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WORK AUTHORIZATION

U.S. Green Card Holder

EDUCATION

Ph.D.	Mechanical Engineering	Hong Kong University of Science and Technology	Hong Kong	2024
M.S.	Petroleum Engineering	University of Alberta	Canada	2021
M.S.	Mechanical Engineering	Iran University of Science and Technology	Iran	2016
B.S.	Mechanical Engineering	Shahid Chamran University of Ahvaz	Iran	2014

PROFESSIONAL EXPERIENCE

Postdoctoral Researcher	University of South Florida	2025 – present
Postdoctoral Researcher	Johns Hopkins University and Morgan State University	2024 – 2025
Visiting Scholar	Texas A&M University	2023 – 2024
Petroleum Engineer	University of Alberta	2018 – 2020

AWARDS AND HONORS

Among the Top 2% Scientists in the World, Elsevier–Stanford University List.

RedBird Scholarship, The Hong Kong University of Science and Technology (HKUST) — *$10,000*.

Overseas Research Award, The Hong Kong University of Science and Technology (HKUST) — *$8,000*.

Graduation Recruitment Award — *$5,000 CAD*.

Alberta Graduate Excellence Award, Government of Alberta — *$12,000 CAD*.

Jacob H. Masliyah Graduate Award in Oil Sands Engineering, University of Alberta — *$2,000 CAD*.

Donald Lougheed Engineering Graduate Scholarship — *$6,000 CAD*.

Jong and Sunjoo Lee Graduate Scholarship in Engineering — *$2,000 CAD*.

GRANT WRITING EXPERIENCE

[1] Li, Z. (Principal Investigator). (2025). *Subject-specific modeling of drug absorption in the nasal cavity* (Award No. R16GM153629; $152,437). National Institute of General Medical Sciences, National Institutes of Health. **Contributions to proposal writing and review by Mohammad Doranehgard.**

[2] Li, Z. (Principal Investigator) and Kimple, A.J. (Co-Principal Investigator). (2024). *Excellence in Research - Numerical and experimental investigations of droplet depositions in the nasal cavity from topical intranasal corticosteroid sprays among diverse groups* (Award No. 2401855; $867,163). National Science Foundation. **Contributions to proposal writing and review by Mohammad Doranehgard.**

[3] Li, Z. (Principal Investigator). (2024). *Numerical Investigation of the Effects of Nasal Balloon Dilation on Airflow and Drug Deposition* ($30,000). Acclarent Company. **Contributions to proposal writing and review by Mohammad Doranehgard.**

SELECTED PUBLICATIONS

Google Scholar: Click Here
Peer-reviewed Journal Papers: 92
Citations: 5,496
h-index: 46
i10-index: 74

Student mentees are indicated by an **asterisk *.**
Co-first authors are indicated by a **dagger †.**
The corresponding author's name is underlined.

[1] **Doranehgard, M.H.**, Borazjani, I., Karimi, N., and Li, L.K.B. (2024). "Ruelle-Takens-Newhouse and degenerate period-doubling routes to chaos in a wavy-channel flow under mixed convection." *Physical Review Fluids* 9 (12): 124403. [Link]

[2] **Doranehgard, M.H.**, Karimi, N., Borazjani, I., and Li, L.K.B. (2024). "Breaking the symmetry of a wavy channel alters the route to chaotic flow." *Physical Review E* 109 (4): 045103. [Link]

[3] **Doranehgard, M.H.**, Gupta, V., and Li, L.K.B. (2022). "Quenching and amplification of thermoacoustic oscillations in two nonidentical Rijke tubes interacting via time-delay and dissipative coupling." *Physical Review E* 105 (6): 064206. [Link]

[4] **Doranehgard, M.H.**, Samadyar, H., Mesbah, M., Haratipour, P., and Samiezade, S. (2017). "High-purity hydrogen production within situ CO_2 capture based on biomass gasification." *Fuel* 202: 29–35. [Link]

[5] **Doranehgard**, **M.H.**, and Dehghanpour, H. (2020). "Quantification of convective and diffusive transport during CO_2 dissolution in oil: a numerical and analytical study." *Physics of Fluids* 32 (8): 085110. [Link]

