Proceedings of The First International Conference on Engineering Sciences' Applications, ICESA

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First International Conference on Engineering Sciences' Applications, ICESA

Supported by

●Ministry of Higher Education and Scientific Research ●Imam Hussein Holy Shrine Trust ●Imam Abbas Holy Shrine Trust ●Kerbala Governorate ●Kerbala Governorate Council ●Kerbala Centre for Studies and Researches ●Engineering Consulting Bureau/ University of Kerbala ● The National Group

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Welcome to 1st ICESA

Welcome to the First International Conference on Engineering Sciences' Applications (ICESA). Excellences, distinguished delegates, ladies, gentlemen, on behalf of the conference organizing committee, it gives us great pleasure to welcome you all. We are so grateful because you have accepted our invitation to convene this conference here in Kerbala.

The conference programme is organized into paper presentation sessions and exhibition breaks to elucidate the scope of the conference in knowledge exchange between experts in different fields. This event provides a useful networking arena, which enables delegates to make new national and international contacts, bridge the gap between the various parties and help transfer technology from research into practice.

We hope that the present delegates will engage only to fruitful debates in order to make this conference productive and relevant. Conference sessions will be held in the college of engineering, AL-Mudhafein campus. We are extremely fortunate to have speakers and delegates from many countries including (Iran, India, U.K and Malaysia), for them we would like to express our thanks.

The conference committee wishes to express their special thanks to Ministry of Higher Education and Scientific Research, and Kerbala University for their continuous help and support. Sponsoring organizations, especially, Kerbala Center for Studies and Researches/ Imam Hussain Holey Shrine, and Imam Abbas Holey Shrine.

We are aware of the tremendous efforts made by all researchers, reviewers and committees, as the conference covers a wide range of very interesting items relating to engineering theories and applications. We are confident that the First International Conference on Engineering Sciences' Applications will be a successful one, and all participants will gain purposeful knowledge which will be useful to Iraq, Iran, and other countries especially the Islamic countries.

Professor Dr. Sabah Rasoul Al-Jabiri
Conference Director

Professor Dr.Moneer Hameed Tolephih
President of Kerbala University

Conference Program

Day One: Wednesday 24 Dec 2014

Morning Session1

Venue: Imam Al-Hassan (peace be upon him) Hall in Al-Abbas Holy Shrine.
Chairman: Prof. Dr. Riyad H. Al-Anbari /Dean of Building and construction Dept.UOT, Iraq

	Registration	9:00
	Conference Opening	10:00
	Holy Quran	10:05-10:10
	Welcome by the Conference Director Professor Dr Sabah Rasoul Al-Jabiri	10:10 – 10:20
	Welcome by the Conference Supervisor Professor Dr Moneer H.Tolephih	10:20 – 10:30
	Welcome by the Minister of Higher Education and Scientific Research, Dr. Hussein Al-Shehristani	10:30-10:40
	Keynote speaker Lecture: Nanotechnology in future Computers (Quantum Computers), Prof. Dr. Mudarr A. Abduasattar, Ministry of Sciences and Technology	10:40-11:30
	Prayer and Lunch, Al-Abbas Holy Shrine	11:30-2:00
	Movement to the College of Engineering at the Al-Mudhafin Campus	2:00-2:30
	Refreshment and Exhibition	2:30-2:55

Afternoon Session2: Civil Engineering Applications

Venue: Hall One, Civil Engineering Department
Chairman : Prof. Dr. Shakir Ahmed Salih/ UOT, Iraq
Register : Assistant Prof. Dr. Laith Sh. Resheed/UOK,Iraq

C40	دراسة تأثير إستخدام المضافات على بعض خواص الجص م.م. هديل خالد عواد, أ.د. ندى مهدي فوزي الجيلاوي	3:00 – 3:15
C30	THE BEST EXPANSION RATIO FOR CASTELLATED STEEL BEAMS BASED ON THE UPPER BOUND CRITERION Mr. Maher K. Abbas, Prof. Dr. Haitham H. Muteb	3:15 – 3:30
C41	Effect of plastic optical fiber on properties of Translucent Concrete Boards Prof. Dr. Shakir Ahmed Salih, Assist.Prof.Dr. Hasan Hamodi Joni, Safaa Adnan Mohamed	3:30 – 3:45
C27	Characterization of cement kiln dust behavior in the sorption of heavy metal from aqueous solutions Abbas H. Sulaymon, Ayad A. H. Faisal and Qusey M. Khaliefa	3:45 – 4:00
C46	Effect of Burning by Fire Flame on Some Mechanical Properties of Reactive Powder Concrete Zainab Sabah Rasoul, Dr. Mohammed Mansour Kadhum, University of Babylon - College of Engineering	4:00 – 4:15
C36	A Proposed Hexagonal – Cylindrical Specimens Relationship of Concrete Alyaa Hussein Mohammed, Marawan Mohammed Hamid, Marwah Sami Abduljabbar	4:15– 4:30
C56	Stability of Foundations due to Under Planning Dewatering Process Dr. Haider M. Mekkiyah, Abdul Karim M, Abdul Razzak	4:30– 4:45
C39	Sun Light (Solar Radiation) Effect on Evaporation and Temperature of Fresh Concrete Asst. Lect. Mahmoud H. Abdulrazzaq, Prof. Dr. Shakir A. Salih	4:45– 5:00

Afternoon Session3: Civil Engineering Applications

Venue: Hall Two, Civil Engineering Department
Chairman: Assistant Prof. Dr. Ali Khodaii/ AmirKabir University, Iran
Register: Dr. Raid R. Al-Muhanna/ UOK, Iraq

C47	Evaluation of Cationic Emulsified Asphalt Paving Mixtures by Moisture Sensitivity Tests Dr. Hasan. H. Al-Baidhani, Assist. Lecturer Hussein Hamel Zghair	3:00 – 3:15
C23	Evaluation Pedestrian Safety at Un signalized T- Intersection on Urban Area Using Traffic Conflict Technique Sahar S.Hadi , Raeda K. Ali, Hayder A. Ashour	3:15 – 3:30
C50	Climate Responsive Building Design in Iraqi Environment Context Ahmed Hasson, , Mechanical Engineering Department, College of Engineering, Nahrain University	3:30 – 3:45
C3	Proposing Transportation Modes for Effective Tourism Management in City of Karbala Sedigheh Vakilly, Ehsan Ramezani, Ghasem Ashtijou, Roozbeh Mohammadi4, Samira Dibaj5	3:45 – 4:00
C35	تأثير درجات الحرارة على المقاومة النوعية للحمأة المنشطة أ.م.د وليد محمد شيت العبدربه، م.د زينب بهاء محمد، م.د علي صادق رشك ،نور سلطان خزعل ، رقية نصيف جاسم ، مهاوش جاسم	4:00 – 4:15
C2	Analysis of Thick Square Plates on Two-parameter Elastic Foundation Riyadh J. Aziz1, Adel A. Al-Azzawi and Tuqa W. Ahmed3	4:15– 4:30
C31	The Effect of Earthquake Characteristics on Seismically Isolated Buildings of Variable Geometric Configurations with and without Shear Walls Dr. Haider S. AL-Jubair , Mr. Fareed H. Majeed	4:30– 4:45
C48	Residential Trip Demand Forecasting: A Regression-Based Approach Using Observed Trip Rate Data Dr. Firas Hasan Alwan Asad	4:45– 5:00

