Investigation of Bayesian Mixtures-of-Experts models to predict semiconductor lifetime

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Abstract

Investigating the reliability of a semiconductor device is time and cost consuming, but essential for industry and customers. To save resources, models that predict the lifetime and the valid parameter range dependent on the stress conditions are needed.

The given semiconductor lifetime data show a mixture of two log-normal distributions [1], where the mixture weights of the two components depend on the applied peak temperature. Hence, a Bayesian Mixtures-of-Experts (ME) approach is used [3]. For the component means linear models as well as physical acceleration models [2] are investigated. Under the assumption of informed normal priors for the model parameters and slightly data dependent hierarchical inverse Gamma priors for the variances, the mixture based on two Coffin-Manson models shows the best fit and the best prediction quality.

Applying the model to lifetime data from other semiconductor technologies shows that the combined Bayesian ME and Coffin-Manson approach is valid for other designs as well. With the given model parameter ranges for one semiconductor design based on a minimum number of stress tests can be predicted. Hence, resources, especially testing time, can be saved.

Keywords

Bayesian Mixtures-of-Experts models, Semiconductor lifetime prediction, Linear models, Physical acceleration models.

References

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