

REVIEW

By Prof. Jordan Yankov Hristov, PhD, DSc.,

Department of Chemical Engineering, University of chemical technology and metallurgy, Sofia

Concerning the materials applied for a promotion to an associate professor position

Area of higher education **5. Technical Sciences,**

Professional area - **5.4. Power Engineering,**

Specialty - **Industrial heat transfer**

Following the announcement in the State Gazette. 54/25.06.2024, as well as at the site of the Technical University-Gabrovo, for the **Department of Power Engineering, Faculty of Mechanical and Precision Engineering**

Applied by Plamen Jordan Penchev, PhD.

1. Briefs of personal data

Doctor Penchev has held the position of Senior assistant professor at the Department of Power Engineering since 2011.

He graduated as a MSc engineer in *Power Engineering* in 2000, from the Technical University-Gabrovo. In 2004 he was awarded a PhD degree in the speciality Industrial heat transfer. Since 2006, up to now, he has been a deputy manager of ZIP Engineering, Nova Zagora

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2. A general description of the applied documents

The applied materials are organized following the rules of the law and the regulations of the Technical University-Gabrovo, among them: administrative documents (diplomas, synopsis of the PhD thesis, referent letters, minimum requirement conditions, self-evaluation of the results and scientific contributions, a list of available citations, abstracts of publications, list of research projects, a list of teaching courses, a monographic book, etc.

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3. Reflection of the candidate's scientific publications in the scientific community (known citations)

A list of 40 citations is presented: 27 in peer-reviewed journals, 10 in foreign journals, 2 in international conferences, and 1 in a foreign dissertation.

Citations adequately reflect the applicant's performance. A significant number of citations in journals with an impact factor indicates that significant results with an impact in the scientific literature have been achieved.

4. Overview of content and results in the presented papers

The main direction in which Dr. Penchev's results were published is intensifying the transfer characteristics of heat exchangers. In this direction, the main results are on turbulators based on spiral strips and tubes with internal grooves. A large part of the obtained results are summarized in a monograph /in English/

HEAT TRANSFER ENHANCEMENT WITH TUBE INSERTS HOW CAN WE DEFINE THE BEST BENEFIT,

The different methods for intensification of heat exchange and the need to use appropriate criteria for evaluating energy benefits, when using different methods and techniques for intensification of heat exchange in heat exchange facilities /**Introduction**/, are considered.

The results of using spiral strips or a combination of several such, which can be used to improve the energy efficiency of existing shell-and-tube heat exchangers or solar collectors, during their repair /**Chapter 1**/, are reviewed.

A critical analysis was made of the most frequently used criterion for evaluating energy efficiency when using a specific technique for intensification of heat exchange, other evaluation criteria, and a system of algebraic equations for calculating the final result /**Chapter 2**/.

The main concept of the research is supported by specific examples demonstrating the conditions under which criteria FG-1a and FG-1b should be used /**Chapter 3**/.

Evaluations of the energy efficiency of using different spiral strips, as well as combinations of several, in laboratory tests of electrically heated ducts and how to determine the most suitable combination, depending on the limiting conditions under which the heat exchanger must operate, are made /**Chapters 3 and 4**/.

This monograph synthesizes the main results and contributions of Dr. Penchev's scientific publications, which makes it possible to avoid listing what was achieved in each article.

I rate the text highly and hope it will be used both in Bulgaria and abroad.

5. General characteristics of the applicant's activity

5.1. Educational and pedagogical activity (work with students and doctoral students)

5.1.1. Lecture courses

Dr. Plamen Penchev teaches the following courses:

Bachelor courses

1. Heat exchangers - horarium 30 hours row, 15 hours seminars
2. Heat and gas supply - horarium 30 hours row, 15 hours seminars
3. Refrigeration equipment - horarium 30 hours row, 15 hours seminars
4. Drying equipment - horarium 30 hours row, 15 hours seminars

Master science students

1. Refrigeration installations - horarium 30 hours row, 15 hours seminars
2. Refrigeration and freezing - horarium 30 hours row, 15 hours
3. Gas supply systems - horarium 30 hours row, 15 hours seminars

5.1.2. Learning aids

- Published textbook on "GAS SUPPLY", "Vasil Aprilov" Publishing House, Gabrovo, 2024.
- A textbook for the lecture course "HEAT EXCHANGER APPARATUS" was published, "Vasil Aprilov" Publishing House, Gabrovo, 2024

5.1.2. Work with graduates

He supervised a total of 20 graduates.

