CLAIMS

1. A method for estimating a failure probability of one or more devices, comprising:
generating life-time information for each of a plurality of observed devices of a class of devices to which the one or more devices belong;
fitting a statistical model to the life-time information of the plurality of observed devices taking into account insufficient failure data in the life-time information by
setting up a prior distribution for each parameter of the statistical model;
formulating a likelihood function based on the life-time information;
computing a joint posterior distribution of the parameters of the statistical model based on the prior distributions and the likelihood function according to Bayes's theorem;
obtaining values of the parameters of the statistical model;
estimating the failure probability of the one or more devices from the statistical model;
using the failure probability to predict, for each of at least one of the one or more devices, a remaining useful life of the device;
determining confidence bounds for the parameters of the statistical model; and
determining confidence bounds for the remaining useful life from the confidence bounds for the parameters.

2. The method of claim 1, wherein taking into account insufficient failure data in the life-time information comprises taking into account possible left truncation and right censoring of the life-time information.

3. The method of any claim 1 or 2, wherein the failure probability is estimated in terms of a probability density function for the probability of failure depending on device life-time.

4. The method of any one of claims 1 to 3, wherein the failure probability is estimated in terms of a cumulative distribution function for the probability of failure depending on device life-time.

5. The method of any one of claims 1 to 4, comprising using the failure probability to predict, for each of at least one of the devices, the probability that the device fails within a given time period.

6. The method of any one of claims 1 to 5, comprising using the failure probability to predict a number of the devices which fail within a given time period.

7. The method of any one of claims 1 to 6, wherein the life-time information for each observed device includes an indication of the beginning of the life-time of the observed device.

8. The method of any one of claims 1 to 7, wherein the life-time information for each observed device indicates whether the life-time information of the observed device is left-truncated.

9. The method of any one of claims 1 to 8, wherein the life-time information for each observed device indicates whether the observed device has failed up to a final time.

10. The method of claim 9, wherein the plurality of observed devices include at least one observed device that has failed and at least one observed device that is still operating at the final time.

11. The method of claim 9 or 10, wherein the life-time information for each observed device that has failed includes a time of failure of the observed device.

12. The method of any one of claims 1 to 11, wherein obtaining values of the parameters of the statistical model comprises taking the expectation on the joint posterior distribution.

13. The method of claim 12, wherein the likelihood function comprises different terms for the following four types of life-time information: life-time information of observed

devices that have failed without left-truncation, life-time information of observed devices that have failed with left-truncation, life-time information of observed devices that are still operating at the final time without left-truncation and life-time information of observed devices that are still operating at the final time with left-truncation.

14. The method of claim any one of claims 1 to 13, wherein in the likelihood function life-time information of observed devices with truncation is weighed higher than life-time information of observed devices without truncation.

15. The method of any one of claims 1 to 14, wherein in the likelihood function life-time information of each observed device with truncation is weighed the higher the higher the left-truncation time of the life-time information is.

16. The method of any one of claims 1 to 15, wherein in the likelihood function life-time information of each observed device with truncation is weighed by the inverse of the probability, given by the statistical model, that the device has not failed during the left-truncation time.

17. The method of any one of claims 1 to 16, wherein the statistical model is a Weibull distribution.

18. Method for controlling one or more devices comprising estimating failure probability for the one or more devices according to any one of claims 1 to 17 and controlling the one or more devices according to the modelled failure behaviour.

19. A data processing system comprising a communication interface, a memory and a processing unit configured to perform the method of any one of claims 1 to 18.

20. A computer program element comprising program instructions, which, when executed by one or more processors, cause the one or more processors to perform the method of claims 1 to 18.

21. A computer-readable medium comprising program instructions, which, when executed by one or more processors, cause the one or more processors to perform the method of any one of claims 1 to 18.