Afternoon Session4: Mechanical Engineering Applications

Venue: Hall Three, Mechanical Engineering Department
Chairman : Prof. Dr. Mohammad M. Aghdam/ AmirKabir University, Iran
Register : Assistant Prof. Dr. Mohammed h. Abood/ UOK,Iraq

M4	Adsorption of Co2+ and Ni2+ from Aqueous Solution on Different Nano Montmorillonite Types Hadi Azimi, Majid Hayati-Ashtiani	3:00 – 3:15
M5	Morphological and Structural Characteristics of Swelling and Nonswelling Nanostructured Montmorillonite Majid Hayati-Ashtiani, Hadi Azimi	3:15 – 3:30
M19	Experimental Study of Transient Forced Convection Heat Transfer Nanofluid in Annular Duct Ahmed H. Ali and Tahseen A. Al-Hattab	3:30 – 3:45
M10	Numerical Study of Thermal Performance for Solar Heating System Audai Hussein Al-Abbas	4:00 – 4:15
M22	Numerical Simulation of Thermal Performance of Variable Conductance Cylindrical Heat Pipe Using Nanofluid Hassanain Ghani Hameed , Proof. Dr. Abudl-Muhsin A. Rageb	4:15– 4:30
M44	Three Dimensional Finite Element Analysis of Wire Drawing Process Dr. Abdul Kareem F. Hassan Alyaa Sh. Hashim	4:45– 5:00

Afternoon Session5: Mechanical Engineering Applications

Venue: Hall Four, Mechanical Engineering Department
Chairman : Prof. Dr. Arkan k. Ali/ UOT, Iraq
Register : Assistant Prof. Dr. Abdu-karim Al-Hamadani/ UOK, Iraq

M16	Robust Control Design of Variable Speed Wind Turbine Under Parametric Uncertainty Dr.Emad Q. Hussien	3:00 – 3:15
M30	Cognitive Neural Trajectory Tracking Controller Design for Mobile Robot Dr. Moafaq Ali Tawfeq , Dr. Ahmed Sabah Al – Araji and Basim Raheem Sadeq	3:15 – 3:30
M32	Hyperelastic Constitutive Modelling for Fiber-Reinforced Rubber Materials Assist. Prof. Dr. Mohsin Noori Hamzah, Mahmood Shakir Nima	3:30 – 3:45
M35	Theoretical and Numerical Study of Natural Frequency Investigation for Orthotropic Unidirectional and Woven Hyper Composite Materials Beam Dr. Muhannad Al-Waily	3:45 – 4:00
M29	Drifting Dynamic Characteristics Due to Effect of Heating Load For Aluminum Alloy 7075 T6 Husam A. Kareem, Prof. Dr. Muhsin J. Jweeg, Prof. Dr. Shaker S. Hassan	4:00 – 4:15
M40	Structural and Morphology studies of nanocomposite materials Prof. Dr. Fadhil Attiya Chyad , Asst. Prof. Dr. Abd Al-Raheem Kadhem, Asst. Lec. Auday Abd Muhatlif	4:15– 4:30

Afternoon Session6: Electrical Engineering Applications

Venue: Hall Five, Civil Engineering Department
Chairman : Prof. Dr. Asaam M. Abdulbaqi/ UOM, Iraq
Register: Dr. Ali J. Mahdi

	Investigation of solar Irradiance Impact on Electro-thermo-mechanical characteristics of a Dish-Stirling Engine power Generation System Pro. Dr. Hossein Askarian Abyaneh, Iran	3:00 – 3:15
E25	Design and Implementation of Hybrid Intelligent Systems Based on FPGA Assist. Prof. Dr. Hanan A. R. Akkar	3:15 – 3:30
E26	Wearable Sierpinski Dragon Fractal Patch Antenna for RFID Applications Ghufran M. Hatem, Ali J. Salim and Jawad K. Ali	3:30 – 3:45
E27	Automatic Digital Modulation Classification Using FFT Ivan A. Hashim, Jafar Wadi Abdul Sadah, Thamir R. Saeed	3:45 – 4:00
E28	Disturbance Analysis in Wind Power System Connected with National Grid based on Intelligent Techniques Dr. Kanaan A. Jalal, Ahmed Najem Abdalameer	4:00 – 4:15
E11	Automated Car Airbag System Using Human Face Detection Hussain F. H. Jaafar1, and Qais K. O. Al-Gayem	4:15 – 4:30

Workshop: Research and Studies to Solve the Infrastructure and Transportation problems of Karbala City
Venue: Madinate Al-Za’arin
Chairman : Assistant Prof. Dr. Mohammed A. Al-Saraj / UOB, Iraq
Register: assistant Prof. Zwhair Al-Jawaheri , UOK, Iraq

Registration	7:30-7:55
Workshop Opening	8:00
Holy Quran	8:00-8:05
Welcome by the Director of Kerbala Center for Studies and Research	8:05-8:15
The high Demand to develop the infrastructure facilities of Kerbala City	8:15 -8:30
Discussion	8:30-9:30
Recommendation and final report	9:30-9:40
Closing the workshop	9:45

Day Two: Thursday 25 Dec 2014

Morning Session7: Civil Engineering Applications
Venue: Hall One, Civil Engineering Department
Chairman : Prof. Dr. Nada M. Fauzi
Register : Dr. Hussein A. Al-Hamami/UOK, Iraq

C43	متطلبات تحقيق الاستدامة في المحلة السكنية م .د صبيح لفته فرحان , م. د .احسان عباس جاسم	9:00-9:15
C1	Simulating the Impacts of Groundwater Pumping on Dibdibba Aquifer in Karbala Province Dr.Waqed H.Al-Mussawy1, Asst. Lecture-Sumayah A. Al-Din2	9:15-9:30
C13	Hydraulic Characteristics of Flow through Monosized Gravel Fadhil Mohammed Al- Mohammed, Ph.D.	9:30 – 9:45
C25	Estimation of Axle Load Spectra for Mechanistic-Empirical Pavement Design in New Brunswick Hayder Abbas Ashour Al-Araza	9:45 –10:00
C51	Development of Predictive Models for the Resilient Modulus of Asphalt Concrete Mixtures Dr. Amjad H. K. Albayati(1), Dr. Shakir AL- Busaltan(2), Sahar S.Hadi (3)	10:00 – 10:15
C37	Clay Brick Waste as Internal Curing Agent in Normal Weight Concrete Dr. Laith Sh. Rasheed, Laith Mohammed-Ridha Mahmmod	10:15– 10:30
C55	Pavement Management using Cost-Effective Data Collection Sensors V. Khalifeh1 & A. Golroo2	10:30– 10:45
C49	Experimental study of insulated and non-insulated concrete behavior under the effect of thermal load Ridha hameed Majeed, mohsin obaid muhi, Mahmood eaifan Mohamed	10:45– 11:00
C19	Shear Strengthening Behavior of Lightweight Aggregate Concrete Beams with Near Surface Mounted Using Carbon Fiber Reinforced Polymer Bars Ali Hameed Naser Al-Mamoori Department of Civil Engineering, College of Eng. Karbala University.	11:00-11:15

C17	Analysis of Earthquake Records from Badra and Kirkuk Seismographic Stations Prof. Dr. Adnan Falih Ali, Majed Ashoor Khalaf	11:15-11:30
C14	ARTIFICIAL NEURAL NETWORKS FOR PREDICTING CHARACTERISTICS OF CIR MIXES AFTER LONG-TERM CURING Seyed Mahmoud Dibaj, Behrooz Saghafi, Roohollah Noori and Payam Daie	11:30-11:45

Morning Session8: Mechanical Engineering Applications
Venue: Hall Three, Mechanical Engineering Department
Chairman : Prof. Dr. Abdulhassan. Karamallah
Register :Assistant Prof. Dr. Abbas S. Sharif/ UOK, Iraq

M6	Study of Nickel Removal on Raw and Acid-activated Nano-structure Montmorillonite Zahra Ashouri Mehranjani [1], Mehran Rezaei [2*], Majid Hayati-Ashtiani[3]	9:00 - 9:15
M7	Physiochemical Characterization of Bentonite Clays for Oil Well Drilling Fluids Masoomeh Bakhshi Mejdar [1], Majid Hayati-Ashtiani [2], Mohammad Reza Mozdian Fard [3*]	9:15 – 9:30
M39	Experimental Investigation of a Heat Pipe Heat Exchanger (HPHE) Performance in Air-conditioning Systems M. Muhsen [a] , W. Mohammad[b], A. Karamallah[c]	9:30 – 9:45
M42	NUMERICAL INVESTIGATION OF FINNED THERMOSYPHON Prof. Dr. Karima Esmail Amori, Mohanad Lateef Abdullah	9:45 – 10:00
M36	Numerical simulation of combined convection of Cu-H2O nanofluid in an inclined lid-driven enclosure with a localized heat source Ahmed Kadhim Hussein , Sameh E. Ahmed and Farshid Fathinia	10:00 – 10:15
M23	The Phases Monitoring System of the Oil Wells Asst. Prof .Dr. Dhirgham A.H. Al-khafaji , Mustafa A. Kadhim Alkizwini [(2)]	10:15 – 10:30
M37	Application of Nanostructured Conducting Polymer Film in Fabrication of Electronic Nose Based on Chemiresistors Array Sensor Naader Alizadeh*, Mohsen Babaei, Mohammad Sadegh Alizadeh , Ahmad Mani-Varnosfaderani	10:30 - 10:45
M12	Combined Cycle Plant "The Future Solution for Iraq Electricity Production" Dr. Raoof M. Radhi	10:45 - 11:00

Morning Session9: Electrical Engineering Applications

Venue: Hall Five, Civil Engineering Department
Chairman : Prof. Dr. H. A. Abyaneh/ AmirKabir University, Iran

	Guest Speaker	9:00 – 9:15
E23	Analysis on Modeling and Simulation Force Control Linear Actuator with Spring in Series and its Driving System For Below Knee Amputees Dhirgaam A. Kadhim	9:15 – 9:30
E7	Experimental Study of Wave Shape and Frequency of the Power Supply on the Energy Efficiency of Hydrogen Production by Water Electrolysis Dhafeer M. H. Al-Hasnawi[1], Haroun A. K. Shahad[2]	9:30 – 9:45
E24	Comprehensive Design and Implementation of a MPPT Controller for a PV Module based on dSPACE Microcontroller Ali J. Mahdi	9:45 – 10:00
E13	New Current-Mode MISO-Type Universal Filter Configurations Using Single FDCCII and Minimum passive components Kasim K Abdalla[1]	10:00 – 10:15
E6	Design and Analysis of Environmental monitoring system Using Wireless Sensor Networks Syed Akhtar Imam[1], Vibhav Kumar Sachan[2]	10:15– 10:30
E2	A Proposed Filter for Low Frequency Signals S. A. Hasan	10:30– 10:45
E21	Design of CMOS IR-UWB Transmitter Fadhil Mohammed Al- Hussein Ali Hamza, Dr. Haydar M. Al-Tamimi	10:45-11:00

Register : Dr. Riadh Mowad/ UOK, Iraq

Afternoon Session10

Venue: Khatam Al-Anbeea (peace be upon him) Hall in Imam Hussein Holy Shrine.
Chairman : Prof. Dr.Sabah Rasoul Al-Jabiri / UOK, Iraq

Holy Quran	2:00-2:05
Speech of Shaikh Abdu Al-Mahdi Al-Karbala’i	2:05-2:20
Awards’ Distribution for the selected papers	2:20-2:40
Conference Final Report	2:40-2:50
Conference closing speech, Prof. Dr. Sabah Rasoul Al-Jabiri	2:50-3:00

Authors' CVs

الاسم: ندى مهدي فوزي علوان الجيلاوي

الشهادة :دكتوارة   تاريخ الحصول على الشهادة : ٢٠٠٦

اللقب العلمي :استاذ تاريخ الحصول على اللقب : ٢٠١١/١٠/١٢

الاختصاص العام والدقيق: هندسة مدنية / تكنولوجيا الخرسانة والمواد الانشائية

الجامعة التي تخرجت منها: جامعة بغداد

Dr. Haitham Hassan Muteb

B.Sc.-M.Sc.-Ph.D.

- Professor and Consultant Engineer
- With B.Sc.-M.Sc.-and Ph.D. degrees in Civil Engineering.
- having more than 25years' experience worked on range of projects in different locations,
- Lecturer in Iraqis Universities (Babylon University, University of Technology, Baghdad University and University of Karbala).
- Supervisor for about 19 M.Sc. Dissertations and 6Ph.D Thesis From the period (2000-2014)

Maher Kheder Abbas

Academic Qualification:

- (2007-2011)

  B.Sc. in civil engineering, university of Babylon.
- (2012-2014)

M.Sc. researcher in civil engineering/structures, university of Babylon.

Safaa Adnan Mohamed

Highway and Transportation Engineering Department, University of Al-Mustansiriyah

Marawan Mohammed Hamid
Iraq- Baghdad
Since 2012 when I got my master's degree in engineering and construction materials to the present time I do my teaching at the University of Technology, Department of Building and Construction Engineering, Construction Engineering Branch. The title and my guest Assistant Lecturer.

Mahmood Hafidh Abdulrazzaq
1. M.Sc. in structural materials (concrete properties) from the college of Engineering/ Al Mustansiria University.
2. B.Sc. in Building and construction from the University of Technology. (1984).
3. B.A in Translation from the college of Arts/ Al Mustansiria University (2000).

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Academic Qualifications:
B.Sc. Degree in –civil engineering in AL-Rasheed College/ University of Technology /1988
M.Sc. Degree in –Civil Engineering/Highway Engineering- in AL-Rasheed College/University of Technology /1995
Ph.D. Degree in Highway Engineering in University of Technology/2006

Name : Ass. Lecturer Hussein Hamel Zghair
Academic Qualifications

1. 2005- 2009 B.Sc. in Building & Construction Engineering / Building Engineering &Construction Management /University of Technology.

2. 2010-2012 M.Sc. in Building & Construction Engineering Specialized in Building Material Engineering/University of Technology.

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University of New Brunswick CANADA
Master of Science (M.Sc.), Highway and Airport Engineering June 2001
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Sahar S. Hadi Al Neham is assistant lecture in the civil department of AL- Furat AL- Awsat Technical University She awarded a M.Sc 2005 from Technology University. She is a Ph.D Student stage, highway and pavement engineering She has 4 researches published.

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Master of Science (M.Sc.), Highway and Airport Engineering June 2000,University of Technology-Iraq Baghdad, Iraq
Higher Diploma, Building and Construction Engineering Jan 1997,University of Technology-Iraq Baghdad, Iraq
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BaghdadUniversity Ph.D. 2001 Structural Engineering

Dr. HAIDER SAAD YASEEN AL-JUBAIR
Ph. D. Geotechnical Engineering, September 2002, University of Baghdad, Iraq.
Dean of the College of Engineering, 2003-2005, University of Tikrit, Iraq**.**
Dean of the College of Engineering, 2006- 2008, University of Thi-Qar, Iraq**.**
- Assistant Professor,1998- till now,.
Member of the ISSMGE, No. IRQ1300017.

Fareed H. M. Al-Mosawi
M.Sc. – Structural Engineering 2002.
Assistant Lecturer in Basrah University- College of Engineering-Department of Civil Engineering from 2005 till now.
Ph.D. Student.

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Dr. Majid Hayati
assistant professor at University of Kashan, Iran
Graduated in Ph.D at 2010 in Chemical Engineering. Published 8 ISI papers, 6 international conference papers, 1 national conference paper and 2 national patents, Advisor of 1 Ph.D dissertation, supervisor of 4 M.Sc. theses, scientific interests is bentonite clays.

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EDUCATION

- B.Sc in Mechanical Engineering, Kufa Unversity, 2003
- M.Sc in Mechanical Engineering, Power Mechanics, Kufa University, 2006

Assistant Lecturer in Department of Automobiles Engineering at Technical College-Najaf from 2007 up to now. The teaching experience includes engineering courses such as design projects, engineering and mechanical drawing and calculus I.

Dr. Audai Hussein Kadhum Al-Abbas
-B.Sc. degree in Mechanical Engineering from University of Technology/ Baghdad in 1997.
-M.Sc. degree in Applied Mathematics in thermal engineering (fluid mechanics) from University of Technology/ Baghdad in 2002.
-Ph.D. degree in Mechanical Engineering / Thermal Engineering / Energy from Swinburne University of Technology/ Australia in 2012.

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•Ph.D, Student, Mechanical Engineering,ThermalMechanics, Basrah University, Supervisor: Prof. Dr. Abudl-Muhsin A. Rageb

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Professor of Industrial Technology, Chief Researchers and Expert of Materials Science
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Published (130) papers, (3) Engineering Books, (2) patents
Supervised (30) Ph.D. and M.Sc.
Chief and member of (140) postgraduate committee

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Degree obtained:- PhD (1998) in Electronic Engineering University of Technology Department of Electrical Engineering
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Number of publications: Seventy-three papers in area of artificial neural networks, Genetic algorithm, Fuzzy logic, Swarm intelligent, FPGA, Switched capacitor, Nanotechnology based on electronics engineering.

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He received his B.Sc and M.Sc degrees in 1979 and 1986 respectively from Al-Rasheed College for Science and Technology, Iraq. From 1989-1991, he joined a PhD study program at the Faculty of Engineering, Antonin Zapotocky Academy, (VAAZ), Brno, former Czechoslovakia. Since 2010, he has been a professor of microwave engineering at the University of Technology, Iraq. Currently, he is the deputy dean for postgraduate studies and scientific affairs at the Department of Electrical Engineering. His fields of interests are microwave antenna miniaturization and design, passive microwave circuits design and FPGA based system design. He has more than 90 published papers in local and international conferences and peer-reviewed journals. Prof. Ali is a Senior Member of IEEE and a Member of IET.

Mr. Ivan A. Hashim
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Thamir Rashed Saeed
Was Born in Baghdad, Iraq 1965. He received the B.Sc. and M.Sc. degree from military engineering college(MEC) in Baghdad in 1987 and 1994 respectivily, and Ph.D. degree from AL-Rashed college of engineering and Secinec in Baghdad 2003. He worked with (MEC) in Baghdad as a member of teaching staff. From 2003 till now, he worked with the (UOT) in Baghdad as a member of teaching staff. His major interests are in digital signal processing, digital circuit design for DSP based on FPGA and Steganography.

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Department: Electrical Engineering
Position/ Job Title: Faculty Member, Dean Assistant
Field of Interest: Electrical Power Systems Renewable Energy Intelligent Systems

Hussain F. Jaafar
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Job Title:- Head of civil engineering department
BSc., MSc:-Building& construction/ University of Technology/Iraq
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Published Papers:- 9

Laith Mohammed-Ridha Mahmmod
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MSc. :- Construction Materials, University of Baghdad.
Published Papers:- 2
ACI- Iraq Chapter Member.

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أشرف على أكثر من ٨٦ رسالة ماجستير وأطروحة دكتوراه.
أنجز اكثر من ٥٥ بحث منشور في مجلات ومؤتمرات علمية محلية وعالمية.

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Asst. Prof. Dhirgham Al-Khafaji
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Asst. Prof. Dr. Amjad H. Khalil Albayati
Dr. Amjad H. Khalil Albayati is assistant professor in the civil
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highway and pavement engineering in 2006 from Baghdad University. he
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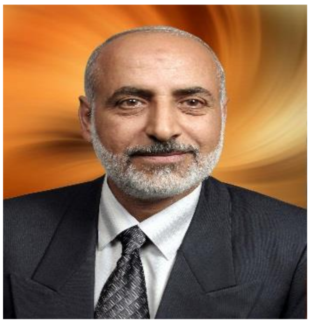

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Iraq - the province of Najaf / Foundation of Technical Education
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BSc.Mechanical Engineering - General Faculty of Engineering / Iraq 2000
MS.Mechanical Engineering - Power Faculty of Engineering / Iraq 2003
Ph.D. Basrah Mechanical Engineering - Power Faculty of Engineering / Iraq 2011

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عملت في جامعة البصرة من ١٩٨٤-١٩٩٣
وفي جامعة بابل من ١٩٩٣ لحد الآن
نشرت حوالي ٦٠ بحثا علميا في مجلات علمية عراقية وعالمية
شاركت في عدد كبير من المؤتمرات العلمية العراقية والعربية والعالمية
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Kasim K. Abdalla

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Dhirgaam Abdul Rahym Kadhim

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Academic Qualification

-Bsc. : Baghdad University/ College of Engineering/1997
-Msc. : Baghdad University/ College of Engineering/2001
-Ph.D : Vladimir State University/college of Engineering/2011
Place of Work: University of Kerbala–College Of Engineering.

Dr. Ali Jafer Mahdi

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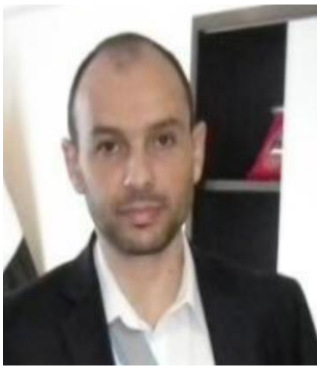

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1)B.Sc.in electrical engineering / Al-Rasheed college/university of technology(Baghdad-iraq)1996
2) M.SC. In Electrical Engineering and Electronics/Al-Rasheed college University of Technology (Baghdad-Iraq) 2002.
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Numerical Simulation of Combined Convection of Cu-H_2O Nanofluid in an Inclined Lid-Driven Enclosure with a Localized Heat Source

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ABSTRACT

A numerical simulation of the combined convection flow in a rectangular inclined lid-driven enclosure filled with copper-water nanofluid has been performed. The upper and the lower walls are maintained at a cold temperature and the upper wall moves from left to right with uniform lid-driven velocity. A localized heat source is embedded on a region of the enclosure left sidewall, the right one is considered thermally insulated together with the remaining regions of the left sidewall. The effects of the governing parameters such as solid volume fraction , Richardson number, enclosure inclination angle and heat source effect are investigated. The results explain that the local Nusselt number decreases as the inclination angle and solid volume fraction increase. Comparisons with another published results are performed and a good agreements are found.

Keywords- combined convection , enclosure , laminar flow , localized heat source , nanofluid

1. Introduction

Nanofluids are a new kind of heat transfer fluids containing a small quantity of nano-sized particles (usually less than 100 nm) that are uniformly suspended in a liquid. They have received more attention as a new generation of heat transfer fluids in building heating, heat exchangers and automotive cooling applications, because of their excellent thermal performance. Various advantages of nanofluids applications include: heat transfer system size reduction, micro channel cooling and miniaturization of systems **[1-2]**.Various numerical and experimental studies on nanofluids in a lid -driven square or rectangular enclosures have been studied in the literature **[3-10]**.Kakac and Pramuanjaroenkij **[11]** presented an excellent review of convective heat transfer enhancement with nanofluids. Moreover, Mahmoudi et al. **[12]** studied numerically mixed convection flow and temperature fields in a vented square cavity subjected to an external copper-water nanofluid. The effects of solid volume fraction on the hydrodynamic and thermal characteristics had been investigated. Talebi et al. **[13]** investigated numerically mixed convection flows in a lid-driven square cavity utilizing copper–water nanofluid. They showed that at a given Reynolds number and Rayleigh number, solid concentration had a positive effect on heat transfer enhancement. Abu-Nada and

Chamkha **[14]** solved numerically the steady laminar mixed convection of a nanofluid made up of water and Al_2O_3 in a lid-driven inclined square enclosure.

It was found that the heat transfer mechanisms inside the cavity were strongly dependent on the Richardson number. Ghasemi and Aminossadati **[15]** numerically studied the mixed convection in a lid-driven triangular enclosure filled with a water–Al_2O_3 nanofluid. The results showed that the addition of Al_2O_3 nanoparticles enhanced the heat transfer rate for all values of Richardson number and for each direction of the sliding wall motion. Shahi et al. **[16]** executed a numerical investigation of mixed convection flows through a copper–water nanofluid in a square cavity with inlet and outlet ports. The results indicated that an increase in solid concentration caused to increase in the average Nusselt number at the heat source surface and a decrease in the average

bulk temperature. A literature review indicates that the papers related with the combined convection in a lid-driven inclined enclosure subjected to a localized heat source using a nanofluid concept are very limited . However, the present paper can be considered as a continuous part of our first published paper deals with this subject (Hussein et al. **[17]**).

2. Mathematical Analysis

2.1 Problem geometry and the governing equations.

Fig.1 shows a schematic diagram of a two-dimensional inclined rectangular enclosure of height (H) and width (w).The fluid inside is a copper-water nanofluid. The nanofluid is assumed incompressible and the flow is assumed to be Newtonian, laminar and steady. It is assumed that the base fluid (i.e. water) and the nanoparticles are in thermal equilibrium state. The enclosure aspect ratio is represented by (A = w / H). The parameters B, D and Gr are considered fixed during the calculation at the values 0.4 , 0.5 and 100 respectively. The solid volume fractions, (φ) have been varied from 0 % to 10 % with an increment of 5% while the enclosure inclination angle (Φ) is varied as 0^o **,** $30°$, $60°$ and $90°$ respectively. The Reynolds number is taken as ($1 \leq Re \leq 100$).The thermo-physical properties of the water and copper nanoparticles are given in **Table 1**. The upper and lower walls are kept to be cooled and the upper wall moves from left to right with uniform lid-driven velocity (U_p). The thermo-physical properties of both the base fluid and nanofluid are assumed to be constant except for the density variation, which is modeled using Boussinesq model. The dimensionless governing equations for the laminar and steady state mixed convection in terms of the stream function-vorticity formulation are given by Hussein et al. **[17]** :

$$\frac{\partial^2 \Psi}{\partial X^2} + \frac{\partial^2 \Psi}{\partial Y^2} = -\Omega \tag{1}$$

$$\frac{\partial}{\partial X}(\Omega \frac{\partial \Psi}{\partial Y}) - \frac{\partial}{\partial Y}(\Omega \frac{\partial \Psi}{\partial X}) = \frac{1}{Re} \frac{1}{(1-\phi)^{2.5}((1-\phi)+\phi \frac{\rho_{nf}}{\rho_f})} + (\frac{\partial^2 \Omega}{\partial X^2} + \frac{\partial^2 \Omega}{\partial Y^2})$$

$$+Ri(\phi(\frac{\beta_{nf}}{\beta_f})+(1-\phi))\ (\frac{\partial\theta}{\partial X}\cos\Phi-\frac{\partial\theta}{\partial Y}\sin\Phi) \tag{2}$$

$$\frac{\partial}{\partial X}(\theta\frac{\partial\Psi}{\partial Y})-\frac{\partial}{\partial Y}(\theta\frac{\partial\Psi}{\partial X})=\frac{1}{\mathrm{Re\,Pr}}\frac{\frac{k_{nf}}{k_f}}{(1-\phi)+\phi\frac{(\rho c_p)_{nf}}{(\rho c_p)_f}}(\frac{\partial^2\theta}{\partial X^2}+\frac{\partial^2\theta}{\partial Y^2}) \tag{3}$$

These dimensionless governing equations have been obtained by employing the following non-dimensional variables as listed below :

$$X=\frac{x}{H}\quad Y=\frac{y}{H}\quad U=\frac{u}{U_p}\quad V=\frac{v}{U_p}\quad \Omega=\frac{\omega}{U_p/H}\quad \Psi=\frac{\psi}{U_pH}$$

$$\theta=\frac{T-T_c}{\Delta T}\quad \Delta T=\frac{qH}{k_f}\quad Gr=\frac{g\beta\Delta TH^3}{\nu_f^{\,2}}\quad \Pr=\frac{\nu_f}{\alpha_f}\quad Ri=\frac{Gr}{\mathrm{Re}^2}\quad \mathrm{Re}=\frac{U_pH}{\nu_f} \tag{4}$$

The non-dimensional boundary conditions are given by :

The bottom wall of the cavity is maintained at constant cold temperature :
at Y = 0 and $0\le X\le 1$ $\theta=0$, U = V = 0 (5)

The top wall of the cavity is maintained at constant cold temperature and moves from left to right with uniform lid-driven velocity :
at Y = 1 and $0\le X\le 1$ $\theta=0$, U = 1 , V = 0 (6)

The lower part of the left vertical inclined side wall of the cavity is considered adiabatic :
at X = 0 and $0\le Y<(D-0.5B)$, U = V = 0 , $\frac{\partial\theta}{\partial X}=0$ (7)

The heat source part of the left vertical inclined side wall of the cavity is considered as :
at X = 0 and $(D-0.5B)\le Y\le(D+0.5B)$, U = V = 0 , $\frac{\partial\theta}{\partial X}=\frac{k_f}{k_{nf}}$ (8)

The upper part of the left vertical inclined side wall of the cavity is considered adiabatic :

at X = 0 and $(D+0.5B)<Y\le 1$, U = V = 0 , $\frac{\partial\theta}{\partial X}=0$, (9)

The right vertical side wall of the cavity is considered adiabatic :

at X = 1 and $0 \le Y \le 1$, U = V = 0 , $\dfrac{\partial \theta}{\partial X} = 0$ (10)

