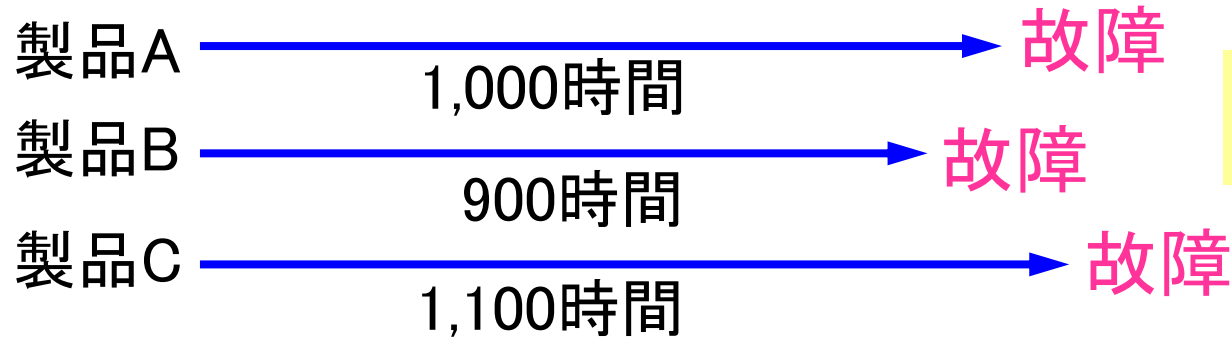


MTTF(故障までの平均時間): **M**ean **T**ime **T**o **F**ailure

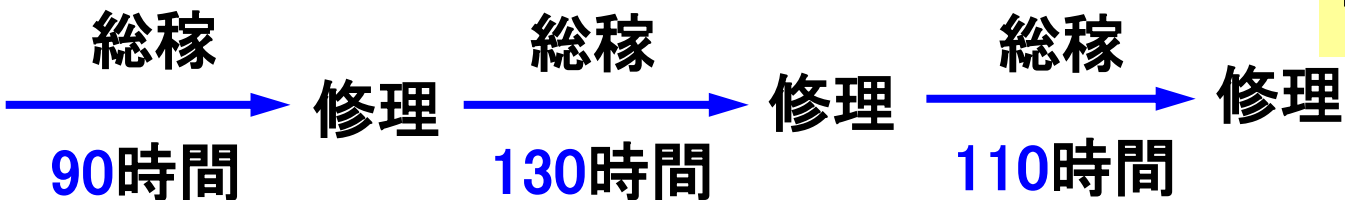
→対象:「修理しない品物」=「使い捨て品」



$$MTTF = \frac{(1,000 + 900 + 1,100)}{3} = 1,000 \text{時間/製品}$$

MTBF(平均故障間隔): **M**ean **T**ime **B**etween **F**ailure(s)

→対象:「修理しながら使用する」



$$MTBF = \frac{(90 + 130 + 110)}{3} = 110 \text{時間/件}$$

平均故障率 $\lambda = \frac{\text{総故障数}}{\text{総稼動時間}}$

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

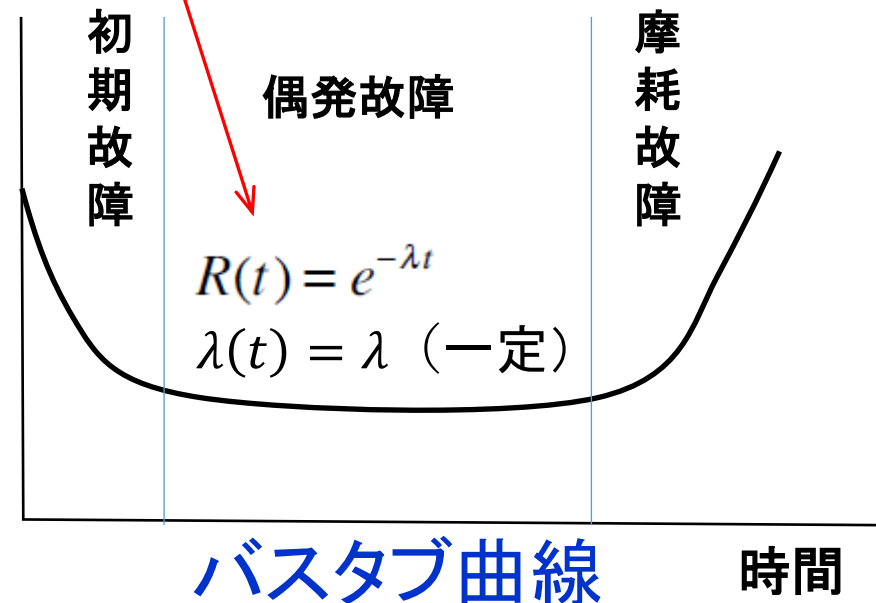
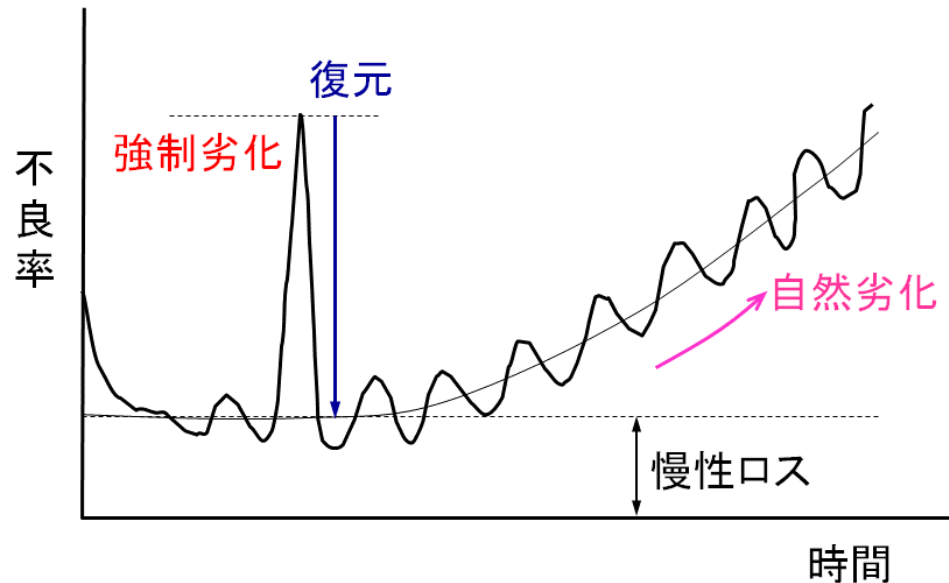
S(t): 総数N個の製品を動作させているときに、時間tの間に正常に動作している数
 F(t): 時間tの間に故障した数

