

Minutes of the Defence of the Ph.D. Thesis

On March 7, 2019 at 14:00 at Faculty of Mechanical Engineering of the Czech Technical University in Prague.

The postgraduate student: **Ing. Petr Zelenský**
Submitted the dissertation named: **Optimum representation of heat sources in simulations of air flow in indoor environment**

in the study programme Mechanical Engineering, in the study field Environmental Engineering.

Brief evaluation of the defence:

After the opening of the defence by the defence committee chairman and presentation of the supervisor's statement, the doctoral student presented the content of his doctoral thesis. In his presentation, he indicated the main reasons that led to the research on numerical modelling of heat sources for indoor air flow studies. The research was motivated by the issue of proper air distribution in large indoor spaces with a high number of heat sources and/or variable occupancy patterns, such as e.g. lecture halls, theatres, cinemas, atriums etc. Modelling and simulation using computer fluid mechanics (CFD) was introduced as one of the tools that can help to analyse and understand the complex interactions in the indoor environment.

The doctoral student stated the main goal of the work, which was the development of a new modelling method to represent models of heat sources for indoor air flow studies, leading to reduction of the computational burden of CFD simulations with heat sources. He described the used methodology and introduced the developed method of simplified representation of indoor heat sources. Particular attention was paid to the optimal characteristics of the near-wall region mesh around the modelled heat source, the choice of an optimal model of turbulence for CFD simulations with prevailing effect of natural convection on the air flow, the sensitivity of the thermal plumes above heat sources on the ambient air temperature conditions and the mutual interaction of thermal plumes rising above multiple heat sources. The applicability of the developed method in practice was demonstrated on the selected case study. In conclusion, the doctoral student summarizes the results of the work, which he compared with the main and partial goals of the doctoral thesis. He presented the benefits of the work and possibilities of further research in the field of numerical modelling of heat sources for indoor air flow studies.

Opponents Ing. Jan Hrubý, CSc., Prof. RNDr. Milada Kozubková, CSc. and prof. Ing. Pavel Šafařík, CSc. informed the committee of their reviews and presented their questions (prof. Kozubková by proxy). In the following section, the doctoral student responded to the comments and questions of the opponents. In the debate attended by the committee as well as opponents, Ing. Zelenský responded to the raised questions and comments factually and with an insight.

At the conclusion, the commission stated that the doctoral thesis brings new original knowledge in the field of Environmental Engineering, namely application of computer fluid mechanics for indoor air flow studies. The doctoral student demonstrated the ability to scientifically work and apply modern research methods. The goals of the doctoral thesis were fulfilled and the results were published on a continuous basis.

The results of the secret vote show that the commission unambiguously recommends the Dean to grant Ing. Peter Zelenský the doctor degree.

Questions and remarks:

Did you applied theory of similarity?

Future research topic and CO2 theory inside the building simulation.

How did you evaluate the ventilation rate in the case study in the church (table 7.1)?

Combination of SBC and the air jet from window diffuser.

Comment the mistake written in tab. 6.1 of the Thesis, where the k- ω Standard model is incorrectly used (the k- ϵ Standard model is correct).

Why the k- ω turbulent model was not used in the sensitive analyses?

How can help candidate for practical using presented method?

Vote:

valid votes 9, invalid votes 0, proposal to award the title of doctor 0,
positive votes 9, negative votes 0

prof. Ing. Pavel Kic, DrSc.

Defence committee chairman

Defence ended at 15:50 hour.

Questions and Remarks

Obhajoba DP Ing. Petra Zelenského, která se koná dne 7. března 2019
Defence of dissertation on March 7, 2019 – Ing. Petr Zelenský

Dotazy a připomínky/ Questions and Comments

Člen komise запиše stručně a čitelně svůj dotaz či připomínku a lístek podepíše.

The committee member shall write down his/ her question or remark briefly and clearly legibly and sign the ticket.

How can help candidate for practical
using presented method?

DRKAL

příjmení (TISKACE)
surname (in capitals)

Obhajoba DP Ing. Petra Zelenského, která se koná dne 7. března 2019
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Dotazy a připomínky/ Questions and Comments

Člen komise запиše stručně a čitelně svůj dotaz či připomínku a lístek podepíše.

The committee member shall write down his/ her question or remark briefly and clearly legibly and sign the ticket.

- ① Comment to mistake written in tab. G.1. of the Thesis, where the k-co standard model is incorrectly used (the k-E standard model is correct).
- ② why the k-co SST turbulent model was not used in the sensitive analyses?

ZÁCHA

příjmení (TISKACE)
surname (in capitals)

Obhajoba DP Ing. Petra Zelenského, která se koná dne 7. března 2019
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Combination of SBC and the AIT jet from window or diffusion.

LAIN

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příjmení (TISKACE)
surname (in capitals)

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HOW DID YOU EVALUATE THE VENTILATION RATE
IN THE CASE STUDY IN THE CHURCH (TABLE 4.1,

ŠTÁVOVÁ

.....
příjmení (TISKACE)
surname (in capitals)

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Člen komise zapíše stručně a čitelně svůj dotaz či připomínku a lístek podepíše.

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Future research topic and CO₂ flows inside
the building simulation.

KIC

.....
příjmení (TISKACE)
surname (in capitals)

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Did you applied theory of similarity?

Šafařík

.....
příjmení (TISKACE)
surname (in capitals)