nasrin**, Amzad Hossain and I. Zahan, Blood flow analysis inside a stenotic artery using power-law fluid model, **Research & Development in Material Science**, Vol. 13, No. 1, pp. 1360-1368, 2020, https://doi.org/10.31031/RDMS.2020.13.000803.

    For numerical investigation, the blood flow modeling method of this research begins with the non-Newtonian power-law model using FEM. The numerical simulation has been conducted for various inlet velocities from 0.005 to 0.1m/s and magnetic field strength from 0 to 6 tesla with superior convergence of the iterative structure. Cross-sectional plots of velocity and viscosity magnitudes across the stenotic contraction have also been

displayed graphically. Obtained results of the blood flow simulations indicate that viscosity increases due to increasing values of inlet velocity of blood and magnetic strength.

17. Ishrat Zahan, **R. Nasrin** and M.A. Alim, Mixed convective hybrid nanofluid flow in lid-driven undulated cavity: effect of MHD and Joule heating, **Journal of Naval Architecture and Marine Engineering**, Vol. 16, No. 2, pp. 109-126, 2019, https://doi.org/10.3329/jname.v16i2.40585.

    A numerical analysis has been conducted to show the effects of magnetohydrodynamic (MHD) and Joule heating on heat transfer phenomenon in a lid-driven triangular cavity using water-based hybrid nanofluid composed of equal quantities of Cu and TiO_2 nanoparticles. The numerical results have been obtained using FEM and presented in terms of streamlines, isotherms, and average Nusselt number (Nu). Increasing wave number from 0 to 3 enhances the heat transfer rate by 16.89%. The enhanced rate of mean Nusselt number for hybrid nanofluid is found as 4.11% compared to the base fluid.

18. H. Fayaz, N.A. Rahim, M. Hasanuzzaman, **R. Nasrin**, A. Rivai, Numerical and experimental investigation of the effect of operating conditions on performance of PVT and PVT-PCM, **Renewable Energy**, Vol. 143, pp. 827-841, 2019, https://doi.org/10.1016/j.renene.2019.05.041.

    A novel thermal collector has been designed as PVT and PVT-PCM systems to improve heat transfer and performance. The 3D numerical analysis is done with FEM and is validated at different volume flow rates of 0.5 to 3LPM, by the experimental investigation at conditions of keeping the inlet water and ambient temperature at 27 °C and solar irradiation at 1000 W/m^2. The experiment is carried out in indoor weather under controlled operating parameters and conditions with passive cooling of the module. Maximum 12.4% and 12.28% electrical efficiency of PVT are achieved in numerical and experimental cases, respectively. Similarly, 12.75 and 12.59% electrical efficiency for PVT-PCM is obtained for experimental and numerical cases respectively. For the PVT system, 10.13 and 9.2% electrical performance is improved. For PVT-PCM the electrical performance improvement is obtained as 12.91 and 12.75% numerically and experimentally respectively.

19. Ishrat Zahan, **R. Nasrin** and M.A. Alim, Hybrid nanofluid flow in combined convective lid-driven sinusoidal triangular enclosure, **AIP Conference Proceedings**, 2121, 070001, 2019; https://doi.org/10.1063/1.5115908.

    A numerical analysis has been carried out on combined magnetoconvection in a lid-driven triangular enclosure with a sinusoidal wavy bottom surface filled with water-Cu-Al_2O_3 hybrid nanofluid. Numerical simulation has been conducted using FEM. and results have been presented in terms of velocity and temperature contours and Nu for different values of governing parameters. The results indicate that the Richardson number has a significant effect on the flow and heat transfer performance. Moreover, it is noticed that the combination of two different nanoparticles suspension has a better performance of heat transfer.

20. M. Ashikuzzaman, **R. Nasrin**, F.T. Fatema, M. Saddam Hossain, 3D Study of Heat Transfer Based On PVT/PCM System, **AIP Conference Proceedings**, 2121, 120007, 2019, https://doi.org/10.1063/1.5115944.

    In this research, a 3D mathematical model of PVT/PCM system has been solved numerically using finite element method. Results have been shown in terms of surface temperature and streamline patterns of PVT/PCM system with time variation. The values of average temperature of solar cell, electrical power, heat energy, electrical-thermal efficiency and overall efficiency have been found. It is observed that using PCM in the PVT module the temperature of solar cell reduces and consequently the output power and efficiency are enhanced.