[6] **Doranehgard**, **M.H.**, Tran, S., and Dehghanpour, H. (2021). "Modeling of natural-gas diffusion in oil-saturated tight porous media." *Fuel* 300: 120999. [Link]

[7] Shahadat, M.R.B., **Doranehgard**, **M.H.** †, Cai, W., Meneveau, C., Schafer, B., and Li, Z. (2025). "An airfoil-based synthetic actuator disk model for wind turbine aerodynamic and structural analysis." *Renewable Energy* (2025): 123780. [Link]

[8] Shahadat, M.R.B. *, **Doranehgard, M.H.**, Cai, W., and Li, Z. (2025). "Large eddy simulation of wind farm performance in horizontally and vertically staggered layouts." *Energy* 322 (2025): 135569. [Link]

[9] Saffarian, M.R., Moravej, M., and **Doranehgard, M.H.** (2020). "Heat transfer enhancement in a flat plate solar collector with different flow path shapes using nanofluid." *Renewable Energy* 146: 2316–2329. [Link]

[10] Sohani, A. *, Sayyaadi, H., Cornaro, C., Shahverdian, M.H., Pierro, M., Moser, D., Karimi, N., **Doranehgard, M.H.**, and Li, L.K.B. (2022). "Using machine learning in photovoltaics to create smarter and cleaner energy generation systems: A comprehensive review." *Journal of Cleaner Production* 364: 132701. [Link]

[11] Abedinia, O., Zareinejad, M., **Doranehgard**, **M.H.**, Fathi, G., and Ghadimi, N. (2019). "Optimal offering and bidding strategies of renewable energy-based large consumers using a novel hybrid robust-stochastic approach." *Journal of Cleaner Production* 215: 878–889. [Link]

[12] Mesgarpour, M., Najm Abad, J.M., Alizadeh, R., Wongwises, S., **Doranehgard**, **M.H.**, Jowkar, S., and Karimi, N. (2022). "Predicting the effects of environmental parameters on the spatio-temporal distribution of the droplets carrying coronavirus in public transport–A machine learning approach." *Chemical Engineering Journal* 430: 132761. [Link]

[13] Mesgarpour, M., Najm Abad, J.M., Alizadeh, R., Wongwises, S., **Doranehgard**, **M.H.**, Ghaderi, S., and Karimi, N. (2021). "Prediction of the spread of coronavirus-carrying droplets in a bus—A computational-based artificial intelligence approach." *Journal of Hazardous Materials* 413: 125358. [Link]

[14] Ferahtia, S., Rezk, H., Olabi, A.G., Alhumade, H., Bamufleh, H.S., **Doranehgard**, **M.H.**, and Abdelkareem, M.A. (2022). "Optimal techno-economic multi-level energy management of renewable-based DC microgrid for commercial buildings applications." *Applied Energy* 327: 120022. [Link]

[15] Sohani, A. *, Sayyaadi, H., Miremadi, S.R., Samiezadeh, S., and **Doranehgard, M.H.** (2022). "Thermo-electro-environmental analysis of a photovoltaic solar panel using machine learning and real-time data for smart and sustainable energy generation." *Journal of Cleaner Production* 353: 131611. [Link]

[16] Osmani, K., Alkhedher, M., Ramadan, M., Choi, D.S., Li, L.K.B., **Doranehgard, M.H.**, and Olabi, A.G. (2023). "Recent progress in the thermal management of lithium-ion batteries." *Journal of Cleaner Production* 389: 136024. [Link]

[17] Bhatti, M.M., Arain, M.B., Zeeshan, A., Ellahi, R., and **Doranehgard, M.H.** (2022). "Swimming of gyrotactic microorganism in MHD Williamson nanofluid flow between rotating circular plates embedded in porous medium: Application of thermal energy storage." *Journal of Energy Storage* 45: 103511. [Link]

