INSTITUTE OF MACHINE AND INDUSTRIAL DESIGN

FME

Faculty of Mechanical Engineering
Brno University of Technology

Review of Doctoral Thesis

1. PhD candidate
Ing. Arnošt Vespalec / Arnost.Vespalec@vut.cz
2. Name of PhD programme
Design and Process Engineering (Mechanical Engineering Design)
3. Title of PhD thesis
3D CONSTRUCTION PRINTING OF COARSE AGGREGATE CEMENTITIOUS COMPOSITE

4. Principal supervisor
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7. Overview of the scope of PhD thesis[1]
Very good
The chosen topic for the PhD thesis offers an exploration of 3D printing and sustainable construction materials processes. Those two dynamically relevant and contemporarily significant subjects. The research is focused on technological innovation and environmental responsibility. The connection between 3D printing techniques and sustainable practices in construction, presents a rich landscape for exploration, with potential for groundbreaking insights. The timeliness of this investigation is underscored by the current emphasis on sustainable solutions in the construction industry in the transformative capabilities of 3D printing. The intersection of these two hot-topic issues amplifies the research's importance, promising not only to contribute to the academic society but also to offer practical implications. The thesis, aims to make a meaningful contribution to the scholar discussion and address real-world challenges within the context of contemporary technological and environmental imperatives.

8. Significance of the topic and clarity of problem statement
Very good
The addressed issue is novel, representing a natural progression derived from the ongoing global research findings. The Author has adeptly identified gaps and limitations in existing studies, establishing a

[1] Overview of the scope of PhD thesis is a short description of objectives of PhD thesis's research and summary of main findings and scientific achievements.

rational foundation for his research objectives. The clarity with which the researcher delineates the deficiencies of prior work contributes to a well-defined problem statement. This precision not only underscores the significance of the chosen topic but also enables a transition into the delineation of research goals. By systematically acknowledging the constraints of previous achievements, the Author not only enhances the scholarly dialogue but also sets a clear trajectory for their investigation. The strategic articulation of these aspects attests to the researcher's acumen in presenting a focused and relevant problem statement, aligning the study with the forefront of contemporary research in a coherent form.

9. Knowledge of existing literature

Very good

The author of the dissertation demonstrated a well understanding of the literature, skillfully incorporating a brief historical overview while analyzing the latest technological advancements. The depth of their knowledge is evident throughout the papers, as they navigate various literary sources with finesse, establishing a strong foundation for their arguments. The historical context provided adds richness to the overall narrative, enhancing the reader's understanding of the subject matter. Moreover, the author exhibits a keen awareness of recent technological developments, offering insightful analyses and critiques. The synthesis of historical perspectives and contemporary insights reflect the author's comprehensive understanding of the topic. Moreover stated research hypothesis are the reasonable extension of previously conducted research by previous scientists.

10. Choice of methods and technical soundness

Very good

The selection of scientific methods in this research aligns with the stated objectives, showcasing a thoughtful and deliberate approach. The methods chosen are well-suited to address the research goals set forth in the dissertation, and the execution of these methods has proven effective in attaining the intended outcomes. The results obtained have been analyzed, demonstrating a commitment to technical rigor and a thorough understanding of the data. The researcher's proficiency in navigating the chosen methodologies is evident, as the analysis contributes meaningfully to the overarching goals of the study. The technical soundness exhibited throughout the research process underscores the reliability and validity of the findings.

11. Quality, originality and significance of the results

Very good

The experimental inquiries undertaken in this study are notably enriched by complementary numerical analyses, reinforcing the high quality of the obtained results. This integration of experimental and numerical methodologies not only substantiates the credibility of the findings but also attests to the thoroughness of the research approach. The commitment to incorporating diverse analytical techniques enhances the robustness and reliability of the results, contributing to the overall quality of the study. Moreover, the work stands out for its originality. This originality not only distinguishes the study within its field but also suggests a valuable contribution to advancing the broader scientific discourse. In essence, the research not only achieves high-quality results but also sets itself apart through its inventive and pioneering nature, signifying a commendable and impactful scholarly endeavor.

12. Quality of attached papers

Very good

The author of the dissertation has significantly bolstered the scholarly merit of his work by incorporating three notable publications into the research. Notably, one of these publications graces the pages of the esteemed journal Construction and Building Materials, widely recognized and respected within the academic community. The inclusion of a publication in such a prestigious journal attests to the author's commitment to engaging with high-impact academic platforms, indicative of the substantive quality of their work. Furthermore, the author fortifies his research by featuring two additional publications in the journal Materials, a periodical that comfortably resides within the second quartile (Q2) of scientific journals. This strategic selection of journals demonstrates the author's discerning approach to disseminating their findings, ensuring their work reaches a broad academic audience while maintaining a high standard of peer review. Altogether, the incorporation of these publications underscores the author's dedication to contributing valuable insights to the field, leveraging reputable platforms to enhance the credibility and impact of their research.

13. Overall assessment, strengths and weaknesses (based upon the above evaluation categories 8–12)

Excellent

The doctoral thesis excels on multiple fronts, demonstrating a comprehensive understanding of the research process. The identification and definition of the research problem are commendable, providing a solid foundation for the study. The selection of research methods aligns seamlessly with the research objectives, resulting in a robust and well-executed investigation. The achievement of the stated research goals is reflected in the high-quality results, analyzed and published in respected journals. The incorporation of both theoretical and practical dimensions, exemplified by the utility patern, underscores the researcher's holistic grasp of the problem. The work stands out as an excellent embodiment of scholarly endeavors, with each criterion fulfilled at the very high level. The commitment to excellence is evident at every level, making this thesis an outstanding contribution to the academic field. While the strengths are abundant, it's crucial to acknowledge that, like any scholarly work, potential areas for refinement could be identified through ongoing discussion and iterative feedback.

14. Questions and comments

1. It is known that in various cementitious composites the adhesion of the layers is assured by the chemical and physical behaviour. The Author mainly focused on setting time and the wet-to-wet cementitious material application. However by evaluating also the layer surface morphology it can be predicted the potential adhesion within the layers of old-to-new (hardened already with fresh mixture) concrete. Has the Author tried to evaluate the properties of such behaviour, fresh mixture applied on hardened already layer. And Has the author analyse the properties of the surface in terms of morphological parameters, not only the surface area but also the others?
2. Does the Author see the potential of expanding this technology in this shape to make it usable for ordinary concretes containing 16mm or even 32 mm coarse aggregates? What should be done to make it possible?
3. What future of 3D printing of cementitious composites does the Author expect? Is it going to be a still and constant improvement in devices/machines or rather modification of composites mixtures leading to be more prone to printing instead to traditional casting into the moulds.

15. Conclusion

PhD thesis is an independent scientific work that presents a novel solution to a significant problem in the research area and demonstrates the candidate's ability to conduct independent research.
YES

16. Date and signature	
06/03/2024	

Please note

A. *Evaluate categories 7 to 13 using the following scale: unacceptable, acceptable, satisfactory, good, very good, excellent. The qualification of 'excellent' should only be given for a PhD Thesis in the top 3% of the research in your field of expertise.*
B. *E-mail the completed form to: Klara.Javorcekova@vut.cz*