21. **R. Nasrin**, M. Hasanuzzaman and N.A. Rahim, Effect of nanofluids on heat transfer and cooling system of the photovoltaic/thermal performance, **International Journal of Numerical Methods for Heat Transfer and Fluid Flow**, Vol. 29, No. 6, pp. 1920-1946, 2019, https://doi.org/10.1108/HFF-04-2018-0174.

    In this research, a 3D numerical model of PVT with a new baffle-based thermal collector system has been developed and solved using FEM. Water-based different nanofluids (Ag, Cu, Al), various solid volume fractions up to 3%, and variations of inlet temperature (20-40°C) have been applied. The numerical results show that increasing solid volume fraction increases the thermal performance of PVT systems operated by nanofluids, and optimum solid concentration is 2%. The thermal efficiency is enhanced approximately by 7.49, 7.08, and 4.97% for PVT systems operated by water-Ag, water-Cu, and water-Al nanofluids, respectively, compared to water. The extracted thermal energy from the PVT system decreases by 53.13, 52.69, 42.37, and 38.99 W for water, water-Al, water-Cu, and water-Ag nanofluids, respectively, due to each 1°C increase in inlet temperature. The heat transfer rate from the heat exchanger to cooling fluid enhances by about 18.43, 27.45, and 31.37% for the PVT system operated by water-Al, water-Cu, water-Ag, respectively, compared to water.

22. H. Fayaz, N.A. Rahim, M. Hasanuzzaman, A. Rivai, **R. Nasrin**, Numerical and outdoor real time experimental investigation of performance of PCM based PVT system, **Solar Energy**, Vol. 179, pp. 135-150, 2019, https://doi.org/10.1016/j.solener.2018.12.057.

    In this paper, the aluminium material of the thermal collector is used by introducing a novel design to enhance heat transfer performance, which is assembled in PVT and PVT-PCM systems. Experimental validation is carried out for the 3D FEM at 200 to 1000 W/m^2 varying irradiation levels while keeping mass flow rate fixed at 0.5 LPM and inlet water temperature at 32 °C. Cell temperature reduction of 12.6 and 10.3 °C is achieved from the PV module in the case of the PVT-PCM system numerically and experimentally, respectively. The highest value of the electrical efficiency achieved is 13.72 and 13.56% for PV and 13.85 and 13.74% for PVT numerically and experimentally respectively. Similarly, for PVT-PCM, electrical efficiency is achieved as 13.98 and 13.87% numerically and experimentally, respectively. In the case of the PVT system, electrical performance is improved by 6.2 and 4.8% and for PVT-PCM, it is improved as 7.2 and 7.6% for numerically and experimentally, respectively.

23. M.S. Rahman, **R. Nasrin** and M.I. Hoque, Prandtl number effect on nanofluid flow inside a porous cavity, **International Journal of Advances in Science Engineering and**

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Conference Presentations

1. M.S. Rahman, M.H.A Biswas and **R. Nasrin**, A mathematical modelling and optimal control of brain encephalitis caused by zoonotic transmitted viruses, **International Conference on Nature Science, Education, and Engineering 2021 (ICNSEE 2021)**, 10 - 11th February, 2022, Canada, Virtual mode.

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3. Ishrat Zahan, **R. Nasrin** and M.A. Alim, Hybrid nanofluid flow in combined convective lid-driven sinusoidal triangular enclosure, **8th BSME International Conference on Thermal Engineering**, 19 – 21 December, 2018, Dhaka, Bangladesh.

4. M. Ashikuzzaman, **R. Nasrin**, F.T. Fatema, M. Saddam Hossain, 3D Study of Heat Transfer Based On PVT/PCM System, **8th BSME International Conference on Thermal Engineering**, 19-21 December, 2018, Dhaka, Bangladesh.
5. Mohammad Ali, Md Abdul Alim and **Rehena Nasrin**, Boundary layer flow of micropolar fluid over a stretching conical surface with magnetic effect, **5th International Conference on Mechanical, Industrial & Energy Engineering**, KUET, Khulna, Bangladesh, 23-24 December, 2018.
6. M.A.A. Mamun, M. Hasanuzzaman, Jeyraj Selvaraj, **Rehena Nasrin**, Numerical and experimental investigation of the effect of tilt angle on the performance of PV systems, **5th IET International Conference on Clean Energy & Technology**, 5-6 September, 2018, University of Malaya, Kuala Lumpur, Malaysia.
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11. Mohammad Mokaddes Ali, M.A. Alim and **R. Nasrin**, Effect of magnetic field on double diffusive natural convection flow in a closed chamber using nanofluid, **12th International Conference on Mechanical Engineering**, 20-22 December, 2017, BUET, Dhaka, Bangladesh.
12. Mohammad Mokaddes Ali, M.A. Alim and **R. Nasrin**, Water based ferrofluid and nanofluid mixed convective flow through a square channel: Effect of magnetic induction, **3rd International Conference on Mechanical Industrial & Material Engineering**, 28-30 December, 2017, RUET, Rajshahi, Bangladesh.
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15. M.M. Ali, **R. Nasrin**, M.A. Alim, Syed Sabbir Ahmed, A study of natural convection heat transfer in a partially heated enclosure filled by Cu/water nanofluid, **4th International**

