



UiT The Arctic University of Norway

Collaboration with Chinese Universities & My Research Portfolio

13th November 2023

Hassan A. Khawaja

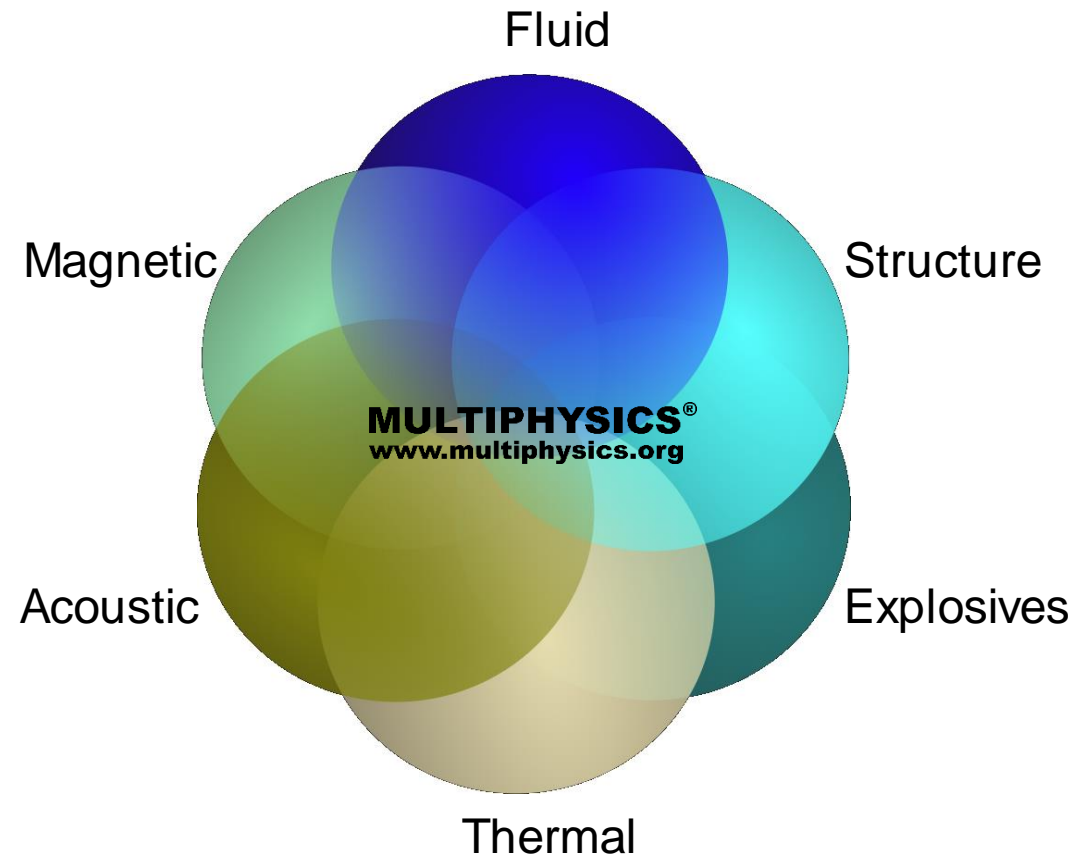
*Associate Professor and Research Group Leader
Department of Automation and Process Engineering (IAP)
IR, Spectroscopy, and Numerical Modelling Research Group*

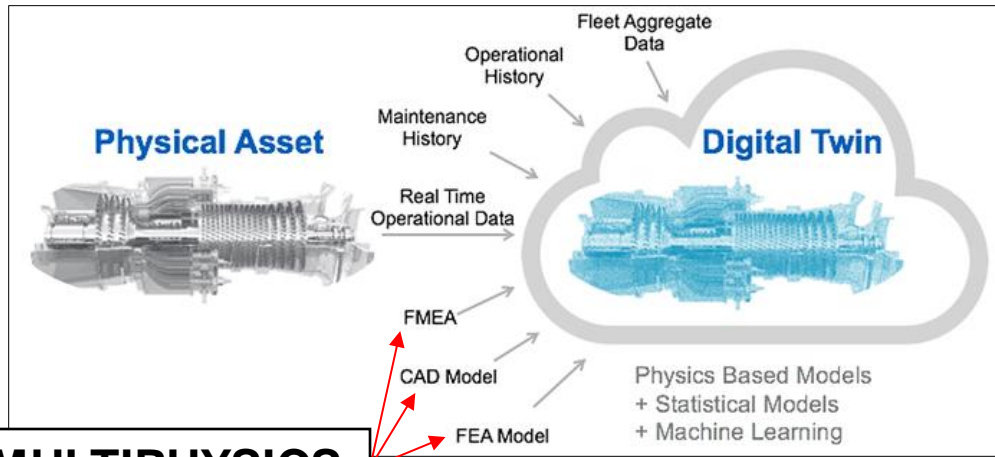
Collaborations with Chinese Universities

- Organized MULTIPHYSICS Conference with Beijing Institute of Technology (BIT) in Beijing, China in December 2017
- Invited as Guest Lecturer by Henan University of Science and Technology (HAUST) in November 2023



