Czech Technical University in Prague,
Faculty of Mechanical Engineering
Department of Process Engineering
Ing. S. Solnař, Ph.D.

Review of Master Thesis

Author: **Harish Balakrishnan**

Title: **EXPERIMENTAL STAND FOR OBSERVATION OF A SUSPENSION FLOW IN A PIPE**

Specialization: (N2301) Mechanical Engineering

Field of study: (3909T012) Process Engineering

Overall

This work deals with the design and process design of a stand for measuring concentration, temperature and velocity fields in heterogeneous flows. This is an extensive work on this topic, which begins with a very successful research on the possibility of measuring these quantities and their applicability to the measurement of heterogeneous flows. From the found literature sources, the methods that are most suitable with regard to various factors (price, accuracy, work safety ...) are then selected. The great pity is the absence of any comparison table / research summary, which would summarize the findings of the research and help the reader to orient themselves without any problems.

Components are then designed for the specified limits of the measuring device. Author proposes two possibilities of operating such a device, either by gravity or by a pump. He prepared a process calculation for both variants and chose the more suitable one - a closed cycle with a pump drive with a frequency converter, which also seems more suitable to me.

In the next part of the work, author deals with the design of heating equipment for the possibility of operating measuring equipment at different temperatures. Again, various concepts are proposed, the most suitable of which is selected, heating through a duplicator jacket on an agitated vessel, which prepares a homogeneous mixture for measurement. I kind of miss some possibility of direct heating using electric current (heating coils, heating belts ...), which would allow easier regulation. Author chose heating using steam, which will condense in the duplicator jacket.

At the end of the work, author selected components that correspond to the process calculation and performed several structural design calculations. The resulting device is more of a conventional design. It is a great pity that at the end of the work there is not at least a price estimate of such equipment or an approximate price of individual components. The work is supplemented by very basic drawing documentation.

Formal comments and mistakes

The text of the thesis contains a very large amount of information and calculations and it is relatively difficult for readers to understand that. The text is very incomprehensible to readers unfamiliar with this field of study.

I see the problem in the inconsistent numbering of equations, of which only some are reported. And couldn’t the result of the equation be written directly into the equation from which the

result was calculated? Sometimes there is a sign for the vector product in the equations, which surprised me quite a bit.

I was very stunned about writting values with decimals, eg Reynolds number $\mathrm{Re} = 1.70\,\mathrm{e}^{-02}$ looks very, very strange and I would definitely not use it anymore (except that is wrong).

A very interesting style of citation is also used, where the beginning of the work is done in the form of numbering from one onwards according to the occurrence of the publication [1],[2]... and suddenly a citation [67] appears. Next time, please also request a uniform format for individual citations.

More serious comments and mistakes

I do not see any fundamental comments or mistakes on the content in this thesis.

Final evaluation

Despite a large number of small and / or formal mistakes, the work is very extensive and certainly beneficial. The student clearly demonstrated the ability to orient themselves in the difficult area of heterogeneous flows and to prepare the entire measuring equipment with the help of acquired knowledge and to select components that will serve this purpose.

Unfortunately, the work is at the level it is, I think that more precise work with the text would lift this work very highly.

Evaluation: very good (B)

Questions

- I am not an expert in measuring the flow of suspensions, but can you estimate the measurement error (or difference) using the selected flow meter in the case of pure water and water with 30% glass balls? I don't need a long answer, it's enough for me: the difference is 30%, the difference is 5%, it makes no difference ...
- When calculating agitated vessel dimensions, you assume a diameter of the vessel is 0.496 meters. Why? Is there any reason for this dimension? Do you want to use an existing vessel?
- In Chapter 4, you calculated NPSH 3.5 and 6 meters for the pumping method (winning and realized method). Can you compare this value with the minimum NPSH value of your selected pump? Is the selected pump suitable in terms of the minimum pressure in front of the pump?
- In your Figure 24 (or the drawing EX - 10001 - JVA) there is a hole for condensate drain at the top. Is this a mistake? Because this way the duplicator jacket would have to be completely filled with condensate for this drain to start working.

Prague, 11.1.2022 Ing. S. Solnař, Ph.D.