5.2. Scientific and scientific-applied activity

5.2.1. Doctor Penchev participated in a total of 13 research projects.

5.3. Implementation activity

Over the years, together with the company ZIP ENGINEERING EOOD, a significant number of heat engineering facilities and installations have been built, the most significant of which are:

1. Design and construction of an industrial gas and heating installation - investor company "Glencom" OOD, Nova Zagora, 2004-2005;
2. Design and construction of a gas and heating installation of the "Varnenski Buditeli" PN, Varna, 2005;
3. Design and construction of a gas installation of the Temple "Sveta Petka", Varna, 2006
4. Design of an industrial gas pipeline and conceptual project for the utilization of waste heat of the company "RUMDO" EOOD, bread producer, Stara Zagora, 2006;
5. Design of the OV part of a drying system for laundry powder - investor "Fikosota Sintez" AD, Shumen, 2006-2007;
6. Design and construction of a gas pipeline installation with propane-butane gas management, "Casa de Angel" Hotel, Sinemorets village, 2007;

7. Construction of a heating installation with an oil farm in an office and business building in Stara Zagora - investor "Avi Stroy" EOOD, Stara Zagora, 2007;
8. Repair and reconstruction of a heating installation in a business building of "DAR 55" EOOD, Nova Zagora, 2008;
9. Repair and reconstruction of a heating installation at a construction site at the PGSAG, Veliko Tarnovo, 2008;
10. Design and construction of a gas pipeline installation with propane-butane gas management at the "Clay Pots" ZOH, Gabrovo - investor "GUM" OOD, 2009.
11. Construction of a gas pipeline installation of the auto complex "Auto Via" EOOD, Stara Zagora, 2009.
12. Design and construction of a gas and heating installation at the production base of "Milkotronic" OOD, Nova Zagora, 2010;
13. Design and construction of a gas line for a low-pressure steam generator and rotary kilns of Yanitsa Bread AD, Nova Zagora, 2010;
14. Design and construction of steam pipelines and waste heat capture system of Yanitsa Bread AD, Nova Zagora, 2010;

6. Contributions (scientific, scientific-applied, applied).

The contributions are scientifically applied and can be summarized as:

6.1. Scientific contributions:

1. Critical analysis of the evaluation criterion of heat exchange intensification techniques based on the fixed pumping power constraint. It has been shown that when the thermal performance of two heat transfer channels is compared, they should be put under equal conditions, such as fixed heat exchange area, mass flow and initial temperature **6.2.**

6.2. Scientific-applied contributions:

2. Application of estimates for the efficiency of heat exchangers based on the method of minimizing the generated entropy in annular channels.
3. Investigation of the characteristics of heat exchangers with spiral strips, various types of spirally wound springs and chips, as techniques to improve heat exchange, by applying the method of minimizing the generated entropy.
4. Selection of the best techniques for heat exchange intensification using spiral strips, spiral-rolled tubes, studded tubes and pyramidal roughness used in skin-tube condensers.
5. The characteristics of a combined system for heating boiler water and water for domestic hot water supply, by using solar collectors and shell-and-tube heat exchangers with spirally rolled pipes, were investigated.
6. Theoretically, based on the generated entropy method, the characteristics of a tube-in-tube type heat exchanger with a band in the annular space have been proven.
7. Investigation of the characteristics of shell-and-tube heat exchangers during condensation of water vapor on horizontal spiral-rolled tubes.

Dependencies for moisture evaporation area and drying intensity of 50/50 polyester/cotton textile materials were obtained.

6.3. Applied contributions:

- A generalized methodology for designing dryers has been created with a spouted bed.
- Experimental results have been obtained for natural slope angles and bulk density of wood chips, important in the design of wood pellet production systems.

7. Evaluation of the candidate's personal contribution.

In the obtained and published results, a significant personal contribution is observed, as a consequence of systematic development in his scientific direction and application of the acquired in the doctoral studies, and new knowledge upgraded afterwards.

8. Critical notes and recommendations

The main recommendation is that the following publications, with experimental and theoretical results, should be mainly targeted in journals with an impact factor, which will lead to greater visibility and easy promotion.

As a critical remark, I can point out the too-brief description of the results in the Author's Reference for contributions to scientific works. Thanks to the fact that I have known the works of his mentor Prof. V. Zimparov for many years, I can understand what this concise presentation is about.

9. Personal impressions

I have not worked with the candidate and have no specific personal impressions. My assessment is based only on the presented materials, long-term knowledge of the candidate's joint publications with Prof. V. Zimparov.

10. Conclusion:

Bearing in mind the above, I propose Dr. Plamen Yordanov Penchev

to be elected as an "**associate professor**" in

field of higher education - **5. Technical sciences**

professional direction - **5.4. Power Engineering**

specialty **Industrial Heat Engineering**.

23.10.2024 г.

Reviewer: /signature/

Prof. Jordan Yankov Hristov, PhD,DSc