My Research Portfolio – Multiphysics





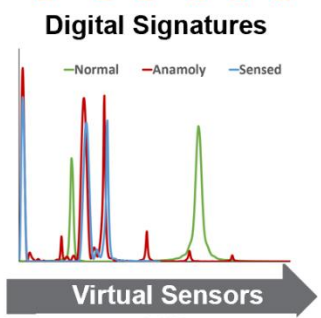
MULTIPHYSICS

DIGITAL TWIN

As Designed
MODEL-BASED ENTERPRISE & SYSTEMS ENGINEERING

As Operated
INTEGRATED IOT ASSETS & ECOSYSTEMS

FLUIDS
STRUCTURES
ELECTRONICS
SEMICONDUCTOR
EMBEDDED SOFTWARE

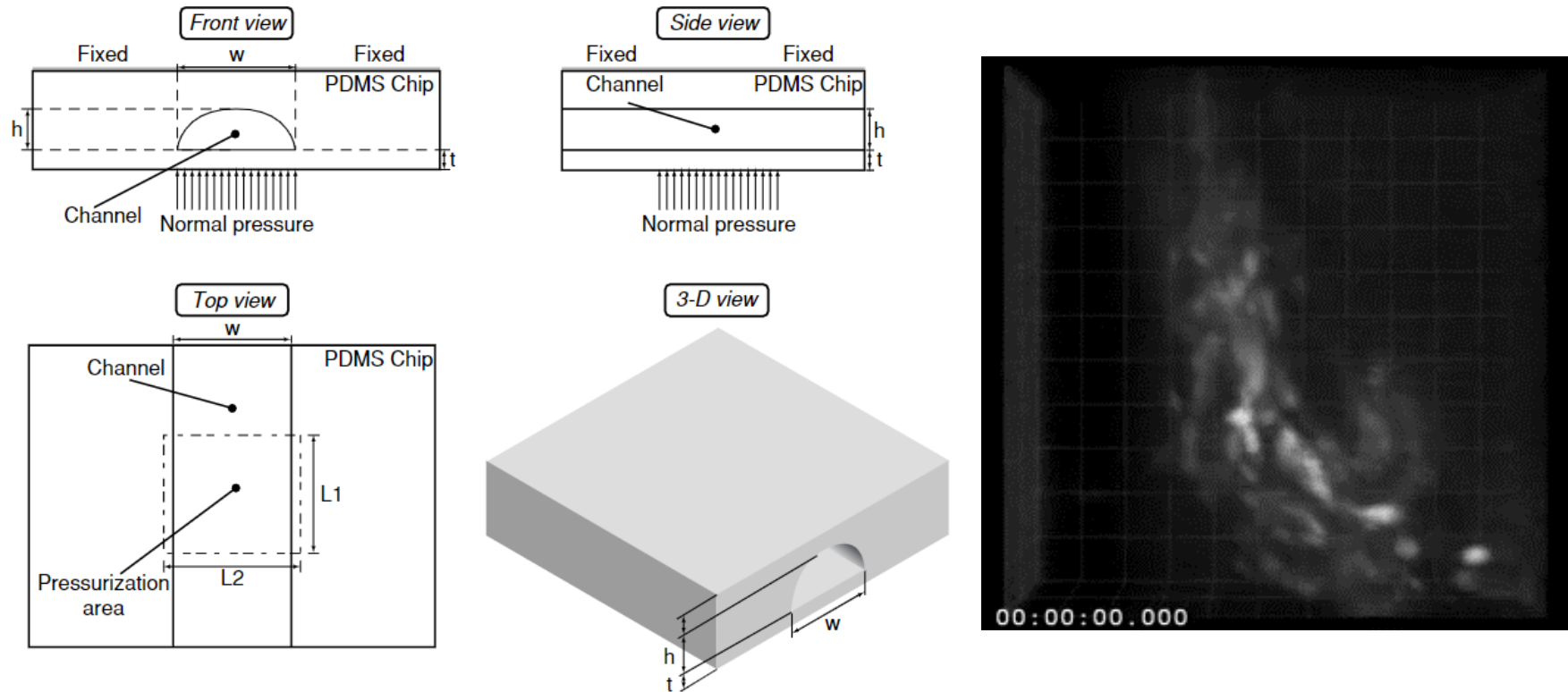


- Further improve:
- Cost
 - Weight
 - Efficiency
 - Robustness



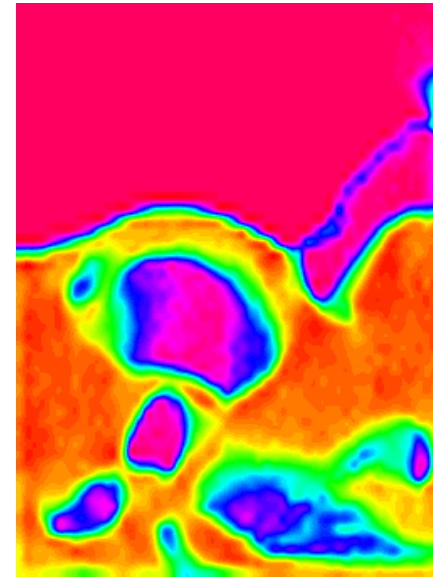
- Assess:**
- Performance
 - Life / Durability
 - Diagnostics
 - Optimization

Micro-Fluidic Pump – Design Simulation

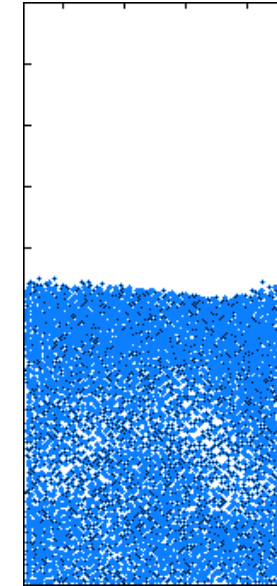


H Khawaja, I Raouf, K Parvez, A Scherer. Optimization of elastomeric micro-fluidic valve dimensions using nonlinear finite element methods. The International Journal of Multiphysics, 2009, 3(2): pp. 187 - 200. <http://dx.doi.org/10.1260/175095409788837847>

