


# Chapter 45

## Residual Life Estimation of Humidity Sensor DHT11 Using Artificial Neural Networks

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### **ABSTRACT**

*Electronic systems have become an integral part of our daily lives. From toy to radar, system is dependent on electronics. The health conditions of humidity sensor need to be monitored regularly. Temperature can be taken as a quality parameter for electronics systems, which work under variable conditions. Using various environmental testing techniques, the performance of DHT11 has been analysed. The failure of humidity sensor has been detected using accelerated life testing, and an expert system is modelled using various artificial intelligence techniques (i.e., Artificial Neural Network, Fuzzy Inference System, and Adaptive Neuro-Fuzzy Inference System). A comparison has been made between the response of actual and prediction techniques, which enable us to choose the best technique on the basis of minimum error and maximum accuracy. ANFIS is proven to be the best technique with minimum error for developing intelligent models.*

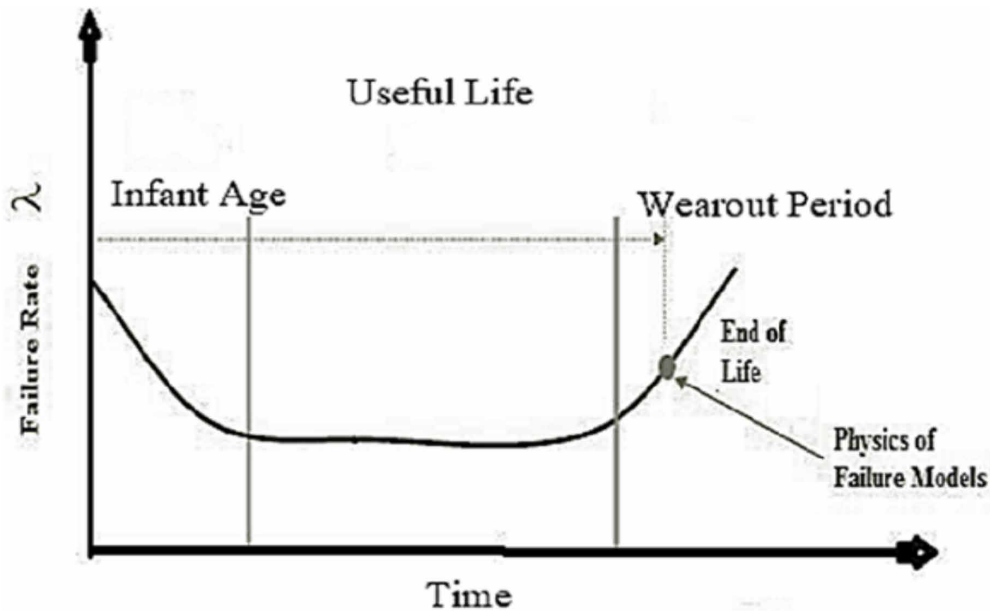
### **INTRODUCTION TO RELIABILITY AND LIFE ESTIMATION**

Across the globe, every industry is trying to lure the customers for electronics and electrical items and for that they need to provide better performance, high quality and low cost. Another factor which comes into picture is the Time To Market (TTM) for these products (Barnes, 1971). As competition is increasing day by day every sector or industry tries to launch their product as soon as possible because there may be chances that likewise product may get launched and industry may face great loss economically.

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Another factor which is most important now-a-days is the “Reliability” of any system. All the big brands, big industry with reputation are moving forward to develop as reliable system as possible to contribute towards customer’s safety as well as to maintain the quality. Higher the brand, higher the cost, high is the Reliability(Neri, Allen, & Anderson, 1979). Generally, a big trade-off is there between the Reliability, Cost and Time. The overall Life of any product has been depicted by Bath-Curve shown in Figure 1,

*Figure 1. Bath Tub Curve for Product Life*



“Reliability” is the general term in our day-to-day life which means how much we can rely over that particular thing. Talking about electronics world than now-a-days this word has been a great buzz. This term is becoming so vast that we have one entire engineering stream with this name i.e. “Reliability Engineering”. Now what is the meaning of term for an electronics Engineer. “It is the degree which tells how reliably a particular electronic system or component will work as it is expected to, in the specific or desired duration.”

Now operational Reliability includes three parts:

1. Reliability, whether system is giving desired output or not.
2. Reliability, whether it’s working fine under different environment.
3. Reliability, whether different conditions are not fluctuating the output.

If we go deeper in the Reliability then comes the term “Life Estimation or Prediction” Normally Prediction and Estimation are two different terms. Prediction is based on the historical observation or data available but Estimation is about the real time data available for that particular system. The data which we are using here is the data about that particular electronic component only that’s why the topic

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