



RAMCO INSTITUTE OF TECHNOLOGY

Approved by AICTE, New Delhi & Affiliated to Anna University
Accredited by NAAC & An ISO 9001: 2015 Certified Institution
NBA Accredited UG Programs: CSE, EEE, ECE and MECH

Academic Year 2021 – 2022 (Odd Semester)

Details of Programme Organized

Sl. No.	Contents	Details
01.	Title of the programme	Investigation of Supersonic Flows in Micro/Nanochannels Using the Unstructured Direct Simulation Monte Carlo (USDMC) Method
02.	Programme Theme	Research opportunities
03.	Programme Type	Webinar
04.	Details of resource person	Prof. Wael Al-Kouz Department of Mechanical Engineering American University of the Middle East Kuwait
05.	Mode & Venue / Platform	Google Meet & YouTube
06.	Date & Duration	24.09.2021 & 1 hour 30 minutes
07.	No. of Student Participants	36
08.	No. of Faculty Participants	12
09.	No. of External Participants	14
10.	Expenditure amount (if any)	NIL
11.	Social Media URL	https://youtu.be/VuSg_Zq6iMU
12.	Video URL (if any)	https://youtu.be/VuSg_Zq6iMU

13. Objective of the Programme:

- To impart knowledge on cutting edge technologies (Unstructured Direct Simulation Monte Carlo Method) to the participants and to upgrade the expertise of the faculty members in mechanical engineering field.

14. Detail description of the activity:

Extramural Lecture Series on the topic "Investigation of Supersonic Flows in Micro/Nanochannels Using the Unstructured Direct Simulation Monte Carlo (USDMC) Method" was organized by Department of Mechanical Engineering, Ramco Institute of Technology, Rajapalayam on 24.09.2021. The main objective of these ELS is to impart knowledge about National Educational Policy 2020. The Resource Person was Prof. Wael Al-Kouz, Department of Mechanical Engineering, American University of the Middle East, Kuwait.

Prof. Al-Kouz gave a brief introduction about his university and the department facilities he is associated with. He started his presentation with the basic definitions in microflow and DSMC fundamentals. Further, the present trend in the Supersonic Rarefied Flow in Microchannels was narrated using the literature reviews. The statistical fluctuations in DSMC, computational issues at the nano scale were explained by the Professor. U-3DSMC grid generation method was explained with a help of flowchart and validation of U3DSMC was presented with results. Further, the statistical fractional errors associated with U3DSMC, simulations for Supersonic Sub-atmospheric flows into nanochannels were explained with the results obtained through the work done by them.

Finally, the resource person concluded the session with inferences they had obtained from their research analysis and with recommendations for future scope. Towards the end the resource person clarified the doubts raised by the participants.

The total no. of participants presented in the webinar was 62. The entire sessions were interactive where faculties raised their doubts and a precise explanation was given by the resource person. The overall feedback of the program was good. Finally, the participants were distributed with the certificates.

15. Banner / flyer of the programme:



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Department of Mechanical Engineering

EXTRAMURAL LECTURE SERIES(ELS) - INT003

INVESTIGATION OF SUPERSONIC FLOWS IN MICRO/NANOCHANNELS USING THE UNSTRUCTURED DIRECT SIMULATION MONTE CARLO(USDMC) METHOD

Research Credentials



https://youtu.be/VuSq_Zq6IMU



Prof. Wael Al-Kouz

Professor
Department of Mechanical Engineering
American University of the Middle East
Kuwait

Date :September 24, 2021
(Friday)
IST: 12.30 P.M.
Jordan Time:10.00 A.M.