Fluidized Bed – Bubbles Simulation

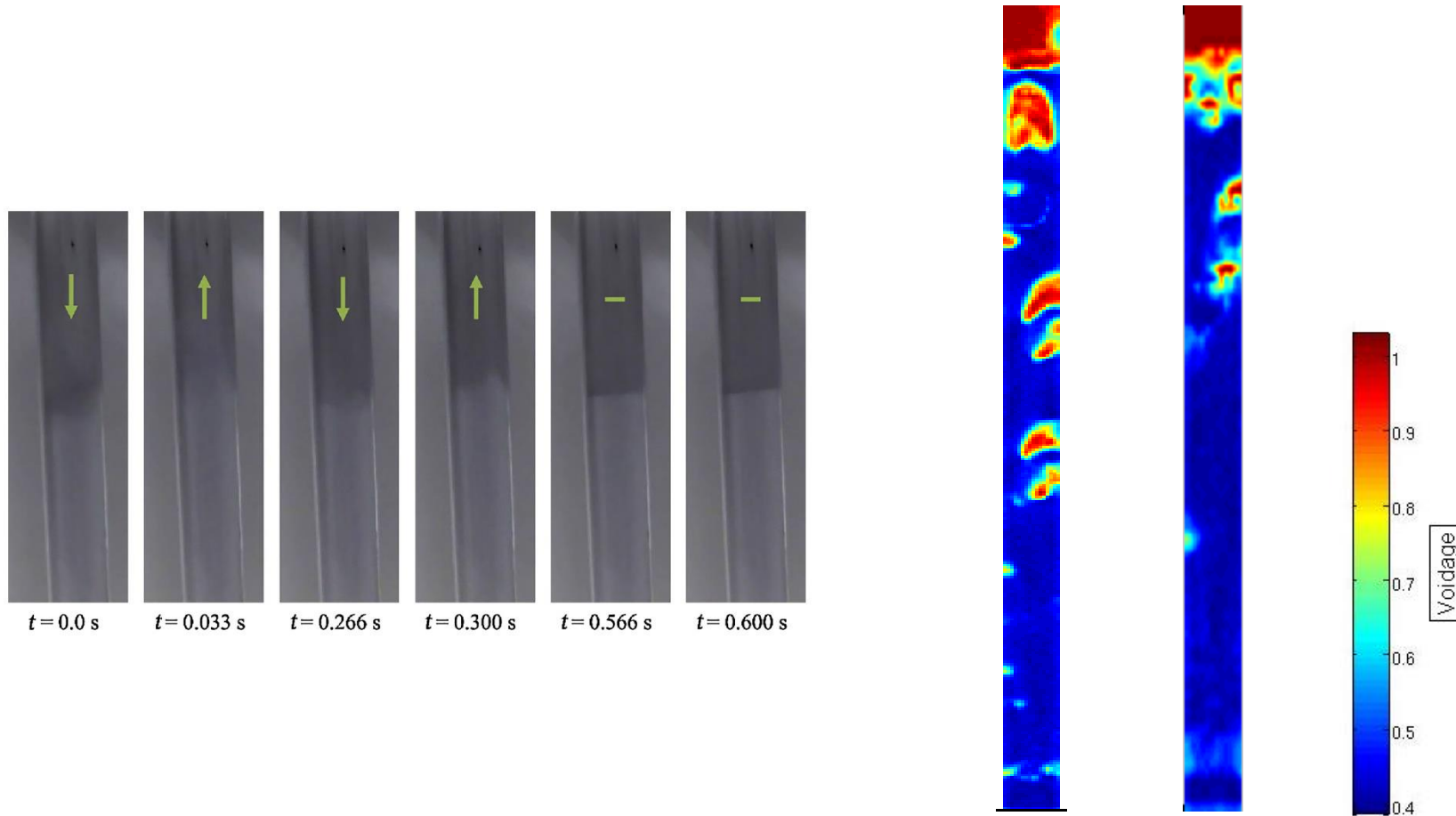


Fluid Inlet



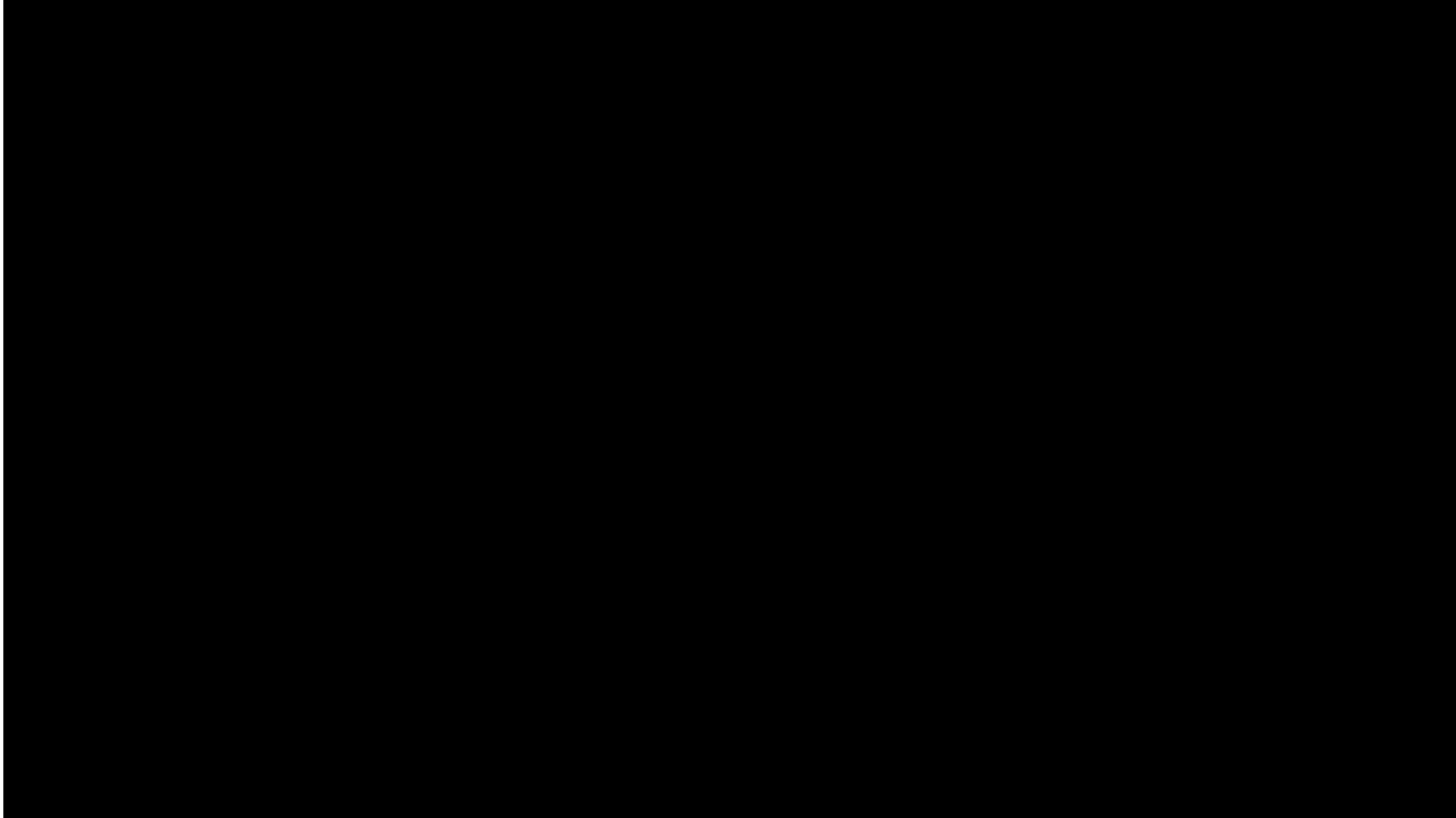
Fluid Inlet

Fluidized Bed – Sound Waves Simulation



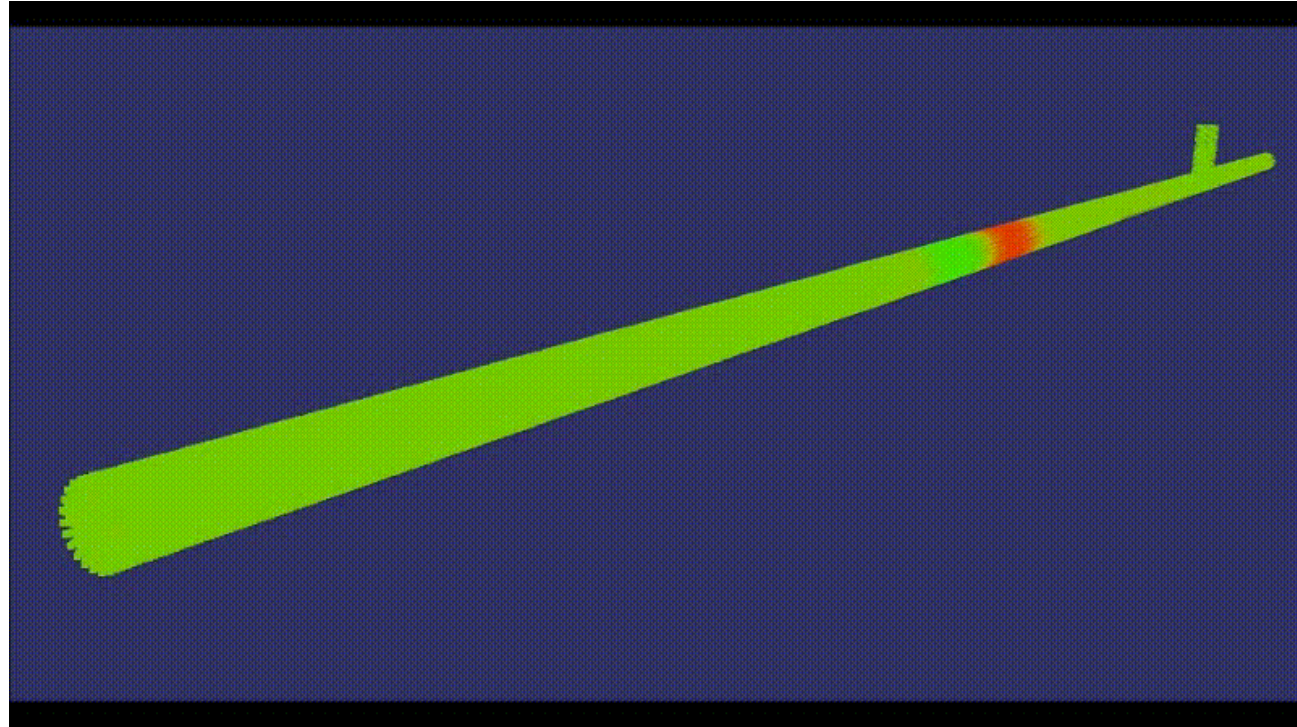
H Khawaja. Sound Waves in Fluidized Bed using CFD-DEM Simulations. *Particuology*, 2017, 38: pp.126 - 133.
<https://doi.org/j.partic.2017.07.002>