[18] Bozorg, M.V., **Doranehgard, M.H.** †, Hong, K., and Xiong, Q. (2020). "CFD study of heat transfer and fluid flow in a parabolic trough solar receiver with internal annular porous structure and synthetic oil–Al_2O_3 nanofluid." *Renewable Energy* 145: 2598–2614. [Link]

[19] Sohani, A. *, Cornaro, C., Shahverdian, M.H., Pierro, M., Moser, D., Nižetić, S., Karimi, N., Li, L.K.B., and **Doranehgard, M.H.** (2023). "Building integrated photovoltaic/thermal technologies in Middle Eastern and North African countries: Current trends and future perspectives." *Renewable and Sustainable Energy Reviews* 182: 113370. [Link]

[20] Sohani, A. *, Cornaro, C., Shahverdian, M.H., Moser, D., Pierro, M., Olabi, A.G., Karimi, N., Nižetić, S., Li, L.K.B., and **Doranehgard, M.H.** (2023). "Techno-economic evaluation of a hybrid photovoltaic system with hot/cold water storage for poly-generation in a residential building." *Applied Energy* 331: 120391. [Link]

[21] Sohani, A., Shahverdian, M.H., Sayyaadi, H., Nižetić, S., and **Doranehgard, M.H.** (2023). "An optimum energy, economic, and environmental design based on DEVAP concept to reach maximum heat recovery in a PV-wind turbine system with hydrogen storage." *Energy Conversion and Management* 288: 117147. [Link]

[22] Chung, R.C.C., Guan, Y., He, W., Ao, W., Yin, B., Yang, Z., **Doranehgard, M.H.**, and Li, L.K.B. (2024). "Ground-induced suppression of chaos in the self-excited flow behind a plunging airfoil." *Physics of Fluids* 36 (3). [Link]

[23] Kimishima, H., Yin, B., **Doranehgard, M.H.**, Gupta, V., and Li, L.K.B. (2025). "Cluster-based control of self-excited thermoacoustic oscillations." *Physics of Fluids* 37 (7). [Link]

[24] Wang, D., Feng, D., Peng, H., Mao, F., **Doranehgard, M.H.**, Gupta, V., Li, L.K.B., and Wan, M. (2023). "Implications of steep hilly terrain for modeling wind-turbine wakes." *Journal of Cleaner Production* (2023): 136614. [Link]

[25] He, G. *, Liu, Q., Cai, W., Wilson, A., **Doranehgard, M.H.**, Sayce, L., Luo, H., and Li, Z. (2025). "Fluid–structure interaction simulations to investigate the asymmetrical pattern and energy transfer during vocal fold vibrations." *Physics of Fluids* 37 (9). [Link]

[26] Habib, R., Karimi, N., Yadollahi, B., **Doranehgard, M.H.**, and Li, L.K.B. (2020). "A pore-scale assessment of the dynamic response of forced convection in porous media to inlet flow modulations." *International Journal of Heat and Mass Transfer* 153: 119657. [Link]

[27] Gholamalipour, P. *, Siavashi, M., and **Doranehgard, M.H.** (2019). "Eccentricity effects of heat source inside a porous annulus on the natural convection heat transfer and entropy generation of Cu-water nanofluid." *International Communications in Heat and Mass Transfer* 109: 104367. [Link]

[28] Siavashi, M., and **Doranehgard, M.H.** (2017). "Particle swarm optimization of thermal enhanced oil recovery from oilfields with temperature control." *Applied Thermal Engineering* 123: 658–669. [Link]

[29] **Doranehgard, M.H.**, and Siavashi, M. (2018). "The effect of temperature-dependent relative permeability on heavy oil recovery during hot water injection process using streamline-based simulation." *Applied Thermal Engineering* 129: 106–116. [Link]

[30] Sohani, A. *, Delfani, F., Hosseini, M., Sayyaadi, H., Karimi, N., Li, L.K.B., and **Doranehgard, M.H.** (2024). "Price inflation effects on a solar-geothermal system for combined production of hydrogen, power, freshwater and heat." *International Journal of Hydrogen Energy* 52: 861–872. [Link]

