

Analysis of Power System Resilience Subject to Extreme Events

Adedayo Aruwajoye

Advisor: Dr Henry Lester, Ph.D.

Department of Engineering Management, Systems and Technology

Research Objective

The objective of this study is to increase understanding of resilience in power systems, through failure pattern recognition of natural-disaster induced disruption.

The goal is to make communities more resilient as this has a direct impact on their standard of life.

Background

- Failure in power systems is non-linear
- Understanding of their resilience and failure pattern is foggy and limited
- Excellent research advantages herein and expected results are unprecedented

Research Questions

- What is the pattern of power outages per time during the hurricane occurrences?
- What is the goodness of fit of the fragility (failure curves and recovery) curves produced?
- What continuous probability distribution does this goodness of fit correlate to?
- What is a descriptive failure and recovery function for the power system and its associated parameters?



Figure 1: Employed V-Model Research Process

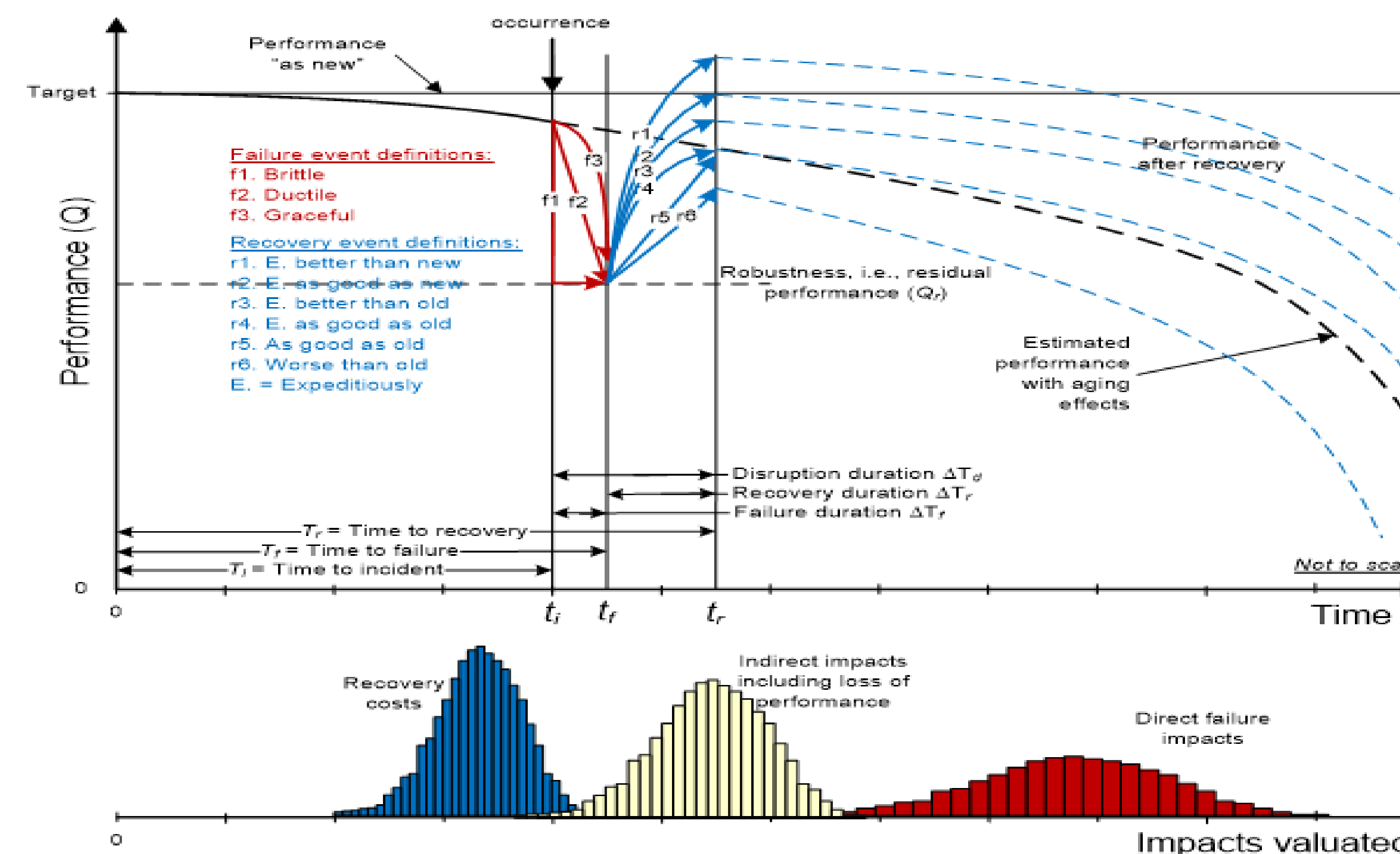


Figure 2: Typical Failure Pattern (Ayyub, 2014)