Shock Tube – Pressure Propagation

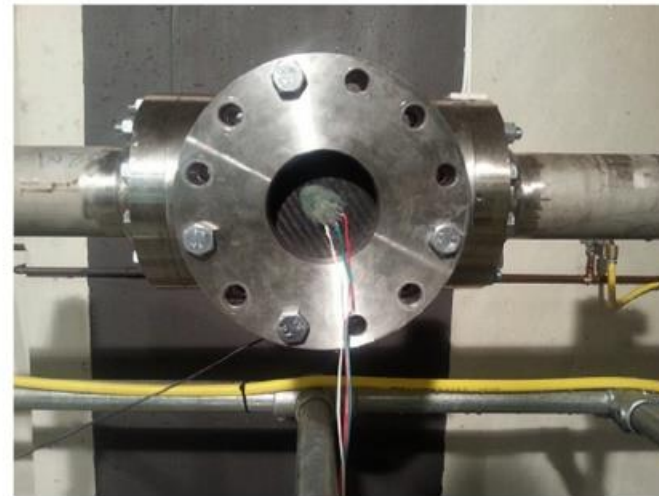
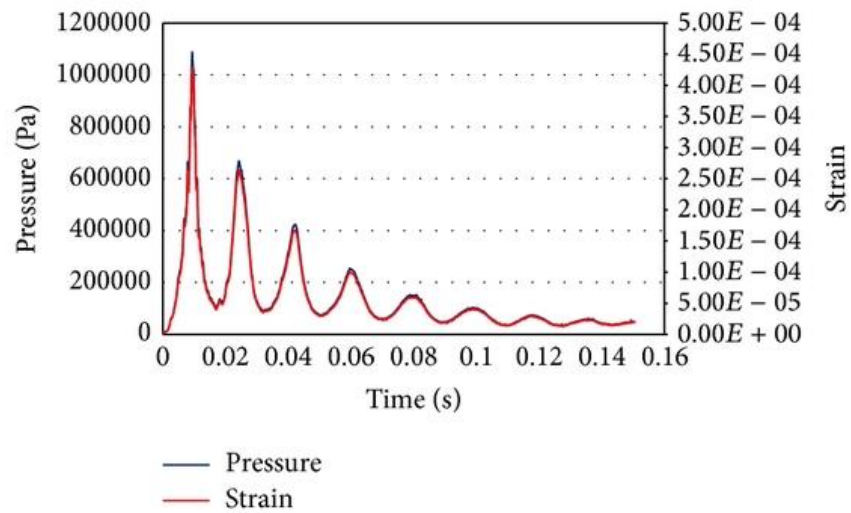
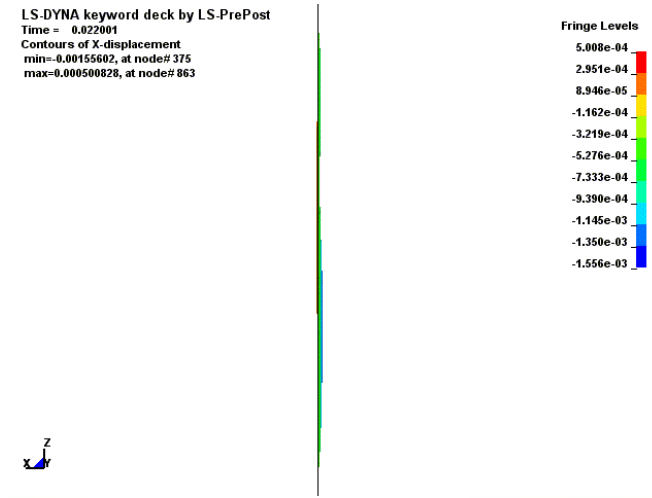
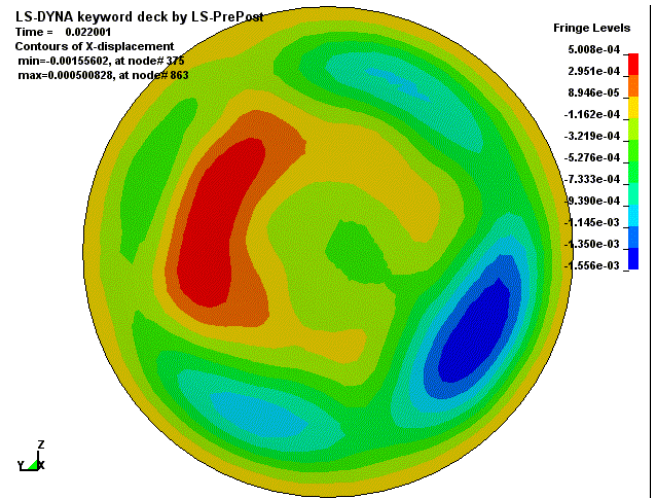


H Khawaja et al. Experimental and Numerical Study of Pressure in a Shock Tube. J Press Vess-T ASME, 2016, 138(4): 041301.
<http://dx.doi.org/10.1115/1.4031591>

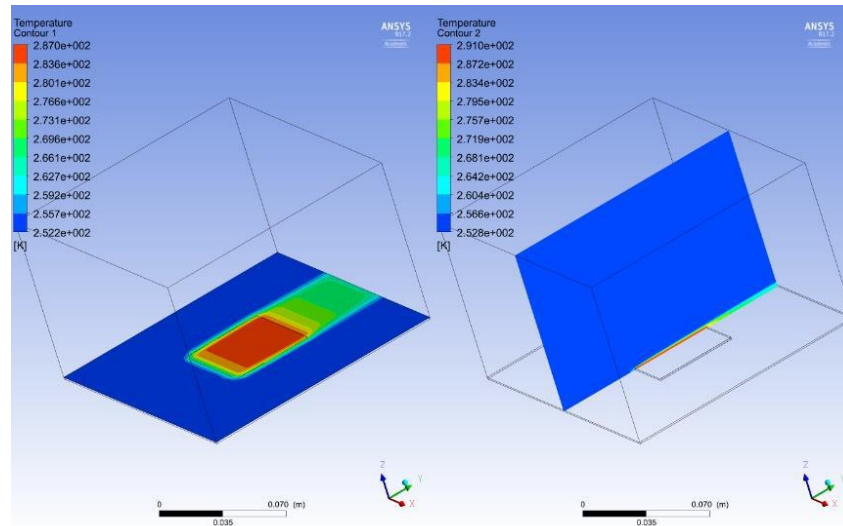
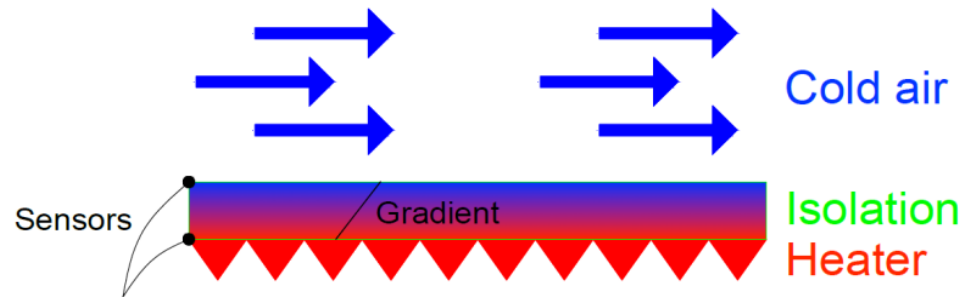
Shock Tube – ALE & FSI Simulations



H Khawaja et al. Experimental and Numerical Study of Pressure in a Shock Tube. J Press Vess-T ASME, 2016, 138(4): 041301.
<http://dx.doi.org/10.1115/1.4031591>

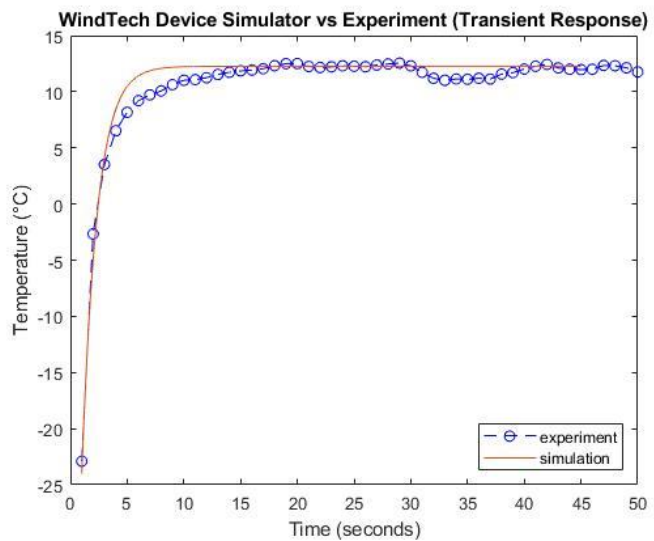


Cold Exposure Sensor – CHT Simulation



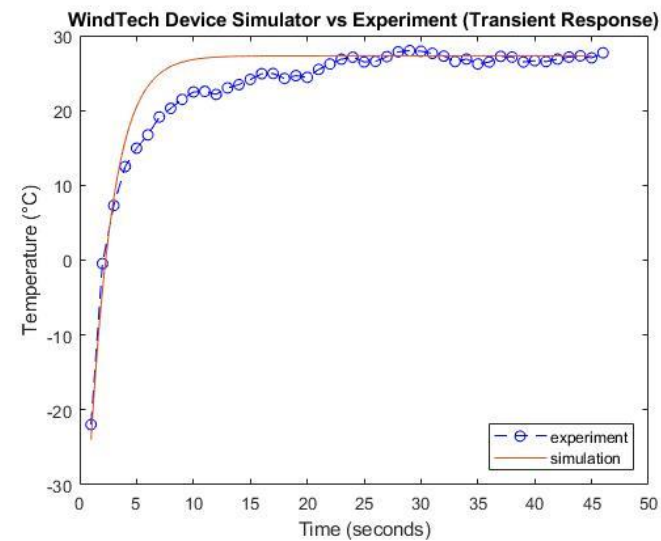
Temperature = -23°C, Relative Humidity = 72%

