Bayesian Analysis with OpenBUGS

by

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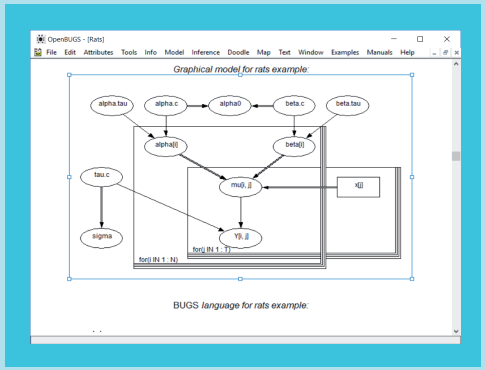

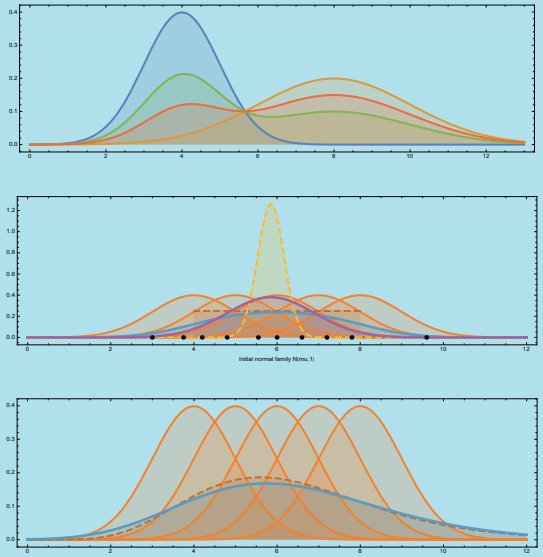

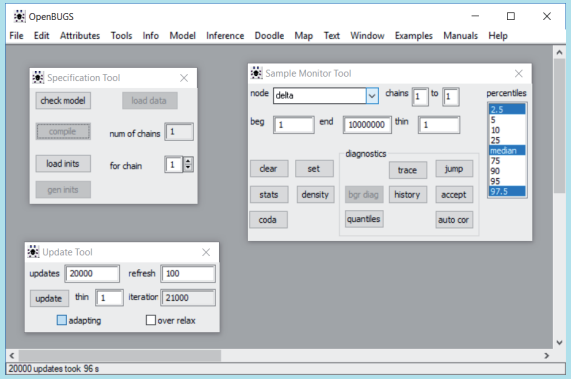

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RANDOM MODELS IN ENGINEERING

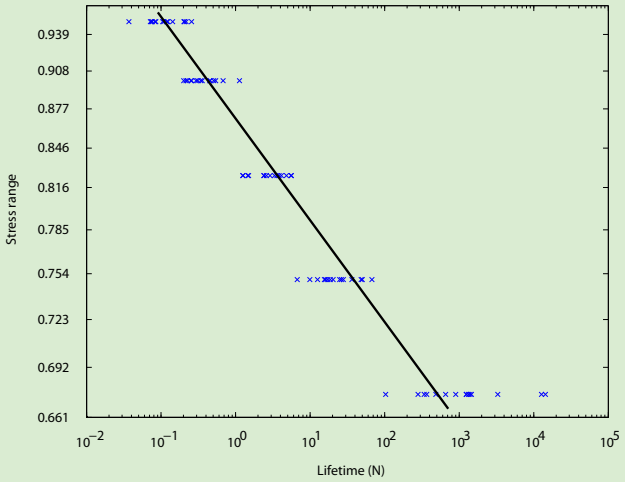
In real engineering practice **we need random or stochastic models** because reality is not deterministic but random.

The OpenBUGS software permits us:

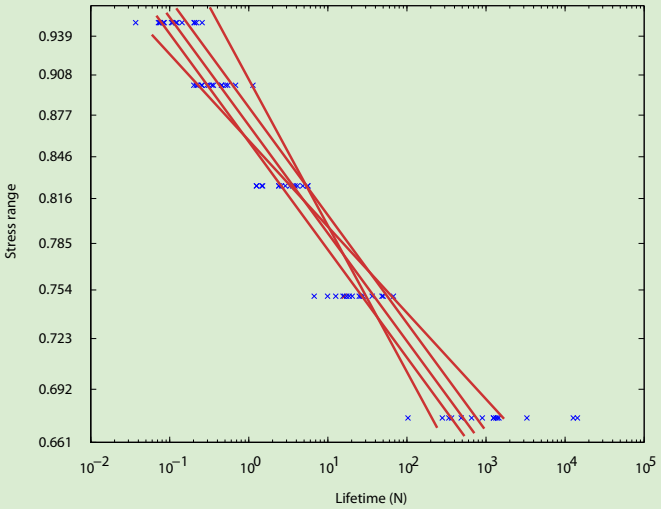
1. **(a) convert deterministic parametric models into random models**
2. **(b) perform Bayesian analysis of random models**.

The OpenBUGS sofware **is especially designed to simulate samples that follow the posterior distribution**.