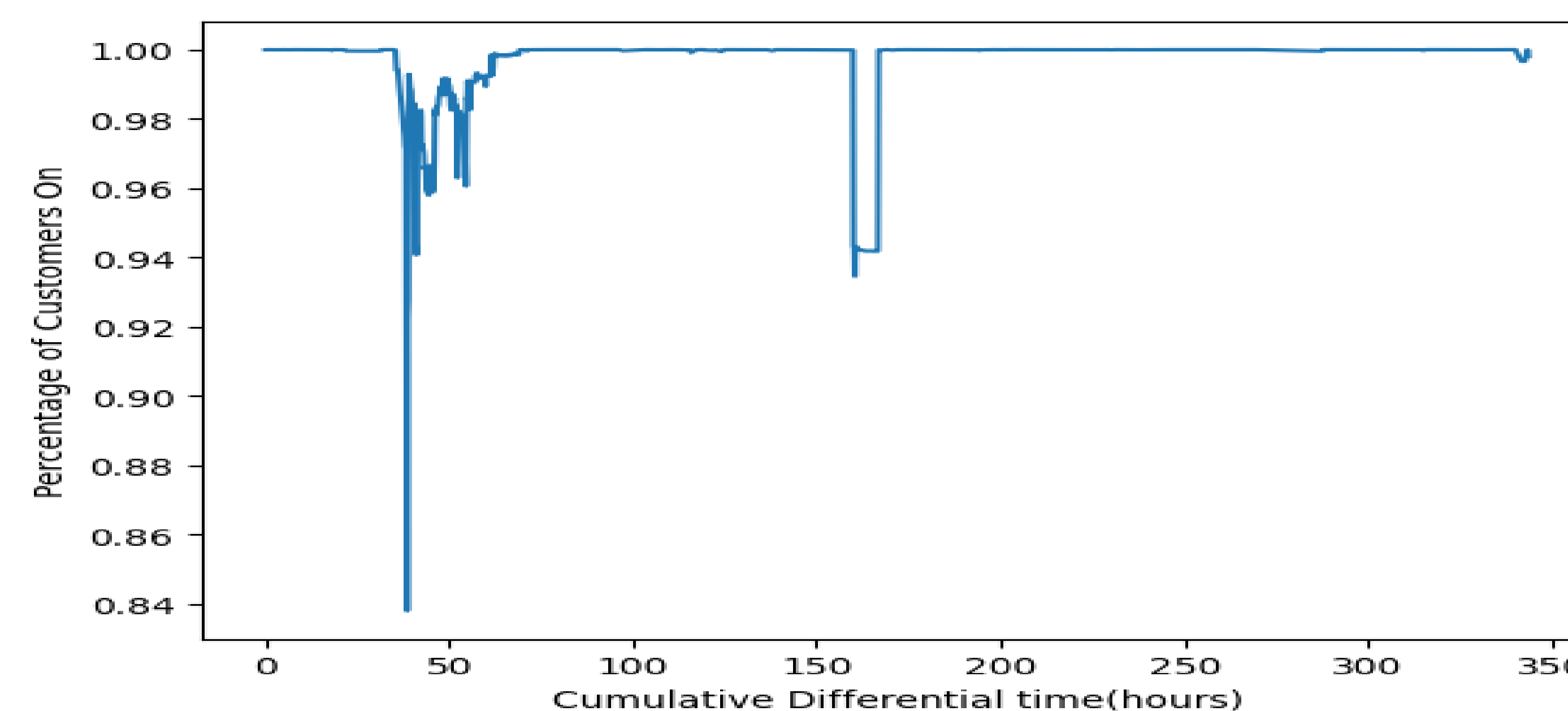


Figure 3: Sample Fragility Curve from collected data set

Methodology

- Identify disaster-affected systems
- Collect post-disaster outage data
- Extract insights
- Develop fragility curves for each region or county
- Obtain goodness of fit and specify resilience engineering parameters
- Develop mixed model algorithm
- Experimentally test novel algorithm on similar systems

Expected Results

- Mathematical model of resilience
- Weibull distribution as Hypothesis
- Extrapolation to other power systems
- Presentation at the American Society of Engineering Management Annual Conference

Selected Reference

- B. Ayyub, Risk Analysis in Engineering and Economics, 2nd Edition, 2014