[31] Sohani, A. *, Delfani, F., Hosseini, M., Sayyaadi, H., Karimi, N., Li, L.K.B., and **Doranehgard, M.H.** (2022). "Dynamic multi-objective optimization applied to a solar-geothermal multi-generation system for hydrogen production, desalination, and energy storage." *International Journal of Hydrogen Energy* 47 (74): 31730–31741. [Link]

[32] Mesbah, M., Vatani, A., Siavashi, M., and **Doranehgard, M.H.** (2019). "Parallel processing of numerical simulation of two-phase flow in fractured reservoirs considering the effect of natural flow barriers using the streamline simulation method." *International Journal of Heat and Mass Transfer* 131: 574–583. [Link]

[33] Bozorg, M.V., **Doranehgard, M.H.**, Hong, K., Xiong, Q., and Li, L.K.B. (2020). "A numerical study on discrete combustion of polydisperse magnesium aero-suspensions." *Energy* 194: 116872. [Link]

[34] Habib, R., Yadollahi, B., Saeed, A., **Doranehgard, M.H.**, and Karimi, N. (2021). "Unsteady ultra-lean combustion of methane and biogas in a porous burner—An experimental study." *Applied Thermal Engineering* 182: 116099. [Link]

[35] Habib, R., Yadollahi, B., Saeed, A., **Doranehgard, M.H.**, and Karimi, N. (2021). "On the response of ultralean combustion of CH_4/H_2 blends in a porous burner to fluctuations in fuel flow—An experimental investigation." *Energy & Fuels* 35 (10): 8909–8921. [Link]

[36] Alizadeh, R., Najm Abad, J.M., Fattahi, A., Mesgarpour, M., **Doranehgard, M.H.**, Xiong, Q., and Karimi, N. (2021). "Machine-learning enhanced analysis of mixed biothermal convection of single

particle and hybrid nanofluids within a complex configuration." *Industrial & Engineering Chemistry Research* 61 (24): 8478–8494. [Link]

[37] Alizadeh, R., Najm Abad, J.M., Fattahi, A., Mohebbi, M.R., **Doranehgard, M.H.**, Li, L.K.B., Alhajri, E., and Karimi, N. (2021). "A machine learning approach to predicting the heat convection and thermodynamics of an external flow of hybrid nanofluid." *Journal of Energy Resources Technology* 143 (7): 070908. [Link]

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[39] Tran, S., Yassin, M.R., Eghbali, S., **Doranehgard, M.H.**, and Dehghanpour, H. (2021). "Quantifying oil-recovery mechanisms during natural-gas huff 'n' puff experiments on ultratight core plugs." *SPE Journal* 26 (01): 498–514. [Link]

[40] Bozorg, M.V., Guan, Y., **Doranehgard, M.H.**, Hong, K., Xiong, Q., Karimi, N., and Li, L.K.B. (2020). "Numerical simulation of the heterogeneous combustion of dust clouds containing polydisperse porous iron particles." *Energy* 212: 118759. [Link]

[41] Karimi, N., Li, L.K.B., Paul, M.C., **Doranehgard, M.H.**, and Sotoudeh, F. (2024). "Introduction to advances in sustainable hydrogen energy." *RSC Advances* 14 (13): 9351–9352. [Link]

TEACHING EXPERIENCE

Morgan State University, Baltimore, MD, USA

Fall 2024	Instructor	Analytical Methods in Engineering (Undergraduate)

The Hong Kong University of Science and Technology (HKUST), Hong Kong

Fall 2022	Instructor	Energy Conversion (Undergraduate)
Spring 2022	Instructor	Aerospace Laboratory (Undergraduate)

Iran University of Science and Technology, Tehran, Iran

Spring 2016	Teaching Assistant	Transport in Porous Media (Graduate)
Fall 2015	Teaching Assistant	Advanced Mathematics (Graduate)

STUDENTS & POSTDOCS MENTORED

Postdoctoral Fellow

Dr. Muhammad Rubayat Bin Shahadat, Morgan State University (Fall 2024 – Fall 2025)

Doctoral Students (Ph.D.)

