



Opponent's review of the Doctoral Thesis

Candidate Arseni TRUSH

Title of the doctoral thesis Turbulence effects on wind-induced fatigue of slender steel structures

Branch of study Building and Structural Engineering

Tutor prof. Ing. Jiří STUDNIČKA, DrSc., doc. Ing. Stanislav POSPÍŠIL, Ph.D.

Opponent prof. Zbigniew ZEMBATY

e-mail z.zembaty@po.edu.pl

Topicality of the doctoral thesis theme

Commentary: Wind loads on structures are random phenomena associated with strong dependence on fluid flow pattern requiring experimental research. Long lasting wind loads on vibration compliant structures generate fatigue effects on structural elements. Should this be affected by eventual ice accretion? The answer is yes. From this point of view the subject studied by the PhD dissertation is original and actual, as not much research was carried out so far in this direction

☐ excellent ☒ above average ☐ average ☐ below average ☐ poor

Fulfilment of the doctoral thesis objectives

Commentary: The main objectives of the dissertation as reported in chapter 2 cover three areas: (i) simultaneous effect of the free stream turbulence and various parameters of surface roughness on VIV response of cylindrical structures (elements), (ii) measurement of the rough cylinders wake characteristics in various turbulent flow, (iii) developing experimental methodology and improvement of laboratory methods for air flow analyses nad measurements around cables, including climatic effects and various surface roughness induced aeroelastic phenomena. Detailed analysis of chapters 4-7 (including appendices A, B, C) demonstrates that these goals were achieved.

☐ excellent ☒ above average ☐ average ☐ below average ☐ poor

Research methods and procedures

Commentary: Present dissertation is a very good example of appropriate proportion of deep and wide literature investigations, careful and laborous experimental research (including design of experimental set-up of various kinds) as well as application of numerical analyses with modern tools (Matlab & Comsol software). Such the methodology can serve as a good model for research aiming at prepering doctoral dissertations in civil engineering.

☒ excellent ☐ above average ☐ average ☐ below average ☐ poor

Results of the doctoral thesis – dissertant's concrete achievements

Commentary: The concrete achievements of this dissertation are described in detail in the chapter 7 (Conclusions). In the opinion of this reviewer the main results cover detailed investigations of the effect of the phenomenon of lockin in the VIV. The role of the lay angle was investigated too. Conclusions for the designers were obtained too.

<input type="checkbox"/> excellent	<input checked="" type="checkbox"/> above average	<input type="checkbox"/> average	<input type="checkbox"/> below average	<input type="checkbox"/> poor
------------------------------------	---	----------------------------------	--	-------------------------------

Importance for practice and for development within a branch of science

Commentary: Since flow turbulence and cable surface roughness considerably influence VIV of structural cables (and alter dynamic characteristics) and as an effect fatigue estimated lifetime of the cable-supported bridges, the results of this dissertation can be implemented into civil engineering codes of practice. Some code coefficients can be modified and updated based on this research.

<input checked="" type="checkbox"/> excellent	<input type="checkbox"/> above average	<input type="checkbox"/> average	<input type="checkbox"/> below average	<input type="checkbox"/> poor
---	--	----------------------------------	--	-------------------------------

Formal layout of the doctoral thesis and the level of language used

Commentary: Formal layout of the doctoral thesis is appropriate, though some proportions could be different. For example too much space is devoted to explain well known methods of wind load effects on structures, while too little is devoted for the important calculations of the fatigue effects on structures. The English language is of good quality, but there are many small, 'typo' errors, missing words etc. Definitely doctoral dissertation should be better checked for these type of annoying errors.

<input type="checkbox"/> excellent	<input type="checkbox"/> above average	<input checked="" type="checkbox"/> average	<input type="checkbox"/> below average	<input type="checkbox"/> poor
------------------------------------	--	---	--	-------------------------------

Remarks

The PhD candidate Arseni TRUSH is very active researcher of an international team. His publication output during the years 2015-2019 includes 4 journal publications and 8 conference papers

Out of the 4 journal publications 3 are in the area of the Dissertation:

1. Trush A., Pospisil S., Kuznetsov S., Kozmar H., Wind-Tunnel Experiments on Vortex-Induced Vibration of Rough Bridge Cables, J. of Bridge Engineering ASCE, vol. 22(10), October 2017, (SCIMAGO index: 59)

2. Kuznetsov S., Ribicic M., Pospisil S., Plut M., Trush A., Kozmar H., Flow and Turbulence Control in a Boundary Layer Wind Tunnel Using Passive Hardware Devices, Experimental Techniques, vol. 41(6), 2017, pp.643-661 (SCIMAGO index 28)

3. Gorski P., Pospisil S., Tatara M., Trush A., PIV analysis of near-wake flow patterns of an ice-accrated bridge cable in low and moderately turbulent wind, J. of Wind Industrial Aerodynamics, vol. 191, 2019, pp. 297-311 (SCIMAGO index: 90)

Using SCIMAGO journal index the above publications can be ranked with respect to journal prestige: from very high (publication 3), high (publication 1) and average (publication 2).

This means that the results of dissertation reached very good levels of international standards

Final assessment of the doctoral thesis

1. Disadvantages of the dissertation: (a) too much space devoted to report well known phenomena of wind effects on structures while (b) the applied model of the fatigue effects is rather conventional and respective calculations do not go beyond actual, typical methodology of this research area, (c) the title could be more precise: 'slender steel structures' refers to too general description, while in fact cable vibrations were studied, (d) the English language suffers from numerous small typo errors.

2. Advantages of the dissertation: (a) interdisciplinary character of research, covering detailed laboratory wind flow experiments as well as analyses of dynamic response of structures and fatigue phenomena, (b) development of new experimental techniques, (c) obtaining, new results with respect to joint effect of wind load on iced structures with simultaneous vortex induced vibrations, (d) obtaining fatigue effects for the wind induced vibrations modified by presence of ice on the cable structures

3. Final conclusion: The reviewed dissertation fulfils requirements of doctoral thesis in civil engineering well above average expectations.

Following a successful defence of the doctoral thesis I recommend the granting of the Ph.D. degree

yes <input checked="checked" type="checkbox"/>	no <input type="checkbox"/>
--	-----------------------------

Date: January 4th 2020

Opponent's signature:.....