Fault-Aware Design Iteration for Complex Systems
Automated fault analysis at the fingertips of the system designer

PARC’s cloud-based fault analysis technology can automatically augment system models with a comprehensive list of fault modes and reason about how they affect system performance. Through automated fault analysis this tool suite gives system designers and engineers the insight of reliability experts. It condenses design cycles and lowers development costs, allowing manufacturers to converge rapidly on a set of highly resilient system designs.

THE VISION
We envision a design paradigm that lets system designers adapt their designs through a tightly integrated build-test-modify loop with multiple points of feedback. In order for this workflow to yield highly resilient system designs, it is essential for designers to have the ability to analyze faults, fault propagation, and system-level impact. However, today’s design tools do not facilitate the integration of fault analysis aspects at the design stage. This prevents designers from converging to the most reliable and resilient designs as quickly as possible.

THE BREAKTHROUGH
As a system increases in complexity the number of possible faults explodes, but the underlying physics-of-failure is restricted to a limited well-understood set. We combine this intuition with a domain-specific ontology of faults to provide automated Fault-Aware Design Iteration (FADI). Our methods use industry standard modeling and simulation data formats. Users can easily upload existing system and component models, use a simple interface to set simulation parameters, and then click on design configurations and fault modes to view in-depth analyses.

An overview of PARC’s automated fault-aware design iteration workflow

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TECHNOLOGY SUMMARY

Behind the scenes, in the cloud, the software automatically:
- Analyzes a design to identify potential fault susceptible components;
- Augments component models with domain-relevant fault modes;
- Simulates all faults to determine system-level severity;
- Applies parameterized physics-of-failure models to predict fault likelihood;
- Combines fault severity and likelihood to predict component degradation over time; and
- Aggregates component-level predictions to predict when the system will fail to meet performance requirements.

TECHNOLOGY BENEFITS

This model-in-the-loop design iteration is orders-of-magnitude faster and cheaper than limited hardware-in-the-loop testing. Additionally, this technology can reduce the manual effort involved in fault analysis of complex engineered systems by an estimated 80% or more. Thousands of faults can be automatically analyzed on the computer, instead of being discovered in the field. This technology allows systems to be designed not just for reliability but also functional resiliency under fault.
- This fault augmentation technology is scalable to new components and systems, and comprehensive to ensure that no significant fault events are missed;
- The fault models are extensible across product families; and
- The modeling and simulation effort is reusable across the life of the system, from design to operation and maintenance.

TECHNOLOGY READINESS

PARC’s automated fault-augmentation technology and the cloud-based fault analysis software are ready for use today. Our technology currently supports in-depth fault analyses of complex systems, where electrical, mechanical, hydraulic, and fluidic components come together under some of the most challenging usage scenarios.

ENGAGE

Companies interested in this technology should contact PARC to discuss our pilot partner program or other opportunities for collaborative technology development and/or licensing. 
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