Guiliang Liu, Morgan State University (Fall 2024 – Fall 2025)

Guofeng He, Morgan State University (Fall 2024 – present)

Ahmed Tolba, University of South Florida (Fall 2025 – present)

Michael Edgemon, University of South Florida (Fall 2025 – present)

Torge Bohlken, University of South Florida (Fall 2025 – present)

Master's Students (M.S.)

Mian Abul Fazal, University of South Florida (Fall 2025 – present)

Undergraduate Students (B.S.)

Mason Morgan, Morgan State University — Capstone Project Mentor

Sara Arroyave, University of South Florida (Fall 2025 – present)

SERVICE

Journal Editorial Service

Guest Editor, *Physics of Fluids* (American Institute of Physics, IF: 4.1), Special Issue on "Turbulent and Multiphase Flows" (Feb 2020 – Dec 2020) [Link].

Guest Editor, *International Journal of Thermofluids* (Elsevier), Special Issue on "Efficient Solutions for Sustainable Development of Energy Systems" (Sep 2023 – Apr 2024) [Link].

Guest Editor, *Energy* (Elsevier, IF: 9.4), Special Issue on "The Role of Smart Technologies in Energy Engineering" (Aug 2023 – Jan 2024) [Link].

Guest Editor, *Engineering Analysis with Boundary Elements* (Elsevier, IF: 4.2), Special Issue on "Applications of Machine Learning in Computational Mechanics" (Jan 2022 – Jan 2023) [Link].

Guest Editor, *RSC Advances* (Royal Society of Chemistry, IF: 4.6), Special Issue on "Introduction to Advances in Sustainable Hydrogen Energy" (Jan 2023 – Jan 2024) [Link].

Guest Editor, *International Journal of Hydrogen Energy* (Elsevier, IF: 8.3) (Jan 2023 – Sep 2023).

Guest Editor, *Sustainable Energy Technologies and Assessments* (Elsevier, IF: 7.1), Special Issue on "Current Challenges in Efficiency Improvement of Solar Thermal Technologies" (Dec 2020 – Sep 2021) [Link].

Guest Editor, *Journal of Energy Resources Technology* (ASME, IF: 2.9), Special Issue on "Multiphase Flow Applications in Energy Engineering" (Jan 2020 – Nov 2020) [Link].

Guest Editor, *Journal of Thermal Analysis and Calorimetry* (Springer, IF: 3.0), Special Issue on "Heat Transfer in Porous Media" (Jul 2019 – Apr 2020) [Link].

Editorial Board Member, *Journal of Energy Sources, Part A: Recovery, Utilization and Environmental Effects* (Taylor & Francis, IF: 2.5) (Feb 2020 – Feb 2024).

Guest Editor, *Journal of the Taiwan Institute of Chemical Engineers* (Elsevier, IF: 6.3), Special Issue on "Applications of Nanofluid in Renewable Energy" (Jan 2021 – Jul 2021) [Link].

Guest Editor, *Journal of the Taiwan Institute of Chemical Engineers* (Elsevier, IF: 6.3), Special Issue on "Optimization in Energy and Process Engineering" (Jan 2023 – Jul 2023) [Link].

Journal Peer-Review Service

International Journal of Heat and Mass Transfer (28 reviews)

Journal of Cleaner Production (48 reviews)

International Journal of Heat and Fluid Flow (12 reviews)

Applied Thermal Engineering (28 reviews)

Applied Energy (22 reviews)

Applied Soft Computing (6 reviews)

Energy Conversion and Management (6 reviews)

Energy (14 reviews)

Physics of Fluids (28 reviews)

Journal of Molecular Liquids (13 reviews)

International Communications in Heat and Mass Transfer (6 reviews)

International Journal of Hydrogen Energy (17 reviews)

Journal of Energy Storage (8 reviews)

Renewable Energy (12 reviews)

Results in Engineering (22 reviews)

Sustainable Energy Technologies and Assessments (25 reviews)

Thermal Science and Engineering Progress (16 reviews)

Journal of Thermal Analysis and Calorimetry (76 reviews)