Wind Velocity = 8 m/s

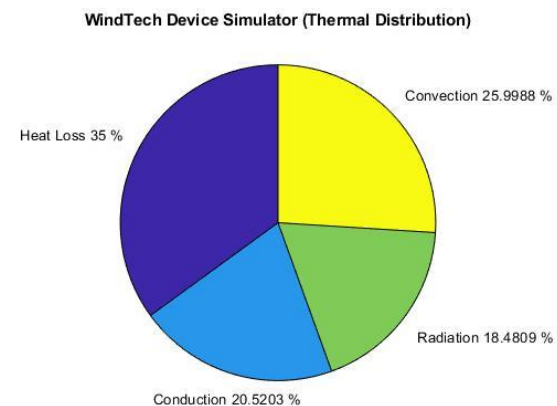
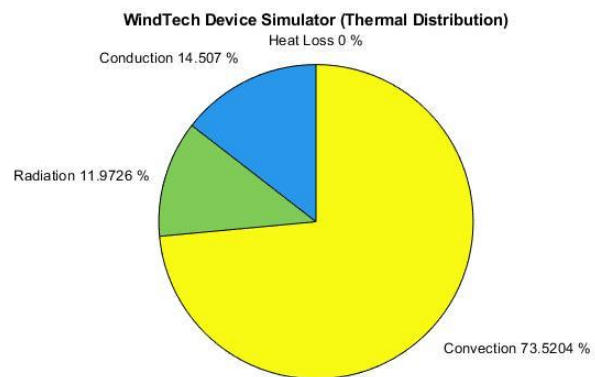


Heated Temperature = 12.1°C

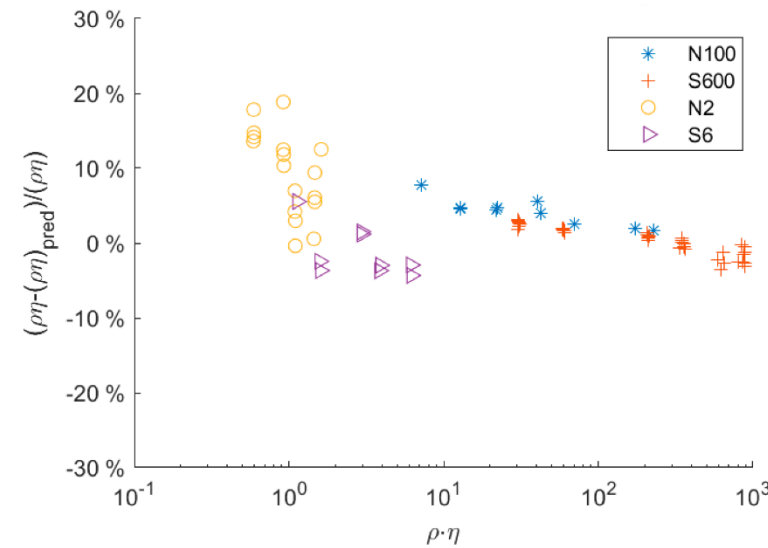
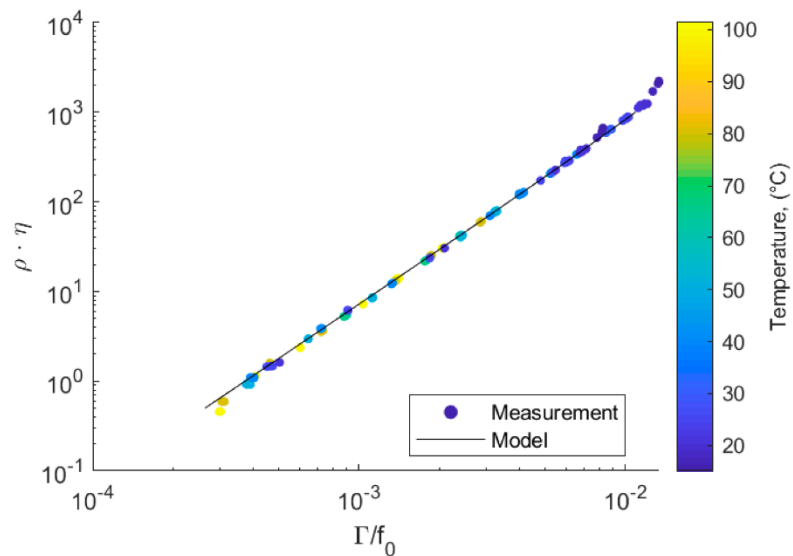
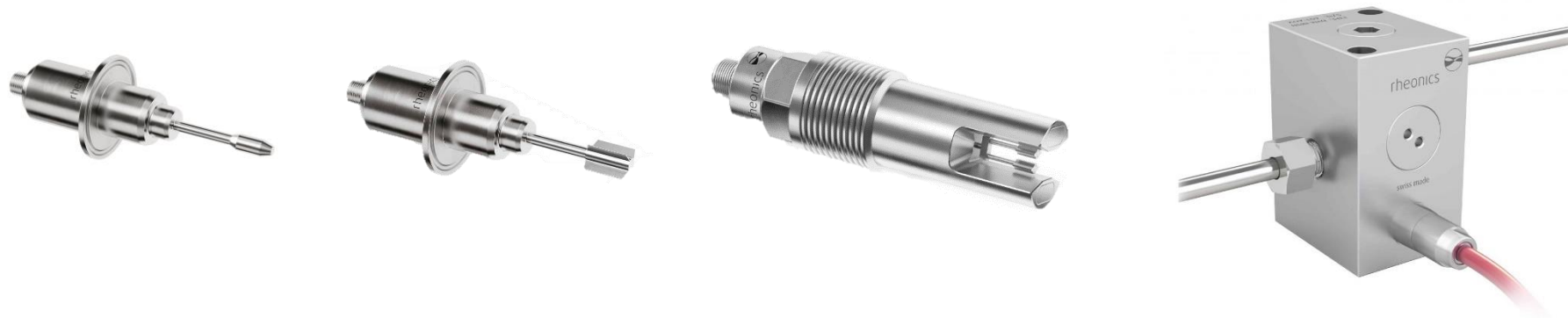
Wind Velocity = 0.5 m/s



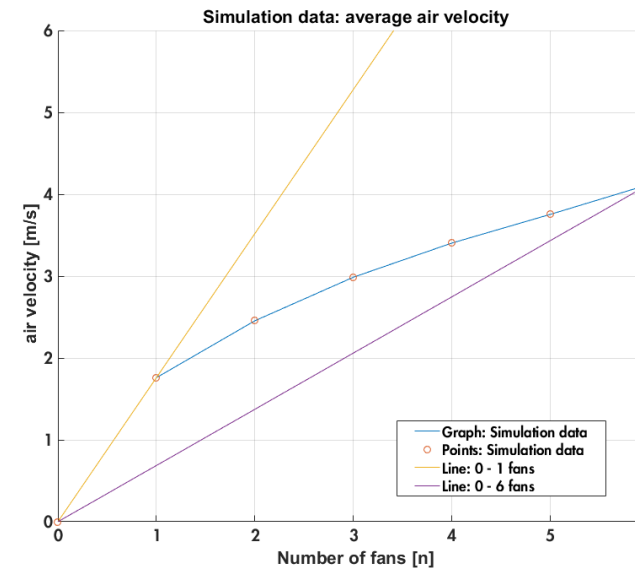
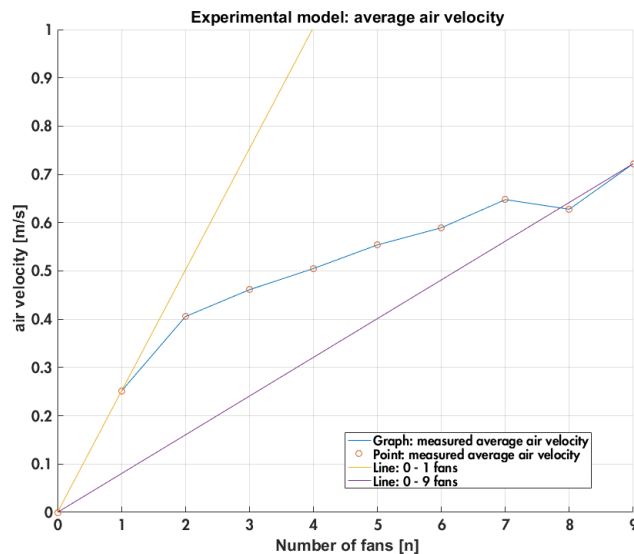
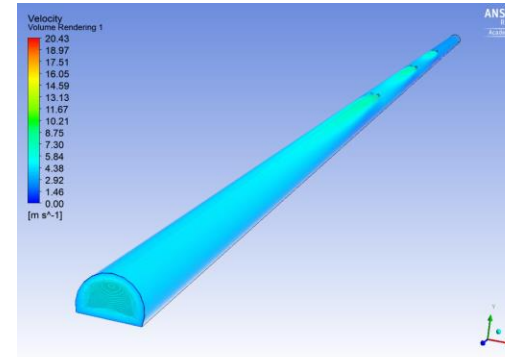
Heated Temperature = 26.9°C