2.2 Local and average Nusselt number along the heat source surface

The local and average Nusselt numbers along the heat source surface can be written as Hussein et al. **[17]**:-

$$\mathrm{Nu}_s(Y) = \frac{1}{\theta_s(Y)} \tag{11}$$

$$\mathrm{Nu}_m = \frac{1}{B} \int_{\mathrm{D-0.5B}}^{D+0.5B} Nu_s(Y)dY \tag{12}$$

where, $\theta_s(Y)$ is the dimensionless local temperature along the heat source

3.Numerical Scheme and Verification

Because of the non-linear interactions among the equations (1–3), solution for these equations with the boundary conditions (5–8) can be obtained numerically using finite difference method. During each axial step, the numerical evaluation is iterated until the relative errors of U,V and θ at sequential iterations are less or equal (10^{-6}). In order to choose the suitable grid for these calculations, an accurcy test using five sets of grids: $31\times31, 41\times41,\ \ 61\times61,\ 81\times81, 101\times101$ is made. This test is clearly shown in **Table 2**. A (61×61) uniform grid is found to meet the requirements of both the grid independency study and the computational time limits.The numerical method is found to be suitable and gives results that are very close to the numerical results obtaind by Aminossadatia and Ghasemi **[5]** and Mansour et al. **[18]** and with using the copper-water nanofluid .**Table 3** shows a good agreement is reached between the present results and the results obtained by Aminossadatia and Ghasemi **[5]** and an excellent agreement between the present results and the results obtained by Mansour et al. **[18]**. These comparisons give confidence in the numerical results to be reported subsequently.

4.Results and Discussion

The streamlines (on the left)and isotherms (on the right) in the enclosure for the water- copper nanofluid are shown in **Figs. (2–5)** for various inclination angles, solid volume fractions and Richardson numbers. It can be seen from **Fig. 2** that, the fluid moves from the inclined left sidewall where the heat source exists towards the right side one and as a result forms a clockwise single circular vortex with $\psi_{min,nf}$ = -0.1032864 and $\psi_{min,f}$ = -0.1024746 at φ =0% and φ =10% when the Richardson number (Ri = 0.05) .When the solid volume fraction increases, the circulation

intensity decreases as a result of small energy transport through the flow related with the low movement of the nanoparticles. The high quantities of nanoparticles volume fraction cause a significant increase in the fluid viscosity and as a result causes the velocity to be decrease. From the other hand, when the Richardson number increases from Ri = 0.05 and 10 to Ri = 100 , the effect of buoyancy forces becomes more dominant which causes the circulation vortex to become more stronger and extends deeply inside the inclined cavity. While, when the Richardson number is low, the effect of the lid-driven is dominant and the streamlines are greatly concentrated to each other. In this case the flow is drived by the forced convection mechanism. Moreover, for low values of Richardson number (Ri = 0.05), the existence of the heat source has no clear effect on the streamlines. Also, it can be observed that the isotherms are accumulated adjacent to some part in the left inclined sidewall of the enclosure where the heat source exists. Furthermore, it can be noticed, that as the Richardson number increases from Ri = 0.05 and 10 to Ri = 100 , the isotherms begin to distribute uniformly parallel to the cold top and bottom walls and approximately take the horizontal shape in the center of the inclined enclosure indicating that convection is the dominant mechanism for heat transfer in the cavity. While, the distribution of the isotherms are considered random and confuse inside the inclined enclosure when the Richardson number is low.Moreover, it can be observed from the figure that the temperature distribution for both base fluid and nano fluid increase with increasing the Richardson number and their maximum values increase from $\theta_{\max,nf} = 0.2308517, \theta_{\max,f} = 0.2867012$ when Ri = 0.05 to $\theta_{\max,nf} = 0.4185633$, $\theta_{\max,f} = 0.5444783$ when Ri = 100. This behavior is due to the strong effect of convection when the Richardson number increases. From the other side, the addition of nanofluid to the base fluid

leads to reduce the temperature distribution and this reduction increases as the solid volume fraction range increases. Since as the solid volume fraction increases, less heat is transferred into the system and thus the temperature of the entire enclosure decreases. Also, **Figs.2** and **3** illustrate the effect of the enclosure inclination angle on the streamlines and isotherms contour when the enclosure inclination angles are taken as 30° and 90° respectively. It can be observed that as the inclination angle increases, the vortex exhibits more clear extension inside the inclined cavity and occupies most of the cavity zone. When the inclination angle reaches to 90° , the vortex begins to separate into two rotating vortices and rotates with a slow rate. From the other hand, no important effect of increasing the enclosure inclination angle can be noticed on the isotherms contour. **Fig. 4** explains the profiles of the local Nusselt number along the heat source with the variations of the inclination angle when the Richardson number (Ri = 10) , A=2 and φ = 10 %. It can be observed that as the inclination angle increases, the local Nusselt number along the heat source decreases due to the reduced value of velocity. This is due to the weak effect of natural convection heat transfer due to slight effect of buoyancy force while the forced convection heat transfer contribution is significant. Therefore, the cavity inclination angle can be used as a control parameter for fluid flow and heat transfer. **Fig.5** demonstrates the profiles of the local Nusselt number along the heat source with the variations of the Richardson number when the enclosure inclination angle (Φ) is 30° and aspect ratio (A = 2).The local Nusselt number along the heat source decreases with addition of nanoparticles (φ =10 %) compared with base fluid (φ = 0 % *)*. This is due to the increase of the thermal boundary layer

thickness, since it increases rapidly with increasing the volume fraction of nanoparticles. This rapid increase causes to reduce the velocity which leads as a result to reduce the thermal energy transport through the fluid. Therefore , the temperature gradient at the heat source position has a slight effect and causes a reduction in the local Nusselt number values.

5.Conclusions

The following conclusions can be drawn from the results of the present work.

1. The existence of a heat source at the inclined left sidewall of the enclosure causes the vortex to extend vertically.
2. Increasing the solid volume fraction decreases the circulation intensity of the flow and reduces the stream function values.
3. The circulation vortex size increases and extends to the central region of the enclosure when the Richardson number increases.
4. When the Richardson number increases, the isotherms are accumulated near the heat source position and it changes their shape from the random and irregular distribution to approximately uniform distribution.
5. By adding the nanofluid to the base fluid, a clear reduction in the temperature distribution can be detected.
6. The local Nusselt number along the heat source decreases as the enclosure inclination angle increases and the opposite is valid.
7. The local Nusselt number along the heat source decreases with addition of nanoparticles compared with base fluid.
8. No significant effect is noticed in the isotherms when the enclosure inclination angle increases.

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Nomenclature

Symbol	Description	Unit
A	The enclosure aspect ratio which is represented by A = w / H	
B	Dimensionless length of the heat source (b / H)	
c_p	Specific heat at constant pressure	J / kg. °C
D	Dimensionless distance of heat source from the bottom wall (d / H)	
Gr	Grashof number	
g	Gravitational acceleration	m/s^2
H	Height of the enclosure	m
k	Thermal conductivity	W / m. °C
Nu_{av}	Average Nusselt number	
Nu_s	Local Nusselt number	
Pr	Prandtl number	
q	Heat generation per unit area	W/m^2
Re	Reynolds number	
Ri	Richardson number	
T	Temperature	°C
U	Dimensionless velocity component in x-direction	
U_p	Uniform lid-driven velocity of the moving top wall	m/s
u	Velocity component in x-direction	m/s
V	Dimensionless velocity component in y-direction	
v	Velocity component in y-direction	m/s
w	Width of the enclosure	m
X	Dimensionless Coordinate in horizontal direction	
x	Cartesian coordinate in horizontal direction	m
Y	Dimensionless Coordinate in vertical direction	
y	Cartesian coordinate in vertical direction	m
Greek Symbols		
α	Thermal diffusivity	m^2/s
β	Coefficient of thermal expansion	K^{-1}
θ	Dimensionless temperature	

Nomenclature Continued

ΔT ΔT	Reference temperature difference	
ψ	Dimensional stream function	m^2/s
Ψ Ψ	Dimensionless stream function	
ω	Dimensional vorticity	1/sec
Ω	Dimensionless vorticity	
Φ Φ	Enclosure inclination angle	degree
φ	Volume fraction of nanofluid	
ν	Kinematic viscosity of the fluid	m^2/s
ρ	Density	kg/m^3
Subscripts		
c	Cold	
f	Fluid	
nf	Nano fluid particle	
s	Heat source surface	

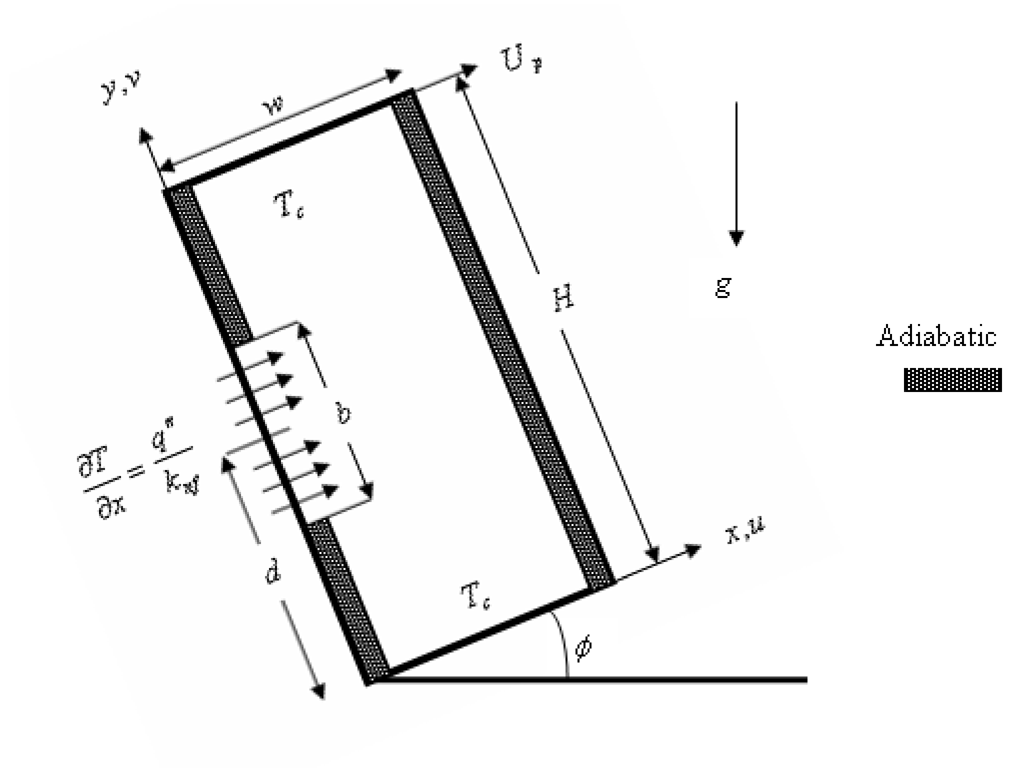


Fig. 1 schematic of the enclosure

Table1 Thermo-physical measured properties of water and copper nanoparticles

(Hussein et al. **[17]**).

Property	Pure water	Copper (Cu)
$\rho(kgm^{-3})$	997.1	8933
$C_p(Jkg^{-1}K^{-1})$	4179	385
$k(Wm^{-1}K^{-1})$	0.613	401
$\beta(K^{-1})$	21×10^{-5}	1.67×10^{-5}

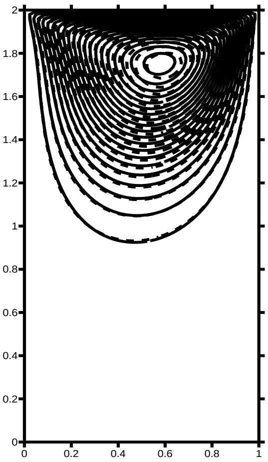
Table 2 Grid independency study for Cu-water nanofluid ($A=1, B=0.4, D=0.5$ $Ri=1, \phi=0^0, \varphi=10\%$)

Grid	$\psi_{\min}$	Nu_m
31×31	-0.1019090	٧,٠٩٧٢٥٢
41×41	-0.1018446	٧,١١٥٠١٣
61×61	-0.1017011	٧,١٤٠٤٩٤
81×81	-0.1015776	7.140493
101×101	-0.1013410	7.140493

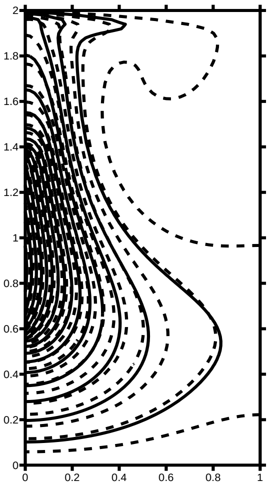
Table 3 Comparisons of Nu_{av} for Cu-water nanofluid with another published works

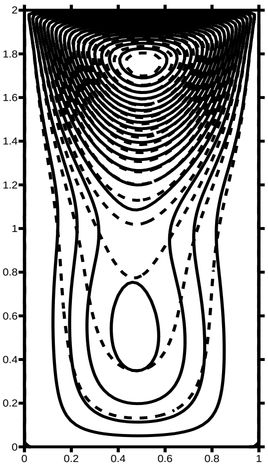
($\varphi=10\%,\ B=0.4,\ D=0.5,\ Ra=10^3$).

Work	Nu_{av}
Aminossadatia and Ghasemi **[5]**	5.451
Mansour et al. **[18]**	5.459225
Present study	5.459225

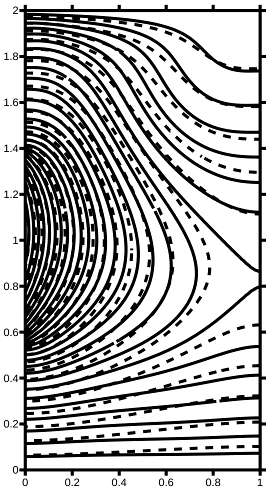


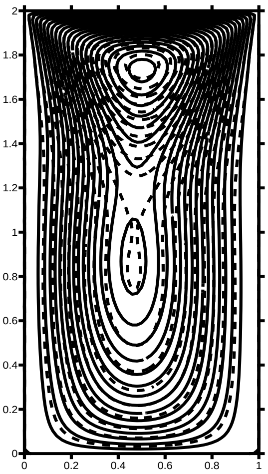
$$\psi_{\min,nf} = \text{-}0.1032725, \psi_{\min,f} = \text{-}0.1024538.$$
$$\theta_{\max,\mathrm{nf}} = 0.2318571, \theta_{\max,\mathrm{f}} = 0.2895406.$$





$$\psi_{\min,nf} = \text{-}0.1028613, \psi_{\min,f} = \text{-}0.0998961.$$
$$\theta_{\max,\mathrm{nf}} = 0.3988945, \theta_{\max,\mathrm{f}} = 0.518526.$$





$$\psi_{\min,nf} = \text{-}0.1027432, \psi_{\min,f} = \text{-}0.1070041$$
$$\theta_{\max,\mathrm{nf}} = 0.4205886, \theta_{\max,\mathrm{f}} = 0.5522865.$$

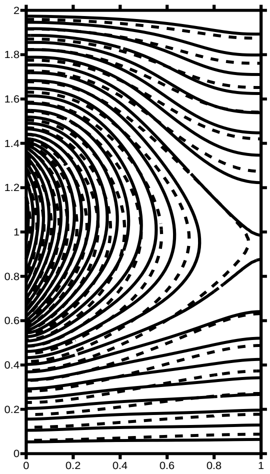
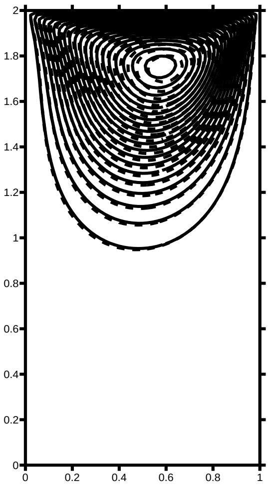
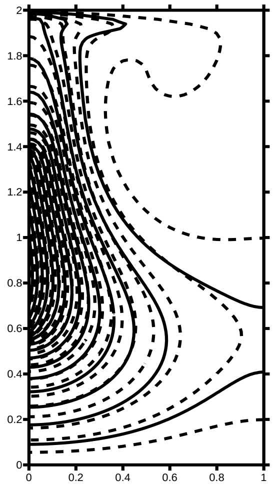
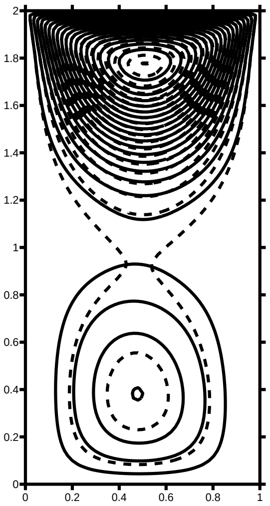


Fig.2 streamlines and isotherms contours for various values for Cu-water nanofluid at $\varphi = 0\%$ (solid), $\varphi = 10\%$ (dash) and $\phi = \pi / 6$. Increasing from top towards bottom.

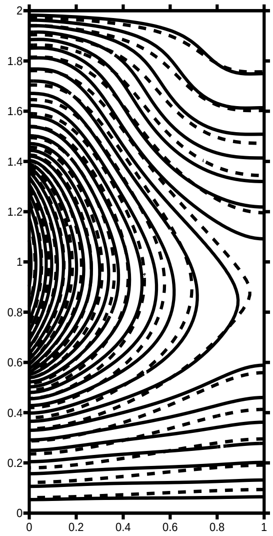


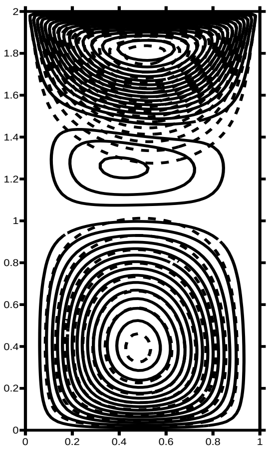
$$\psi_{\min,nf} = \text{-}0.1031985, \psi_{\min,f} = \text{-}0.1023384.$$
$$\theta_{\max,\mathrm{nf}} = 0.2354761, \theta_{\max,\mathrm{f}} = 0.2982305$$





$$\psi_{\min,nf} = \text{-}0.0973557, \psi_{\min,f} = \text{-}0.095029$$
$$\psi_{\max,nf} = 0, \psi_{\max,f} = 2.51\mathrm{E}\text{-}005$$
$$\theta_{\max,\mathrm{nf}} = 0.4056342, \theta_{\max,\mathrm{f}} = 0.5312343.$$





$$\psi_{\min,nf} = \text{-}0.0877071, \psi_{\min,f} = \text{-}0.0787396.$$
$$\psi_{\max,nf} = 0.0017282, \psi_{\max,f} = 0.0159315.$$
$$\theta_{\max,\mathrm{nf}} = 0.4234517, \theta_{\max,\mathrm{f}} = 0.5638728.$$

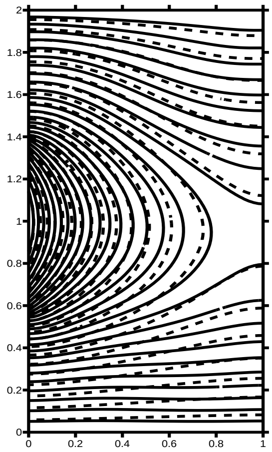


Fig. 3 streamlines and isotherms contours for various $Ri = 0.05{,}10{,}100$ values for Cu-water nanofluid at $\varphi = 0\%$ (solid), $\varphi = 10\%$ (dash) and $\phi = \pi/2$. Increasing from top towards bottom

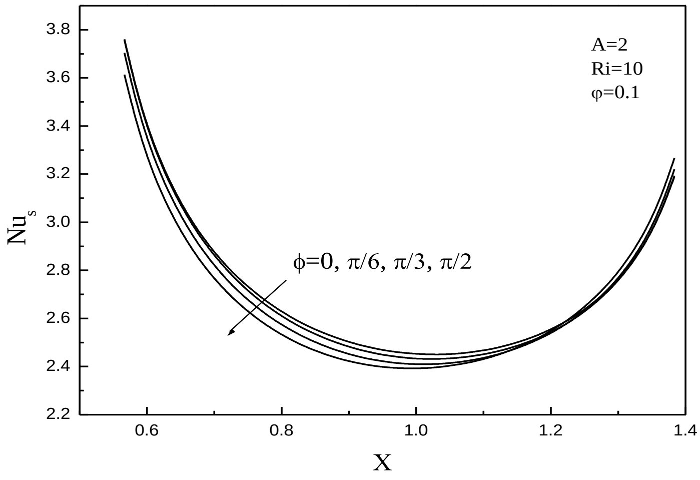


Fig. 4 profiles of the local Nusselt number along the heat source with the variations of the inclination angle.

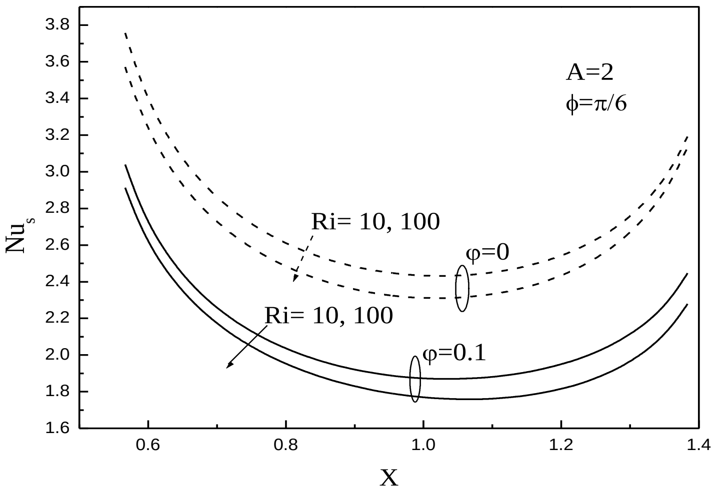


Fig.5. profiles of the local Nusselt number along the heat source for variations of Richardson number.

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