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MSc thesis proposal with international collaboration

(In collaboration with University of California, Los Angeles)

Title	Resilience assessment and management of power grids in response to extreme weather conditions (heat wave, storm, flood, wildfire, etc.)
Motivations and objectives of the research	In the last couple of decades, a large number of climate disasters has happened in the world, resulting in overall damage exceeding US3.5 trillion and particularly US$1.3 trillion in the United States. In recent years, the frequency and intensity of extreme weather and climate-related events have been trending higher. Around 63% of the worldwide disasters has happened after 2010, and seven of the ten costliest storms in U.S. history occurring in the last ten years. The considerable rise in both severity and frequency of occurrences of climatological catastrophes, draws attention to a more climate-resilient electricity sector. In recent years, several databases and platforms have been developed to perform resilience assessment of electricity sector in response to extreme weather and climate-related events. In this thesis, a methodology for resilience assessment of power grids in response to extreme weather conditions (heat waves, storm, flood, wildfire, etc.) will be developed. The proposed model will be implemented on a case study to show the effectiveness of the proposed methodology. **References** Shirvani, R., & Parhizkar, T. (2022). Resilience based Electric Sector Optimization in Response to Extreme Weather Conditions with Distributed Generation Systems. arXiv preprint arXiv:2209.10050. Fang, Y. P., Pedroni, N., & Zio, E. (2016). Resilience-based component importance measures for critical infrastructure network systems. IEEE Transactions on Reliability, 65(2), 502-512. Fang, Y. P., & Zio, E. (2019). An adaptive robust framework for the optimization of the resilience of interdependent infrastructures under natural hazards. European Journal of Operational

	Research, 276(3), 1119-1136. Rocchetta, R., Zio, E., & Patelli, E. (2018). A power-flow emulator approach for resilience assessment of repairable power grids subject to weather-induced failures and data deficiency. Applied energy, 210, 339-350. Fang, Y., Pedroni, N., & Zio, E. (2015). Optimization of cascade-resilient electrical infrastructures and its validation by power flow modeling. Risk Analysis, 35(4), 594-607. Abdin, I. F., Fang, Y. P., & Zio, E. (2019). A modeling and optimization framework for power systems design with operational flexibility and resilience against extreme heat waves and drought events. Renewable and Sustainable Energy Reviews, 112, 706-719. Fang, Y. P., Pedroni, N., & Zio, E. (2014). Comparing network-centric and power flow models for the optimal allocation of link capacities in a cascade-resilient power transmission network. IEEE Systems Journal, 11(3), 1632-1643.
Activities	• Literature review on the effect of extreme events on power generation, transmission, storage, and end users. • Methodology development. • Implementation of the algorithms in Python. • Application and validation of the proposed methodology.
International collaborations	University of California, Los Angeles (UCLA)
Required competencies and skills	• Good knowledge of power grids and optimization methods or a willingness to learn. • Good knowledge of reliability, risk and resilience or a willingness to learn. • Good knowledge of Python programming or a willingness to learn.
Composition of the research group	Number of Professors: 2
Name of the research director	Enrico Zio Tarannom Parhizkar
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Duration of the dissertation	
Total thesis duration	8 months. At most 2 pending exams