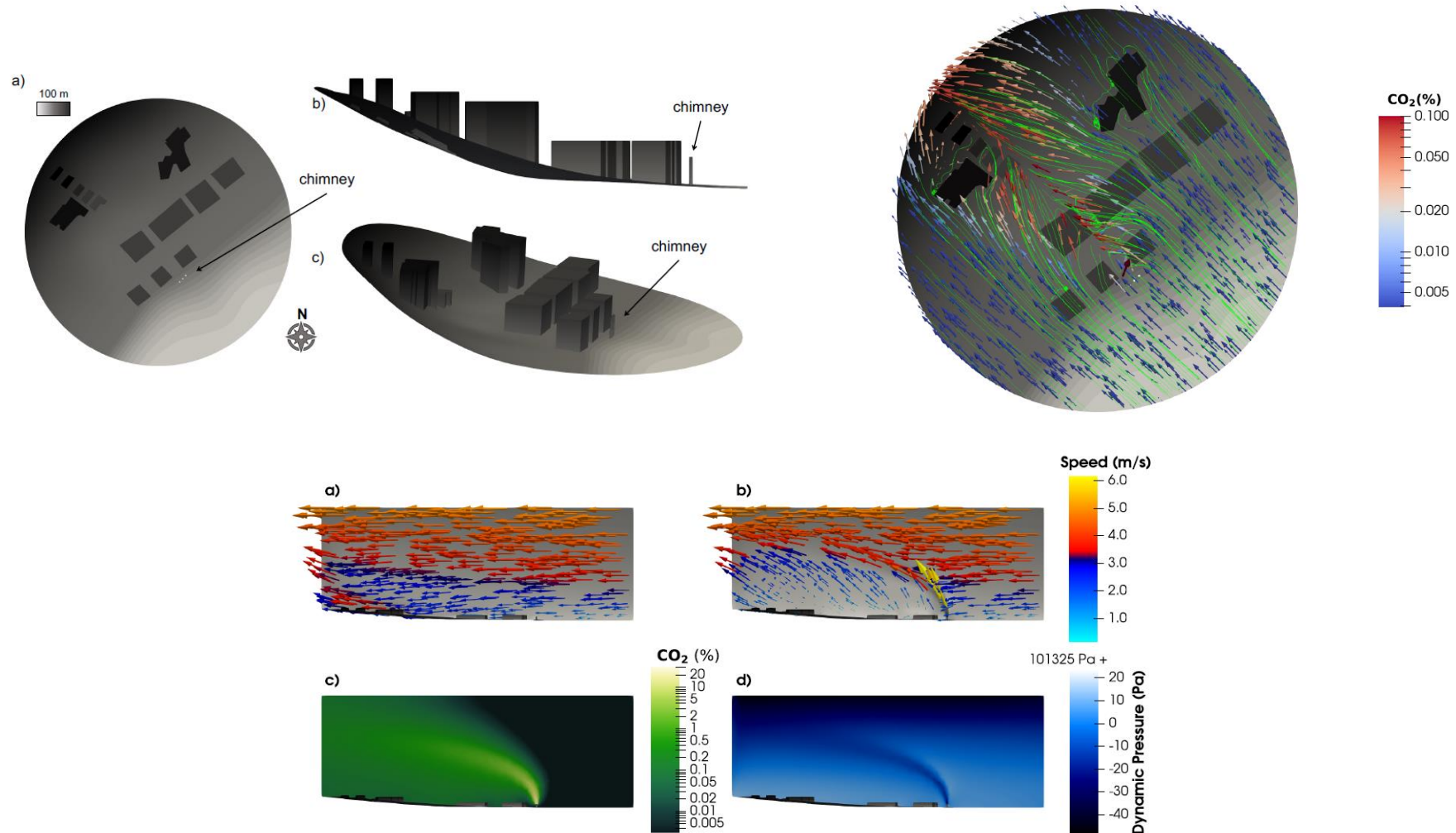
Fluid Viscosity-Density Sensor



Flow in Highway Tunnel – Simulation



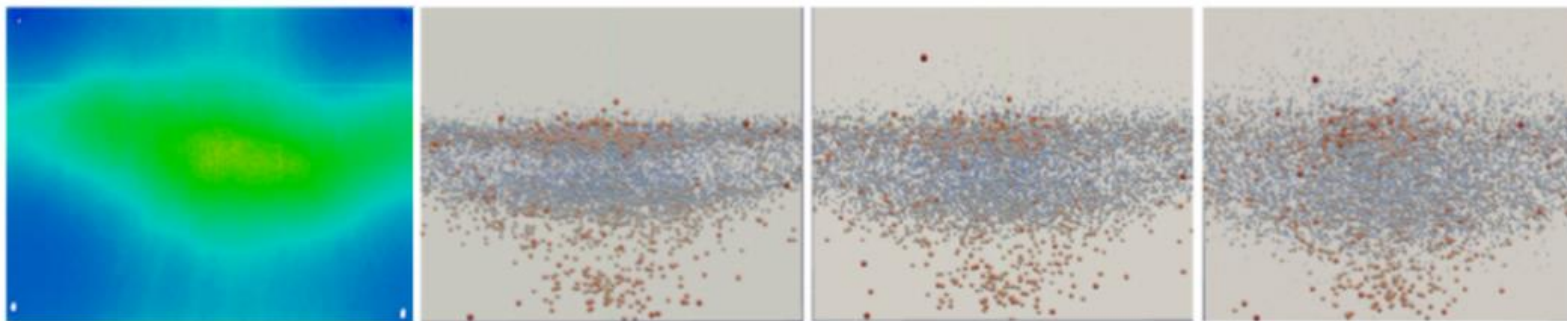
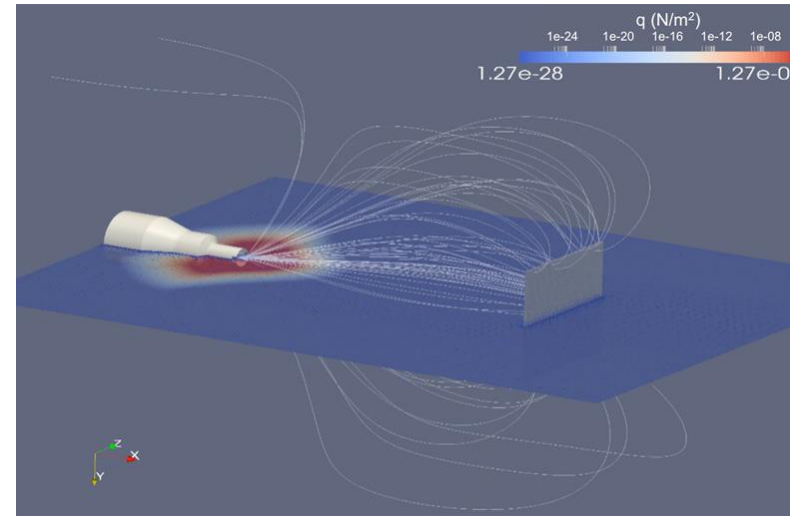
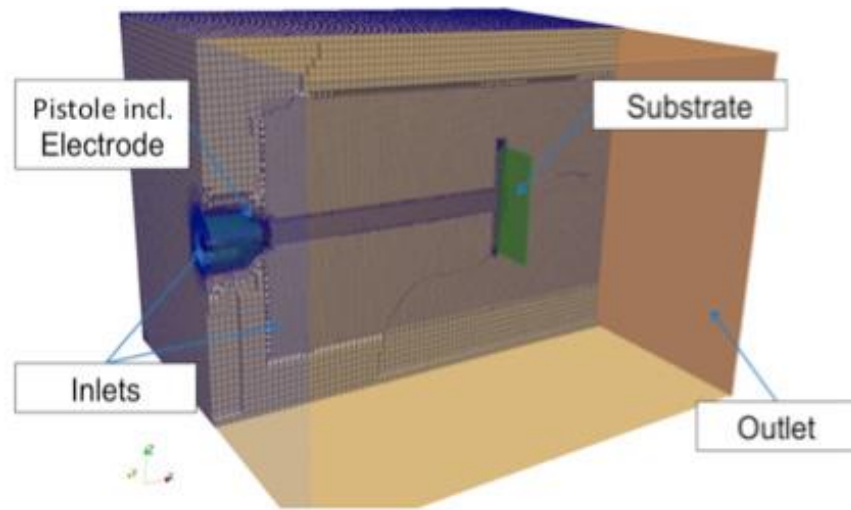
Emission Breivika Port – Simulation



