Formulas *Formules*

Reliability Modelling / Betroubaarheidsmodelering

$$R = \prod_{i=1}^{w} R_i$$

$$R = \sum_{j=k}^{w} \frac{w!}{j!(w-j)!} R_i^j (1-R_i)^{w-j}$$

$$R = 1 - \prod_{i=1}^{w} (1 - R_i)$$

$$R = \left[\sum_{l} \left(\prod_{i} R_i \prod_{j} F_j \right) \right] + \prod_{y=1}^{w} R_y$$

$$R = (1 + \lambda t) e^{-\lambda t}$$

$$I_i = \frac{\partial R_S}{\partial R_i}$$

$$R = 1 - \frac{(-\lambda t)^n e^{-\lambda t}}{n!}$$

$$R = e^{-k\lambda t} \sum_{i=0}^{n-k} \frac{(k\lambda t)^i}{i!}$$

Laplace Trend Test / Tendenstoets

$$U = \frac{\frac{\sum_{i=1}^{r-1} T_i}{r-1} - \frac{T_r}{2}}{T_r \sqrt{\frac{1}{12(r-1)}}}$$

Non-repairable Components / Nie-herstelbare Komponente

$$f_X(x) = \frac{\beta}{\eta} \left(\frac{x}{\eta} \right)^{\beta - 1} \cdot \exp\left(- \left(\frac{x}{\eta} \right)^{\beta} \right)$$

$$R_X(x) = \exp\left(- \left(\frac{x}{\eta} \right)^{\beta} \right)$$

$$F_X(x) = 1 - \exp\left(- \left(\frac{x}{\eta} \right)^{\beta} \right)$$

$$h_X(x) = \frac{\beta}{\eta} \left(\frac{x}{\eta} \right)^{\beta - 1}$$

$$E[X_{r+1} | X_{r+1} \leq X_P] = \frac{\int_x^{X_P} x \cdot f_X(x) dx}{\int_x^{X_P} f_X(x) dx}$$

$$\mu_{r+1} = E[X_{r+1} | X_{r+1} \leq X_P] - x$$

$$E[X_{r+1}] = \frac{\int_0^{\infty} x \cdot f_X(x) dx}{\int_0^{\infty} f_X(x) dx}$$

$$\mu_{r+1} = E[X_{r+1}] - x$$

$$min(\hat{\alpha}_0, \hat{\alpha}_1) : \sum_{i=1}^{r} [E[N(0 \to T_i)] - N(0 \to T_i)]^2$$

$$min(\hat{\alpha}_0, \hat{\alpha}_1) : \sum_{i=1}^{r-1} [E[N(0 \to T_i)] - N(0 \to T_i)]^2$$

$$l_{\rho_1}(\alpha_0, \alpha_1) = r\alpha_0 + \alpha_1 \sum_{i=1}^{r} T_i - \frac{e^{\alpha_0}(e^{\alpha_1 T_r} - 1)}{\alpha_1}$$

$$l_{\rho_1}(\alpha_0, \alpha_1) = r\alpha_0 + \alpha_1 \sum_{i=1}^{r} T_i - \frac{e^{\alpha_0}(e^{\alpha_1 T_r} - 1)}{\alpha_1} - \frac{1}{\alpha_1} \cdot (e^{\alpha_0 + \alpha_1 T_r} - e^{\alpha_0 + \alpha_1 T_{r-1}})$$

$$\rho_1(t) = \exp(\alpha_0 + \alpha_1 t)$$

$$E[N(t_1 \to t_2)] = \frac{1}{\alpha_1}[\exp(\alpha_0 + \alpha_1 t_2) - \exp(\alpha_0 + \alpha_1 t_1)]$$

$$R(t_1 \to t_2) = e^{\frac{-[\exp(\alpha_0 + \alpha_1 t_2) - \exp(\alpha_0 + \alpha_1 t_1)]}{\alpha_1}}$$

$$MTBF_{\rho_1}(t_1 \to t_2) = \frac{\alpha_1(t_2 - t_1)}{\exp(\alpha_0 + \alpha_1 t_2) - \exp(\alpha_0 + \alpha_1 t_1)}$$

$$E[T_{r+1} | t = T_r] = \frac{\ln[(r+1)\alpha_1 + \exp(\alpha_0)] - \alpha_0}{\alpha_1}$$

$$\mu_{r+1} = T_{r+1} - T_r$$

$$min(\hat{\lambda}, \hat{\delta}) : \sum_{i=1}^{r} [E[N(0 \to T_i)] - N(0 \to T_i)]^2$$

$$min(\hat{\lambda}, \hat{\delta}) : \sum_{i=1}^{r-1} [E[0 \to T_i)] - N(0 \to T_i)]^2$$

$$l_{\rho_2}(\lambda, \delta) = r \cdot ln\lambda + r \cdot ln\delta - \lambda \cdot T_r^{\delta} + (\delta - 1) \sum_{i=1}^{r} ln \cdot T_i$$

$$l_{\rho_2}(\lambda, \delta) = r \cdot ln\lambda + r \cdot ln\delta - \lambda \cdot T_r^{\delta} + (\delta - 1) \sum_{i=1}^{r} ln \cdot T_i - \lambda(T_2^{\delta} - T_1^{\delta})$$

$$\rho_2(t) = \lambda\delta t^{\delta - 1}$$

$$E[N(t_1 \to t_2)] = \lambda(t_2^{\delta} - t_1^{\delta})$$

$$R(t_1 \to t_2) = e^{-\lambda(t_2^{\delta} - t_1^{\delta})}$$

$$MTBF_{\rho_1}(t_1 \to t_2) = \frac{(t_2 - t_1)}{\lambda(t_2^{\delta} - t_1^{\delta})}$$

$$E[T_{r+1} | t = T_r] = (\frac{1 + \lambda T_r^{\delta}}{\lambda})^{\frac{1}{\delta}}$$

$$\mu_{r+1} = T_{r+1} - T_r$$

Availability / Beskikbaarheid

$$\lambda = \frac{1}{\mathrm{MTBF}}$$

$$\mu = \frac{1}{MTTR}$$

$$A = \frac{MTBF}{MTBF + MTTR} = \frac{\mu}{\lambda + \mu}$$

$$A(t) = \frac{\mu}{\lambda + \mu} + \frac{\lambda}{\lambda + \mu} e^{-(\lambda + \mu)t}$$

$$A_{Series} = \prod_{i=1}^{w} \frac{\mu_i}{\lambda_i + \mu_i}$$

$$A_{Active} = 1 - \prod_{i=1}^{w} \frac{\lambda_i}{\lambda_i + \mu_i}$$

$$A_{Active,2/3} = 1 - \frac{1}{(\lambda + \mu)^w} \sum_{i=0}^{k-1} \binom{w}{i} \mu^i \lambda^{w-i}$$

$$A_{Standby,2} = \frac{\mu^2 + \mu\lambda}{\mu^2 + \mu\lambda + \lambda^2}$$