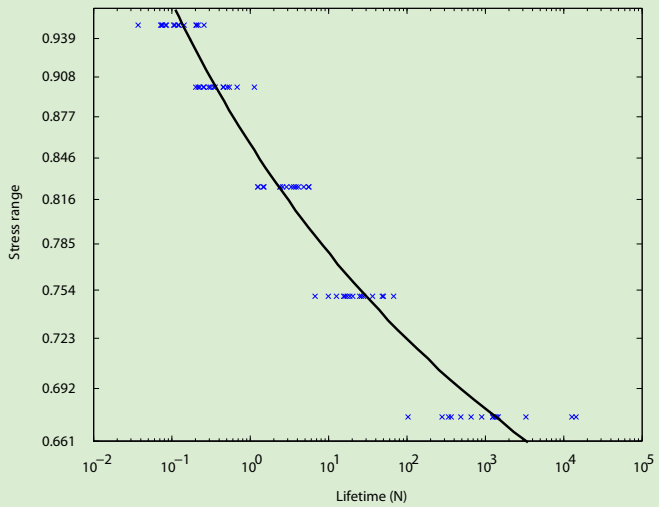
Once we have a set of parametric models and a multi-dimensional sample of the random variable being analyzed, **we can make predictions using the posterior predictive distribution, that will be closer to the real model**.



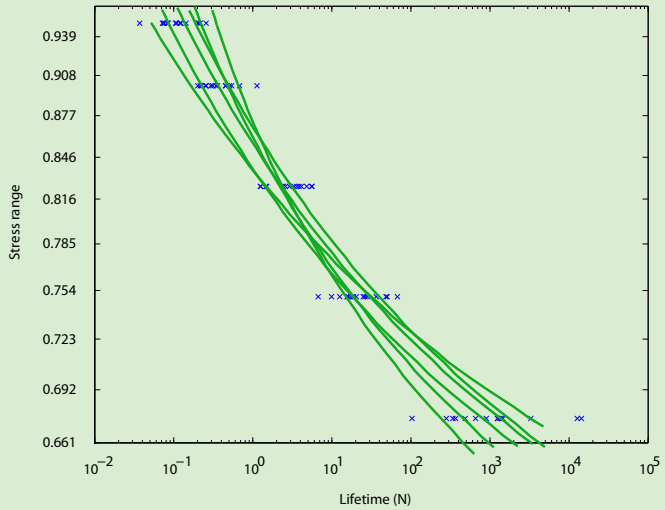
The first model $log(\Delta\sigma) = A + B\ log(N)$ **is deterministic and non-linear but linear in the parameters**.



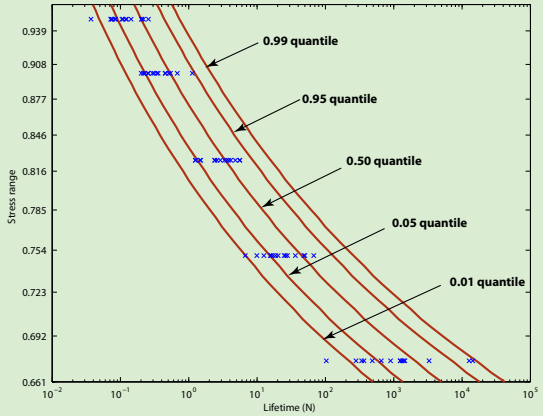
It has two parameters A and B, that **can be converted into random, by considering that the parameters A and B are random, as indicated above**.



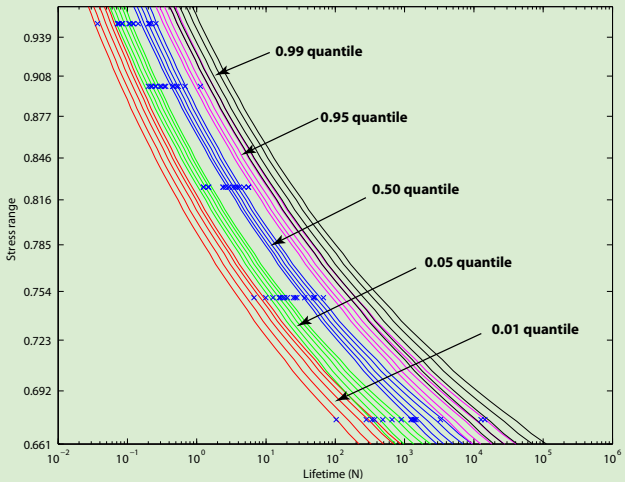
The second model $log(\Delta\sigma) = A + B\ log(N) + Clog(N)^2$ **is deterministic and non-linear but linear in the parameters**. It has three parameters A, B and C, that **can be converted into random**.



It has three parameters A, B and C, that **can be converted to random, by considering that the parameters A, B and C are random, as indicated above**.



The third model **is random non-linear** with cdf $F(N, \Delta\sigma)$:

$$1 - \exp\left\{ - \left(\frac{(log(N) - B)(log(\Delta\sigma) - C) - \lambda}{\delta} \right)^{\beta} \right\}$$

that depends on five parameters B, C, λ, δ and β, that **can be converted to random**. In this case each **percentiles curve generates several percentile new curves, as indicated below**.