Journal of Energy Sources, Part A (108 reviews)

Case Studies in Thermal Engineering (15 reviews)

PROFESSIONAL MEMBERSHIPS

American Society of Mechanical Engineers (ASME) 2020-present
American Physical Society (APS) 2021-present
Society of Petroleum Engineering (SPE) 2019-2021

REFERENCES

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Relationship: Visiting Scholar Supervisor

Physics of Fluids EDITORIAL scitation.org/journal/phf

Special topic on turbulent and multiphase flows

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AFFILIATIONS

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Note: This paper is part of the special topic on Turbulent and Multiphase Flows.
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Turbulent and multiphase flows, owing to their ever-increasing applications, have gained a lot of attention from both academia and industry. Enhanced oil recovery, to nanofluid, to combustion can lie within the scope of turbulent and multiphase flows. *Physics of Fluids* hosted a special issue on this topic last year that attracted original high-quality papers on recent developments in the field of multiphase and turbulent flows applied to chemical and mechanical engineering applications. Fourteen papers have been published that cover a variety of subjects from heat transfer in transitional and turbulent flow to fully resolved complex multi-physics multi-phase flow systems.

Regarding turbulent flows, Mendez *et al.*[1] studied the development of a laminar flow boundary layer over a concave surface and its transition to turbulence due to Gortler instability using direct numerical simulations (DNSs). They performed, for the first time, the DNS simulations of wall heat transfer effects in the receptivity, growth rate, and the development of primary and secondary instabilities up to their final breakdown to turbulence. Furthermore, the first and second momentum statistics in a fully turbulent region for such flows are reported by the authors. Doranehgard and Dehghanpour[2] used a turbulence analogy to quantify diffusive and convective transport during the dissolution of CO_2 in oil. Their results reveal that fingers introduced within the oil bulk phase, due to the existence of the convective flow, play an important role in diffusion coefficient calculations. Balasubramaniyan *et al.*[3] experimentally investigated hydrodynamic instability of a lean-premixed flame. They observed that, owing to the effect of turbulent flow, the varicose mode is convectively unstable, and the sinuous mode is globally unstable as a result of Bénard–von Kármán instability. Jin *et al.*[4] studied the effect of Stefan flow on the Nusselt number and drag coefficient for supercritical water flowing over a fixed spherical particle. Their results indicate that increasing Stefen flow intensity increases the velocity and temperature boundary layer thickness from one side and decreases Nusselt number and drag coefficient from the other side. Fang *et al.*[5] applied an effective 3D DNS to investigate flow past bubbles using a non-body fitted gas-liquid interface tracking scheme. Using their method, they parameterically investigated the vortex structure and the evolution of the flow field. Fattahi *et al.*[6] theoretically investigated entropy wave generation and propagation in a gas turbine combustor. They found that the unsteady chemical entropy generation is due to the existence of fluctuations in the mixture fraction. Also, they show that neglecting chemical entropy generation leads to the wrong prediction of the combustion instabilities. Farnoud *et al.*[7] used large eddy simulation (LES) to study the particle deposition in pulsating, bi-directional nasal drug delivery. They observed that increasing the pulsation flow rate increases nasal deposition efficiency. Also, increasing drug particle size increases nasal deposition efficiency as well. Li *et al.*[8] used linear stability analysis to theoretically study the partial vortex shedding in Taylor–Culick flow. They investigated the role of amphidromic points and revealed that these points divide the flow into two different regions: an inner region with weak perturbations and an outer region with stronger perturbation.