Asier Zubiga, Synne Madsen, Hassan Khawaja, Gernot Boiger. Atmospheric Contamination of Coastal Cities by the Exhaust Emissions of Docked Marine Vessels: the case of Tromsø. *Environments*, 2021, 8(9), 88.

<https://doi.org/10.3390/environments8090088>

Powder Spray – EM Field Simulation



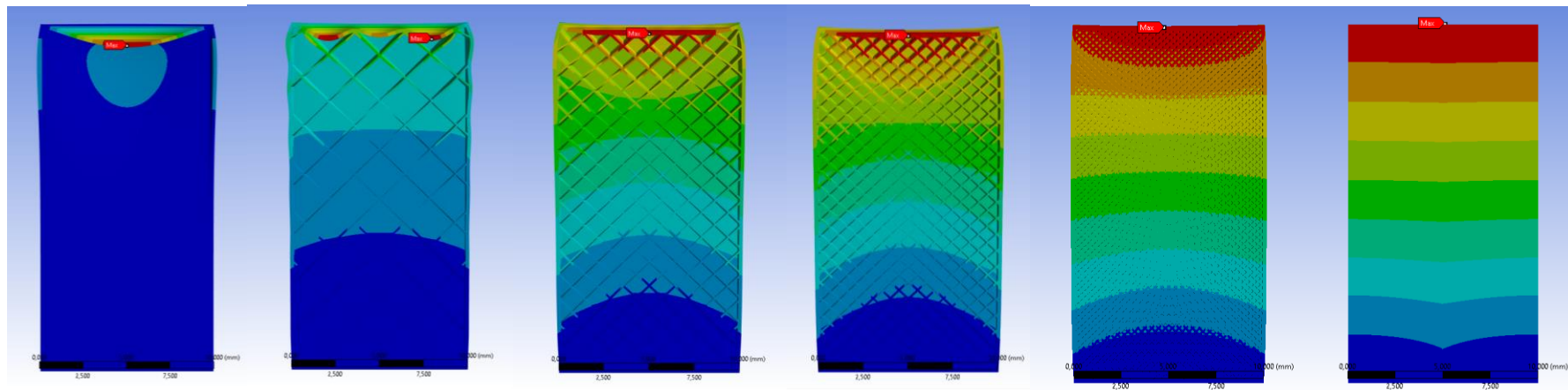
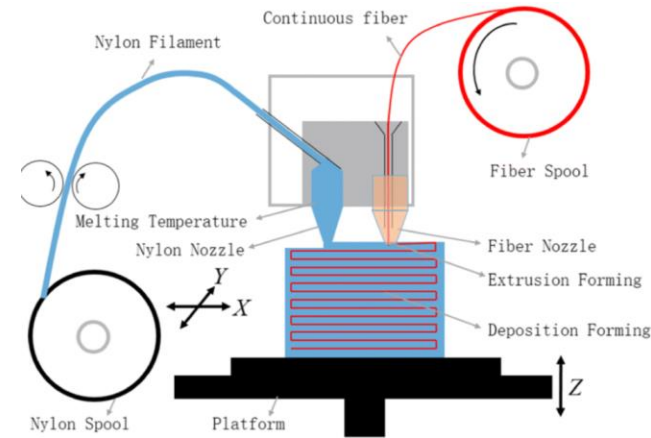
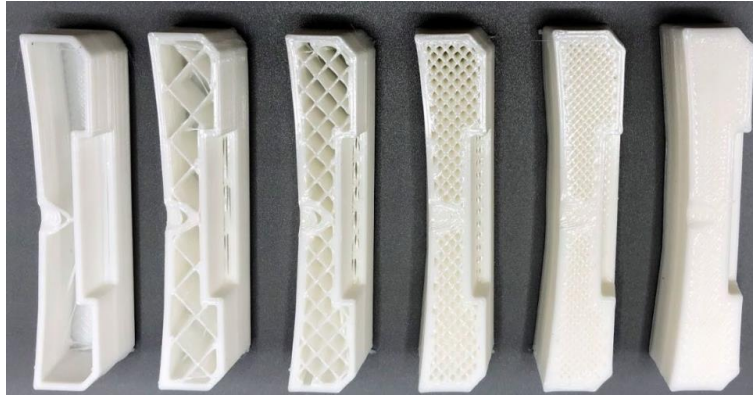
Experiment

