Ph.D. Thesis by Omarov Anuar Serikovich
“Research of parameters and development of modules of automatically controlled wind farm with swinging umbrella sail
on the specialty 8D0703 - “Electric Power Engineering”
In Karaganda State Technical University, Kazakhstan

Judgement Report by
Prof Marco Ceccarelli
LARM2: Laboratory of Robot Mechatronics
Dept of Industrial Engineering; University of Rome Tor Vergata
Via del Politecnico 1, 00133 Roma, Italy
Phone +39-333-4479314 email: marco.ceccarelli@uniroma2.it
http://orcid.org/0000-0001-9388-4391

Roma 23.5.2023

The PhD thesis attaches the topics of wind power generation using swinging umbrella sail for low-speed airflow (from 2.5 m/s) by presenting procedures useful in design and analysis.
The thesis is properly organized in four chapters containing a logic development from an analysis of the state-of-art to define problems and requirements up to a proposal of new solution that is analyzed with proper calculations of the expected performance that are characterized experimentally with a prototype used also for validation.
Chapter 1 summarizes the conditions with data analysis mainly referring to Kazhakastan and discuss the needs and requirements for wind power generation.
In Chapter 2 results are reported form experimental characterization of the win airflow and its characteristics for power generation, by using experimental equipment and procedures properly developed. It is also discussed the potential of sail umbrella system as alternative design of wind power generators.
Chapter 3 focuses on the proposed swinging umbrella sail power generator for low-speed airflow by developing models and formulation both for the design and analysis of structure, operation control and performance. Part prototypes are defined and used to build a prototype in reduced scale.
In Chapter 4 the implementation plan includes discuss on a comparative analysis with direct current generators, asynchronous, and synchronous alternating current generators. A design of a full installation is presented with details of the operation capability.
A Conclusion chapter summarize the PhD work and its future developments, even with a full scale wind power generator using the proposed swinging umbrella sail for low-speed airflow
The reference list is enough rich of sources from a wide literature on the subjects for robotic manufacturing and task planning.
The PhD work is also substantiated by a reference list of co-coauthored publications in journals and conference proceedings on the topics of the thesis arguments.
The content of the PhD thesis is considerable in the above-mentioned aspects of the topics in mechanical design, airflow modeling and controlled operation with valuable results. Because of the limited publication production and its international characters, missed can be considered a clear discussion of the personal novel contributions of the candidate in the proposed approaches and solutions even if it is evident the originality of the wind power generator using swinging umbrella sail for low-speed airflow.
Summarizing, the thesis shows good results in a clear discussion. Therefore, according to my opinion, although the above-mentioned suggested minor argues, the thesis has a significant value that deserves a recommendation for PhD degree.