Concerning multiphase flows, Keepaiboon *et al.*[9] experimentally investigated the two-phase flow boiling heat transfer characteristics of a refrigerant in a microfluidic channel at high mass fluxes. A new universal correlation is proposed for two-phase flow boiling in such systems that accounts for the important dimensionless numbers, such as the Reynolds, boiling, and Weber numbers, that potentially may provide a design basis for the micro-heat exchanger micro-electro-mechanical systems and electric vehicle battery cooling systems. Rahmat *et al.*,[10] using the smoothed particle hydrodynamic (SPH) method, investigated the settling particle agglomeration in a dewatering process. They observed that agglomeration happens in

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four different structures based on the interplay between the pair potential and Reynolds number. Saghatchi *et al.*,[11] by the means of the incompressible SPH method, investigated droplet electrohydrodynamic deformation in a superconfined domain. They found that, for some systems and confinement ratios, the influence of unbounded deformation is significant. Laurila *et al.*[12] investigated two-phase bubbly flow in a swirl atomizer using the volume of fluid (VoF) method in OpenFoam. Their analysis revealed that the global liquid film characteristics are affected by the bubble inclusion at the nozzle inlet with relevance to atomization. Zhao *et al.*[13] applied a computational fluid dynamics-discrete element-immersed boundary method to investigate heat transfer in compressible gas-solid flows with complex geometries. They observed that heat transfer profiles are in good agreement with the experimental data. They concluded that the proposed method would be an efficient tool to study heat transfer problems in the fluidized beds with complex geometries. Davydzenka *et al.*[14] quantified the effect of wettability on porous media deformation. They found that wettability could affect the drag forces and control the fluid propagation patterns.

The guest editors would like to take this opportunity to thank the editorial board of *Physics of Fluids*, especially Professor Alan Jeffrey Giacomin (Editor-in Chief) and Dr. Matthew Kershis (Journal Manager) for their kind help and input. The first author acknowledges the support provided by Alexander von Humboldt Foundation through the project FRA-1204799-HFST-E for the experienced researcher.

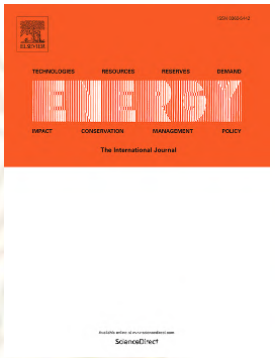
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[2]M. H. Doranehgard and H. Dehghanpour, "Quantification of convective and diffusive transport during CO2 dissolution in oil: A numerical and analytical study," Phys. Fluids **32**(8), 085110 (2020).
[3]M. Balasubramaniyan *et al.*, "Global hydrodynamic instability and blowoff dynamics of a bluff-body stabilized lean-premixed flame," Phys. Fluids **33**(3), 034103 (2021).
[4]H. Jin *et al.*, "Influence of Stefan flow on the drag coefficient and heat transfer of a spherical particle in a supercritical water cross flow," Phys. Fluids **33**(2), 023313 (2021).
[5]Z. Fang *et al.*, "Spatiotemporal evolutions of forces and vortices of flow past ellipsoidal bubbles: Direct numerical simulation based on a Cartesian grid scheme," Phys. Fluids **33**(1), 012108 (2021).
[6]A. Fattahi, N. Karimi, and N. Hajialigol, "Dynamics of entropy wave generation in a simplified model of gas turbine combustor: A theoretical investigation," Phys. Fluids **32**(10), 106107 (2020).
[7]A. Farnoud *et al.*, "Large eddy simulations of airflow and particle deposition in pulsating bi-directional nasal drug delivery," Phys. Fluids **32**(10), 101905 (2020).
[8]Y. Li *et al.*, "A theoretical study of parietal vortex shedding in Taylor–Culick flow via linear stability analysis," Phys. Fluids **32**(10), 104101 (2020).
[9]C. Keepaiboon *et al.*, "Two-phase flow boiling in a microfluidic channel at high mass flux," Phys. Fluids **32**(9), 093309 (2020).
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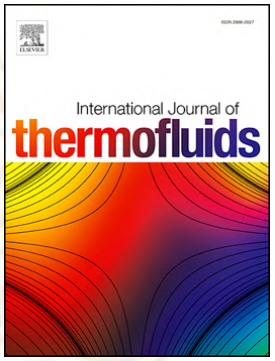
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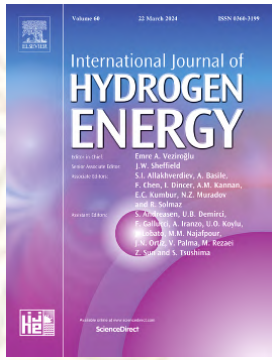
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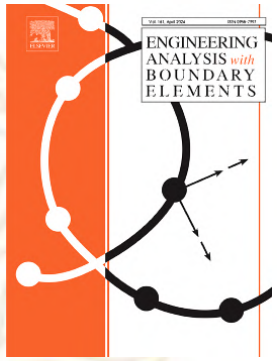
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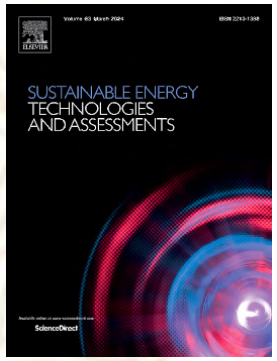
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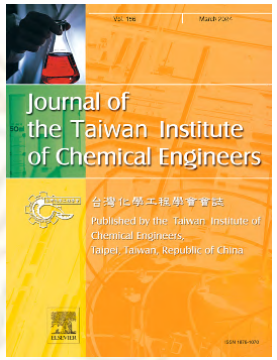
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EDITORIAL