k-factor: 0.5

k-factor: 1

k-factor: 2

3D Print – Structure Integrity Simulations



Ice Detection & Mitigation

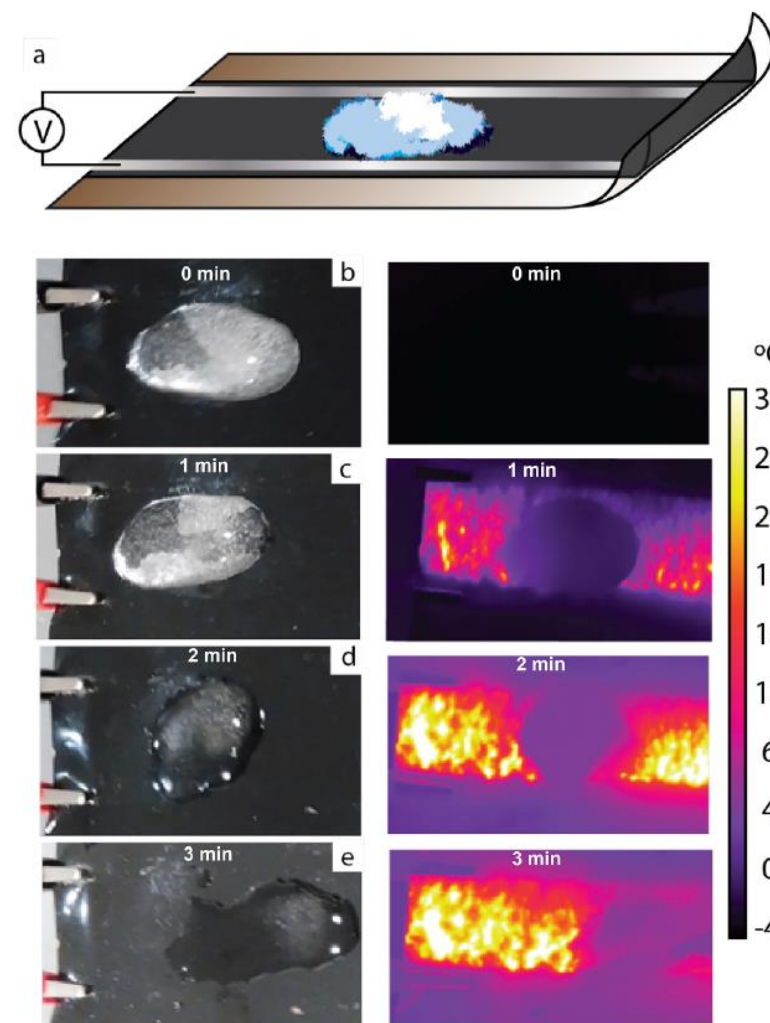
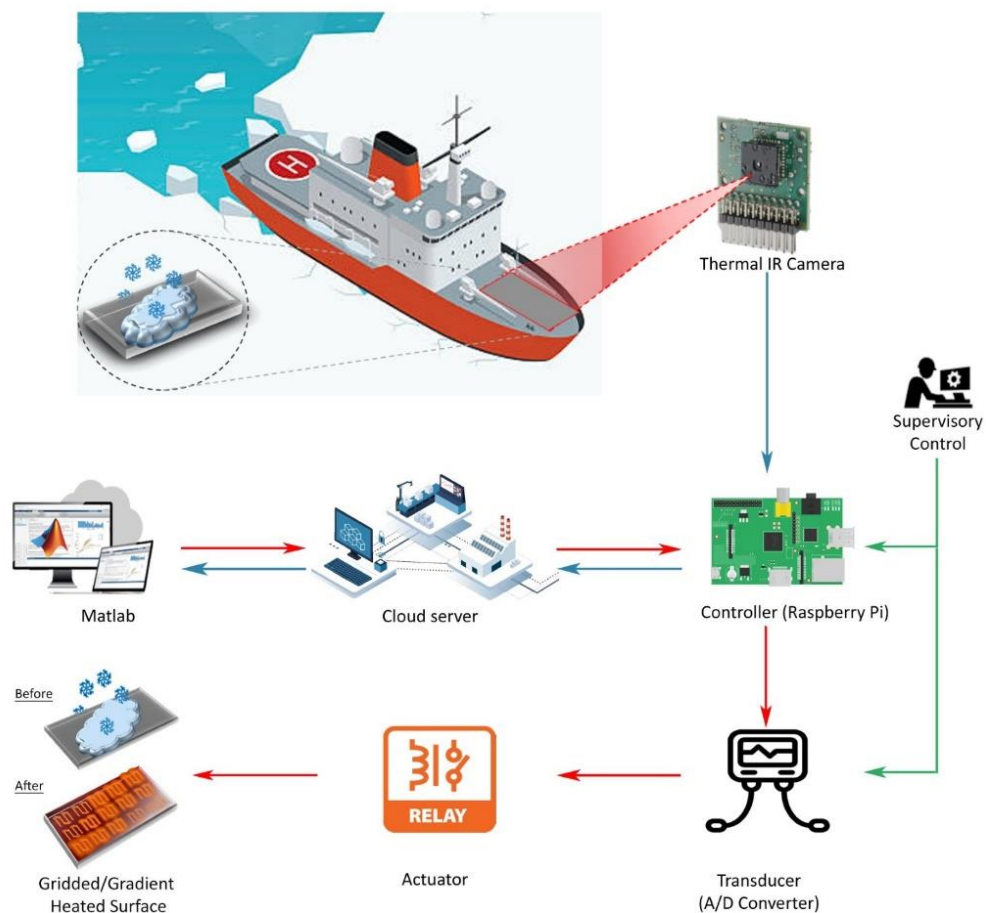
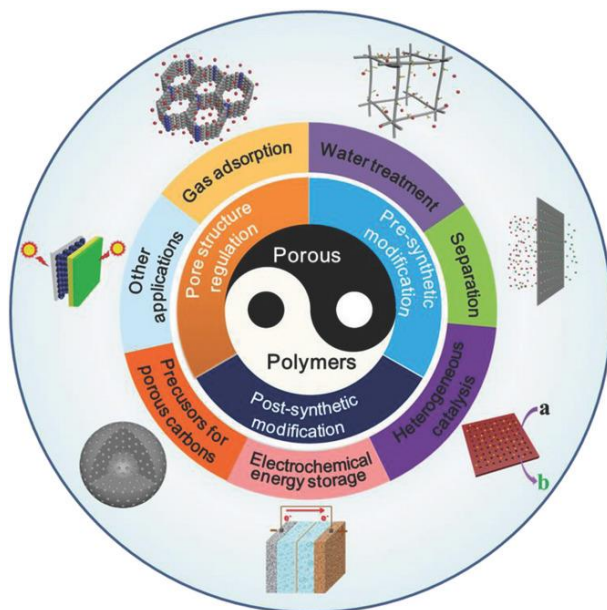
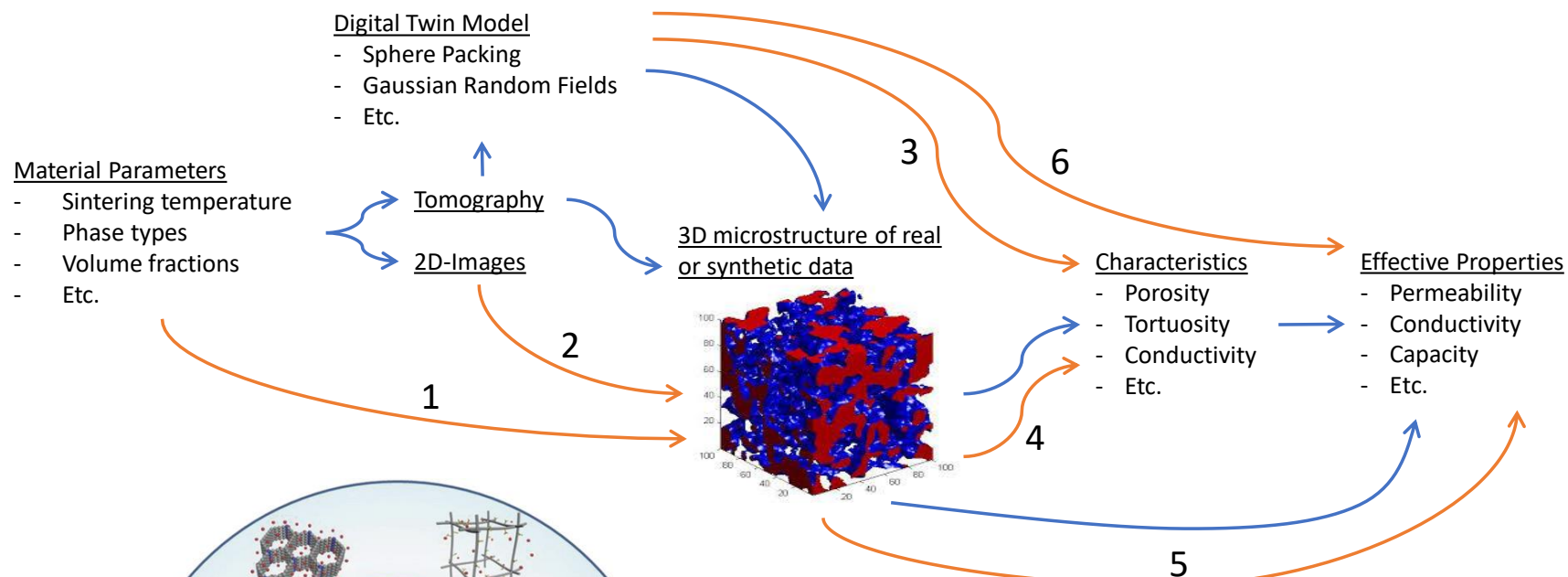


Fig. 4. De-icing demonstration of R2R CNT coated sheet (IR and colour images), when ice is frozen inside cold room at steady state temperature of -2°C .

Microstructure Characterization – AI/ML





UiT The Arctic University of Norway

Thank you and questions!

Email: hassan.a.khawaja@uit.no

WeChat: hassan-khawaja

Hassan A. Khawaja

*Associate Professor and Research Group Leader
Department of Automation and Process Engineering (IAP)
IR, Spectroscopy, and Numerical Modelling Research Group*