Registration Link : <https://tinyurl.com/INT003-Supersonic>

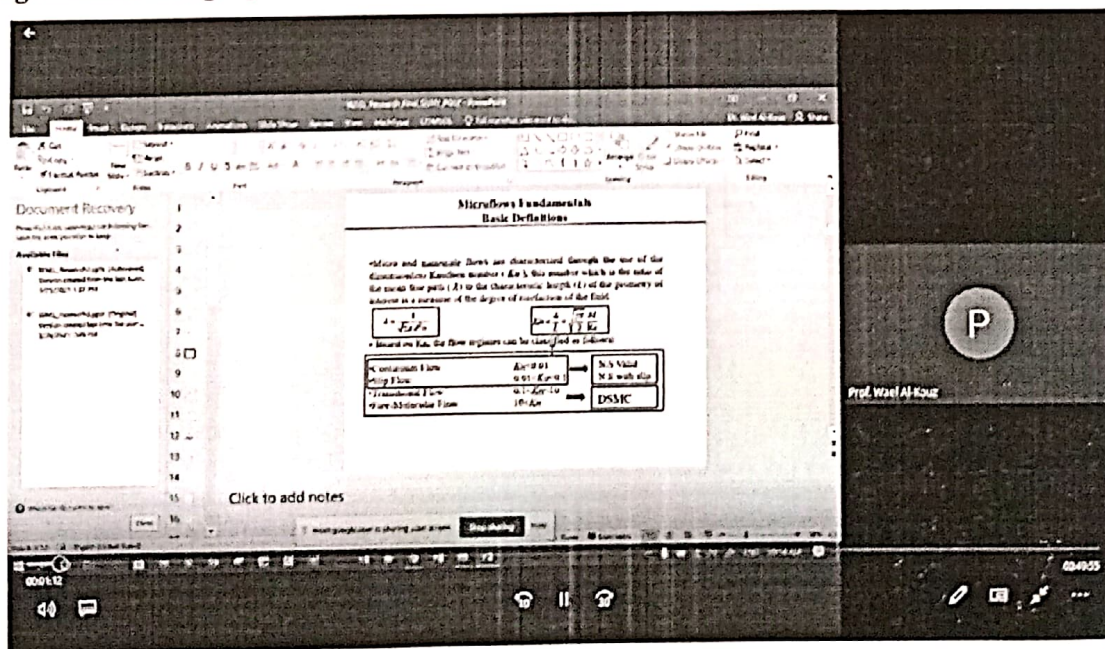
COORDINATOR
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CONVENER
Dr.P.SURESHKUMAR
ASSOC. PROF./MECH

PATRON
Dr.S.RAJAKARUNAKARAN
VICE PRINCIPAL & HEAD /MECH

CHIEF PATRON
Dr.J.GANESAN
PRINCIPAL

16. Programme Photographs:



Wael Research Final Slides PCLT - PowerPoint

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Microflows and DSMC Fundamentals

Basic Definitions

- Nanoscale flows are in the transitional to free-molecular regime even at atmospheric pressure.
- Nanoscale flows are affected by statistical fluctuations due to small number of particles in sampling volumes.
- DSMC developed by Bird
 - Models rarefied gas flows with representative simulated particles.
 - The major assumption behind the DSMC method is that the molecular motion is unimpeded from the most molecular collisions. That implies that the gas is dilute.
 - Also, the method assumes the overwhelming majority of the collisions will be binary.

Prof. Wael Al-Kouz

Statistical Fluctuations in U3DSMC Pressure Driven Nanoscale Flow

Simulation Parameters

$H = 100 \text{ nm}$	$P_e = 0.1 \text{ atm}$
$W = 500 \text{ nm}$	$G_D = 8182$
$D = 4 \text{ μm}$	$\langle l_D \rangle = 0.0163 \text{ μm}$
$\lambda = 45.1 \text{ nm}$	
$P_{in} = 1 \text{ atm}$	
$T_{in} = 273 \text{ K}$	
$M = 200 \text{ samples}$	
$\Delta t = 1 \times 10^{-12} \text{ sec}$	
$\langle N_D \rangle = 315$	

DSMC Error and the theoretical DSMC error are almost identical.

Minimum error in the velocity occurs at the center of the channel where the maximum velocity is achieved.

Prof. Wael Al-Kouz

Prepared by:

Approved by

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Page 4 of 4
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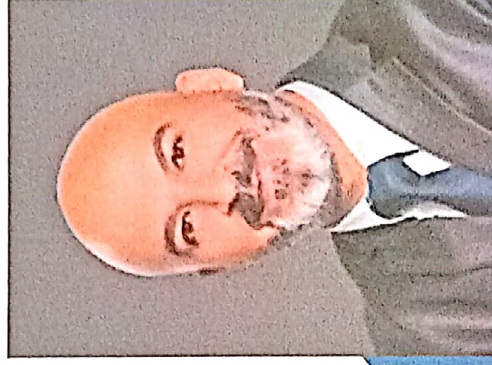
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