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58. **Rehena Nasrin** and M.A. Alim, Joule heating effect on magnetoconvection in a chamber with a heated cylinder, **International Conference on Modeling, Simulation and Applied Optimization**, UTM, Kuala Lumpur, Malaysia, 19-21 April, 2011.

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61. **Rehena Nasrin** and Salma Parvin, Prandtl number effect on mixed convection in an octagonal channel with a heat-generating hollow obstacle, **9th International Conference of Mechanical Engineering**, BUET, Dhaka, Bangladesh, 18-20 December, 2011.

62. **Rehena Nasrin**, Salma Parvin and M.A. Alim, Natural convective flow and heat transfer of water - Cu nanofluid in a trapezoidal enclosure, **17th International Mathematics Conference**, Jahangirnagar University, Dhaka, Bangladesh, 22-24 December, 2011.

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65. **Rehena Nasrin** and Salma Parvin, Effect of Reynolds number on MHD mixed convection in a lid-driven cavity with sinusoidal wavy bottom surface, **13th Annual Paper Meet, Mechanical Division**, The Institute of Engineers Bangladesh, 25th September, 2010.

66. S. Parvin and **R. Nasrin**, Effect of diameter of heated block with MHD free convection flow in a cavity, **International Conference on Marine Technology**, ISSN: 2220-3117, BUET, Dhaka, Bangladesh, 11-12 December, 2010.

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Poster Presentations

1. **R. Nasrin**, Heat transfer analysis of hybrid nanofluid flows in enclosure, **IWM Regional Workshop on Research and Opportunity**, Dept. of Mathematics, NIT Meghalaya, India, 19-20th October, 2019.

2. M. Ali, M. A. Alim and **R. Nasrin**, Boundary layer flow of momentum, heat and mass transfer along a stretching cylindrical surface with magnetic effect, **12th International Conference on Mechanical Engineering**, 20-22 December, 2017, BUET, Dhaka, Bangladesh.

Thesis Papers

1. **Rehena Nasrin**, A 3D numerical study of thermofluid characteristics of a flat plate solar collector using nanofluid, *Ph. D. Thesis,* Department of Mathematics, Bangladesh University of Engineering and Technology, Dhaka, Bangladesh, 2015.

In this thesis, a numerical analysis has been performed for better understanding of the heat transfer phenomena of the flat plate solar collector (FPSC) using base fluid water as well as single nanofluid water-copper and hybrid nanofluid water-copper-silver in both 2D and 3D models. Heat transfer and flow characteristics have been presented for various pertinent parameters using Finite Element Method. Two correlations for heat transfer rate and thermal efficiency have been developed from obtained 3D results. Higher heat transfer rate of 3%, mean output temperature of 1.6K and collector efficiency of 5% have been obtained in 3D analysis than that of 2D analysis. Not more than 2% solid volume fraction of water-copper nanofluid has found to be advantageous. Suitable mass flow rate is obtained as 0.0248Kg/s. More heat transfer rate of 17% and thermal efficiency of 8% are found for using 2% concentrated water-copper nanofluid than base fluid in 3D simulation. Also a quadratic form of thermal efficiency equation has been derived from 3D numerical study and compared with a survey report available in the literature.

2. **Rehena Nasrin**, Effects of variable thermal conductivity on the coupling of conduction and Joule heating with MHD free convection flow along a vertical flat plate, *M. Phil. Thesis,* Department of Mathematics, Bangladesh University of Engineering and Technology, Dhaka, Bangladesh, 2009.
3. **Rehena Nasrin**, A modern view to the general theory of relativity and cosmology, *M. Sc. Thesis,* Department of Mathematics, University of Dhaka, Bangladesh, 2002.