Introduction to Advances in Sustainable Hydrogen Energy

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Developing a low-carbon economy is an essential prerequisite to sustainability. Despite an overwhelming desire for the replacement of fossil fuels, realisation of hydrogen economy continues to be a great challenge. Currently, there are a wide range of technologies for the production, storage, and utilisation of hydrogen. However, we are still yet to develop hydrogen based integrated energy systems that are economically viable and environmentally friendly.

Recently, there has been a new wave of research into system design and analysis which has greatly promoted the development of sustainable hydrogen energy. However, in order to complement elements of socioeconomics and policy making, we must also consider thermodynamic, technoeconomic, and environmental analyses in our research. Therefore, we were inspired to launch a themed collection dedicated to advancing sustainable hydrogen energy.

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As the most environmentally friendly and cleanest fuel, hydrogen has the potential to replace the current fossil fuel-based energy infrastructure. In order to optimise hydrogen energy systems, it is important to understand the current status of achievable hydrogen energy. Le and Natsuki *et al.* establish an understanding of the current production, storage, and transportation methods, all within the context of the environment, economy, and society – this is imperative for developing a future outlook (**https://doi.org/10.1039/D3RA05158G**).

Hydrogen is produced from fossil-based or renewable sources, through various techniques such as thermochemical conversion, or biological conversion. Recently, there has also been progress in the use of metal organic frameworks (MOFs) for electrocatalytic water splitting. However, these methods are still not comparable to the commercial noble metal catalysts; therefore, further advancement is needed, such as the stabilisation of MOF materials during electrocatalysis, and the development of change-conducting MOFs (**https://doi.org/10.1039/D3RA04110G**).

There have been several applications of computational modelling techniques for the analysis of hydrogen energy systems. Simulation software allows for the creation of steady-state and dynamic models, so can be used to guide biomass gasification (a method of thermochemical conversion). Aspen Plus® enables accurate prediction of gasification behaviour, which in turn enables processing parameter optimisation (**https://doi.org/10.1039/D3RA01219K**). Mathematical modelling also allows for optimisation. Computational fluid dynamics (CFD) can be used to show the impact of throat sizing and gasification agents. Lower throat ratios result in higher yields and better gasifier performance, suggesting the potential for generation of CO_2-free syngas (**https://doi.org/10.1039/D3RA01408H**).

Following on from modelling and optimisation, when assessing the feasibility of a large scale H_2 gas production method, it is important to consider technoeconomic assessment. For instance, at optimal conditions, the eucalyptus wood sawdust (EWS) gasification process could be an appealing option for a hydrogen energy source in the market (**https://doi.org/10.1039/D3RA00287J**) – this ties in with the current focus on developing hydrogen generation technologies from renewable energy sources, particularly biomass.

Nevertheless, hydrogen storage is still a significant issue. Microwave-assisted hydrogen production could become an effective and cost-efficient method, especially given the potential for syngas transformation into high-hydrogen-content methanol, which would be

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