

Posudek disertační práce

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Název disertační práce Simulace pohyblivých membránových konstrukcí

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Aktuálnost tématu disertační práce

komentář: The topic of the PhD thesis is very relevant and actual. Lightweight membrane structures are an ideal candidate to achieve structures which can be easily adapted to changing conditions in the environment. Due to their light weight, they require less material and handling energy than traditional massive materials and components. Thus we can reduce the amount of embodied energy while offering at the same time comfort and adaptable structures to our buildings.

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Splnění cílů disertační práce

komentář: As stated in the thesis, the "Main goal of the dissertation is to analyse the chosen types of convertible light weight tensile structures. Based on this analysis are created digital simulations of folding and movement of the convertible tensile structures. The simulations are made in specialised software tools for parametric design and physical animation." It can be concluded that these goals have been fulfilled in the thesis work.

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Metody a postupy řešení

komentář: The methodological steps are not very clear. Chapter 7 mentions analysed forms of single-layer convertible membrane constructions (funnel, baffle, along rope structure, mobile frame structures) and in Chapter 8 analysed forms of pneumatic convertible membrane structures (cylindrical and conical, rotating ellipsoids, pneumatics with internal construction, chained surfaces, pneumatic gridshell, and movable pneumatic partitions). Chapter 10 contains the actual simulations: hypars, membranes with inserted arch, funnel, baffle, and an animation rather than simulation of ETFE pillow (aquapark Wave). It is not clear on what criteria the selection of analyzed structural types is made. Why are they representative of convertible light weight tensile structures? If they are not representative, then why a limited selection has been made?

The literature section contains mainly references to books and handbooks. There is not reference to specialised research literature in journals. Books and handbooks offer only generalised knowledge and principles, but advanced, state of the art research on membranes and convertible structures can only be found in research journals. This aspect is missing - thus also the section of research contribution is more superficial than would be desirable in a dissertation thesis.

The results of the simulations seem to be verified purely on a visual level. In the section on Blender, page 57 the use of keyframes is mentioned. Keyframing is more an animation

techniques rather than simulation. The program simply interpolates between keyframes and does not really simulate anything. Why is this considered a good example of simulation?

Appendix 1 is a summary of selected examples. The treatment of each example could have benefitted from a more in depth discussion of the simulation aspects. Right now it is a list of examples that can be compiled from any textbook or website concerning membrane structures. The same applies to Appendix 2 - a discussion of the modelling of anchoring techniques would have been very useful here.

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Výsledky disertace - konkrétní přínosy disertanta

komentář: The contribution of the PhD thesis lies in making simulation of the complex phenomenon of convertible membrane structures more accessible to the design process and visualisation stage in architectural design. This easier application will lower the threshold to use this type of constructions and materials.

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Význam pro praxi a pro rozvoj vědního oboru

komentář: As stated above, the work will mean easier access in practice to the design and implementation of convertible membrane structures. Due to the methodological limitations mentioned earlier, the scientific contribution lies in the preparation of future research on simulation and verification of such simulations - this has not been achieved here.

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Formální úprava disertační práce a její jazyková úroveň

komentář: From all required elements of a dissertation thesis, what is missing are the research questions and hypothesis, and a systematic literature review of research work that has already been done.

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Připomínky

The availability of web pages with animations is very helpful for the reader to understand the contribution of the research work.

Závěrečné zhodnocení disertace

The work gives a sound basis to further develop and integrate the design and visualisation of convertible membrane structures in architectural design. Future work should look at the verification of these methods so that are a reliable depiction of real structure and membrane behaviour.

Doporučuji po úspěšné obhajobě disertační práce udělení titulu Ph.D. **ano** **ne**

Datum: 2. 5. 2022

Podpis oponenta: