Reliability Prediction And Field Data

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Topics

- Relationships
- Prediction Models
  - MIL-HDBK vs. Civilian Specifications
- Data Sources
  - EPRD-97, other sources
  - What to do when you have no data?
- Conclusions
- Paper

Relationships

- Electronic/Electrical Reliability
- Mechanical Reliability
- Multi-Disciplinary Design

Reliability Prediction

- Standard model is MIL-HDBK 217
  - Complicated model
  - Tools exist to simplify the job
- Industry has developed other models
  - SAE - based around 400 hrs use/year
  - Bellcore - specializing in communications systems
- There is no one appropriate model, economic concerns often demand different models
- Models are good for comparing analyses, not necessarily objective.

SAE Prediction Model

$$\lambda_p = \lambda_p \prod_{\forall_i} \pi_i$$

λ_p = predicted failure rate

λ_b = generic failure rate for component

π_i = Correction factor

The SAE Model (2)

- Classic “fudge factor” model.
  - Orthogonal factors are thrown in until something accurate results
- Emphasis on generic components
  - Models a generic component and then throws in a collection of factors based on the physical characteristics of the component.
  - Model is ‘coarser’ than the MIL-217 model
- Motivated by cost over reliability
  - 400 hrs/year is stressed over and over again

Field Data

- Prediction schemes are useless without field data
  - SAE: fudge factors are calculated by analyzing field data
- Depending on the scheme, field data varies
  - These collections do not have to match each other.
  - Possible to map between models
  - Definition of failure can vary

Gathering Data

- Various sources
  - Direct observation
  - Manufacturer info
  - Maintenance databases
- Sometimes you can't get enough data
  - EPRD contains both detailed and summary data
  - Rely on the law of averages
- Data can be skewed
  - Warranty data will only cover warranted repairs

EPRD-97

- Electronic Parts Reliability Data handbook
- Intended specifically as a complement to MIL-HDBK-217
  - Failures/E6 hours
- Data acquired from manufacturers, direct observation
  - Large amount of data to sift through
- Two levels of information
  - Generic summary, detailed summaries
  - Encouraged to take the most conservative prediction

Conclusions

- Field data acquisition is motivated by the model.
- Reliability models are motivated by economic concerns for the target industry
- As with any other experimental science, this is an onerous task. Data acquisition takes a lot of time.
- Reliability prediction is a science of compromises:
  - Perfectly accurate data may not be available
  - You guess conservatively

Paper

- Demonstrates the SAE model of reliability prediction
  - Note the emphasis on 400 hours/year
  - Emphasis placed on the physical location of the component
- Industrial concerns
  - Anonymity