$$N = S(t) + F(t)$$

$$\text{信頼度 } R(t) = \frac{\text{正常品数}}{\text{総数}} = \frac{S(t)}{N} = e^{-\lambda t} \quad F(t) = 1 - R(t)$$

$$\text{故障率 } \lambda(t) = \frac{1}{S(t)} \frac{dF(t)}{dt}$$

1[fit] = 10⁻⁹ [/hour]



$$R(t) = \frac{S(t)}{N} = \frac{\{N - F(t)\}}{N} = 1 - \frac{F(t)}{N}$$

$$\frac{dR(t)}{dt} = -\frac{\frac{dF(t)}{dt}}{N} \Rightarrow \frac{dF(t)}{dt} = -N \frac{dR(t)}{dt}$$

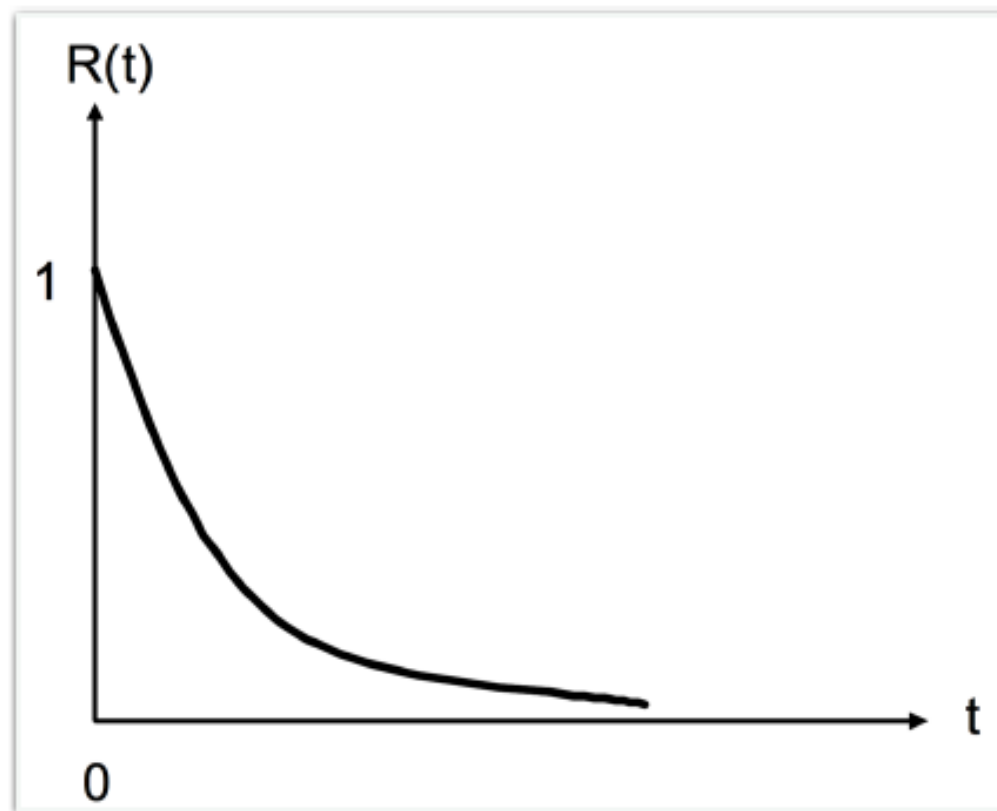
$$\begin{aligned} \lambda &= \frac{1}{S(t)} \frac{dF(t)}{dt} \\ &= -\frac{1}{R(t)} \frac{dR(t)}{dt} \end{aligned}$$

λ が一定であれば,

$$\lambda \int_0^t dt = -\int_1^{R(t)} \frac{1}{R(t)} dR(t)$$

$$\lambda t = -[\log_e R(t)]_1^{R(t)}$$

$$R(t) = \exp(-\lambda t)$$



故障率が一定の場合の信頼度関数

$$\lambda t \ll 1 \text{ であれば } R(t) \doteq 1 - \lambda t$$

$$MTTF = \int_0^{\infty} R(t) dt = \int_0^{\infty} \exp(-\lambda t) dt = [\exp(-\lambda t)/(-\lambda)]_0^{\infty} = 1/\lambda$$