



Research Trip Summary Report

Task 2. Foreign mobility of WUST doctoral students

I. Data of the doctoral student

1. Full name: **Sindu Daniarta**
2. Year of studies: **2nd year**
3. Educational discipline: **Environmental engineering, mining, and energy**

II. Foreign research trip (research visit)

1. Research institute in which the foreign research was implemented: **Centre for Compressor Technology, City, University of London, the United Kingdom**
2. Name and surname of the host person (mentor): **Professor Ahmed Kovacevic**
3. Dates of the research trip: **1-30 September 2022**
4. Title and date of a seminar delivered during the research trip: **Progress report of a research visit to the Centre for Compressor Technology, 23 September 2022**
5. Description of work carried out during the research trip:

During the research visit, the student conducted research in a two-phase volumetric expander at the Centre for Compressor Technology, City, University of London. One of the main research project topics at this centre is focusing on the screw expander and compressor which is the same direction as the student's dissertation on the analysis of volumetric machines. The main objective of this visit is to study the application and performance of volumetric expanders, and also study of two-phase expansion process in ANSYS CFX.

The work of the visit to the centre was divided into three tasks that were conducted simultaneously. Firstly, the literature review in terms of two-phase expansion was conducted. The review of the literature was based on scientific databases such as Web of Science, Scopus, project reports, and some conference papers from the City University of London. Some conference papers, that discussed two-phase turbine, biphasic turbine, two-phase expander, and two-phase nozzle in the past, may be helpful in the writing of the review article on this topic.

The second task focused on the modelling of two-phase expansion using ANSYS CFX. The main goal is to learn the configuration of the two-phase setup and control solver in ANSYS CFX. In this case, the simple model of the CD nozzle was built including some parameters such as the diameter of the bubble, liquid and vapour temperature initialization function, and so on. The model was validated using data from BNL309 experiments that can be found in the Abuaf experiment (1981).

The last task was about the cycle analysis of the reversible thermodynamic cycle. The cycle analysis was computed using MATLAB software. The benefit of this cycle is described.

6. Description of the main results obtained:

During the one-month visit to the centre, the following results were obtained:

- a. Reviews in positive displacement machines and their category (including how many types of current screw machines)
- b. Configuration of two-phase expansion (using CD nozzle model) in ANSYS CFX
- c. Analysis and reversible thermodynamic cycle

Based on the main results above mention, two scientific articles are being prepared.

7. Future collaborations (if applicable):

The research initiatives on the two-phase expansion, as well as scientific publication, will arise from the collaboration with Professor Kovacevic's team that was developed during the internship. The student was able to learn about the study opportunities in terms of the facilities and literature accessible thanks to the visit to the City, University of London. This research has made it possible to do joint research in the area of interest, which will lead to upcoming journal articles.

8. Title and date of a seminar presenting the results of the trip delivered at Wrocław University of Science and Technology after returning from the research trip: **Two-phase expansion in CD nozzle using ANSYS CFX, 18 October 2022**

III. Doctoral student's signature

Wrocław, 7 October 2022
(Date)

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(doctoral student's signature)

IV. Confirmation and information from the host

1. Confirmation of compliance with the information contained in the report: **I CONFIRM** / ~~DO NOT CONFIRM~~. (In justified cases, the confirmation of the host may be sent by e-mail to the Dean's Office of the Doctoral School email: interdocschool@pwr.edu.pl)

2. Additional information and comments

It was our great pleasure to host Sindu Daniarta in the Centre for Compressor Technology at City, University of London. He is very engaging and motivated PhD student and it was pleasure to work with him. We hope that, following this visit, we will be in position to produce a joint paper on the review of technologies for low grade heat power recovery. Also, we hope that Sindu and his supervisors at Wrocław University and BME will engage further through our International Conference in 2023 and other opportunities.

London, 7th October 2022
(Date)

Professor Ahmed Kovacevic
(signature(s) of Host)