

Jump-point PLP (JPLP)

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Intensity function: The intensity function of a point process is

$$\lambda(t) = \lim_{\Delta t \rightarrow 0} \frac{P(N(t, t + \Delta t] \geq 1)}{\Delta t}$$

When there is no simultaneous events, ROCOF is the same as intensity function.

1 NHPP and PLP

Nonhomogeneous Poisson Process (NHPP): The NHPP is a Poisson process whose intensity function is non-constant.

Power law process (PLP): When the intensity function of a NHPP is:

$$\lambda(t) = \frac{\beta}{\theta} \left(\frac{t}{\theta} \right)^{\beta-1}$$

Where $\beta > 0$ and $\theta > 0$, the process is called the power law process (PLP).

Therefore, the mean function $\Lambda(t)$ is the integral of the intensity function:

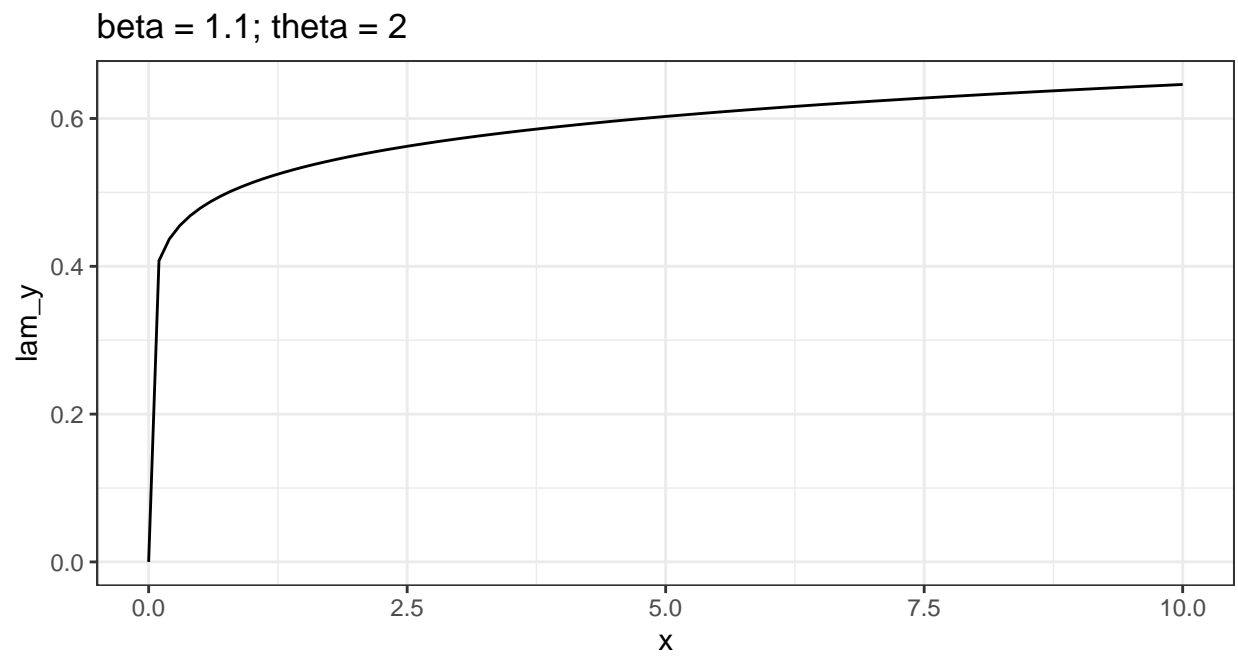
$$\Lambda(t) = \int_0^t \lambda(t) dt = \int_0^t \frac{\beta}{\theta} \left(\frac{t}{\theta} \right)^{\beta-1} = \left(\frac{t}{\theta} \right)^{\beta}$$

```
library(ggplot2)
lambda = function(beta, theta, t) return(beta/theta^beta*t^(beta-1))

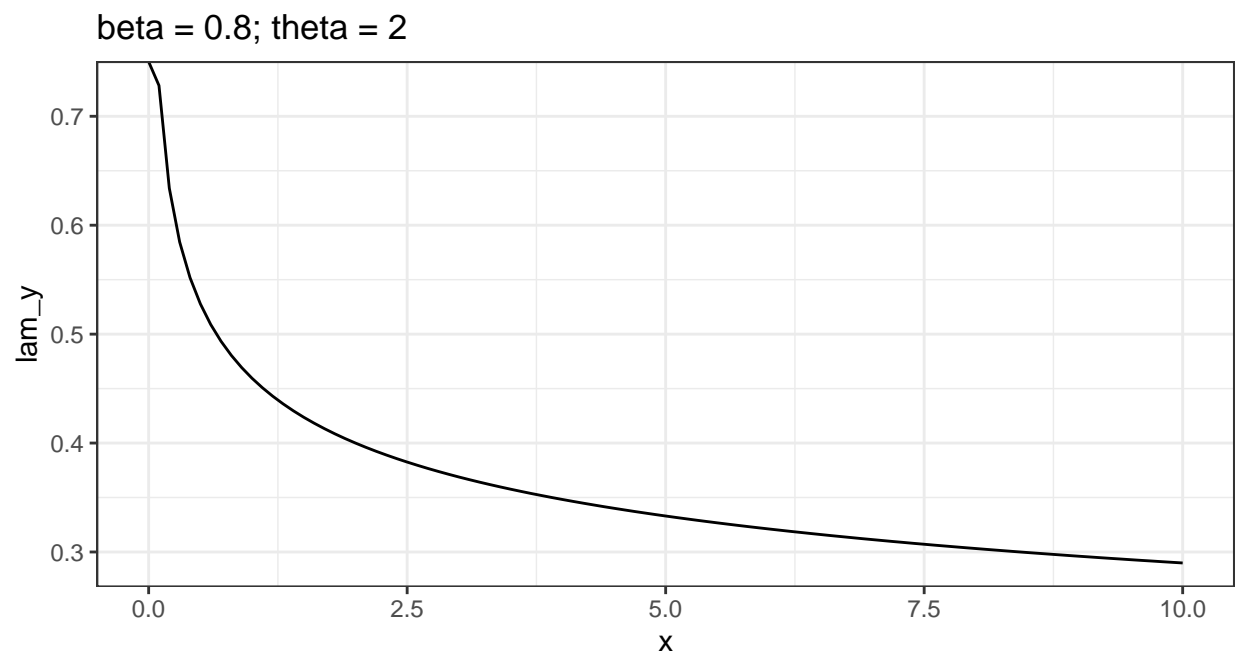
plot_plp = function(beta, theta){
  x = seq(0, 10, 0.1)
  lam_y = lambda(beta, theta, x)
  dat = data.frame(lam_y, x)
  p = ggplot(dat, aes(x, lam_y)) +
    geom_line() + theme_bw() +
    ggtitle(paste0("beta = ", beta, "; theta = ", theta))
  return(p)
```

```
}
```

```
plot_plp(1.1, 2)
```



```
plot_plp(0.8, 2)
```



2 Jump-point PLP (JPLP)

At the time of the failure or rest, the intensity will bounce back at a certain percent κ , and $0 < \kappa < 1$.

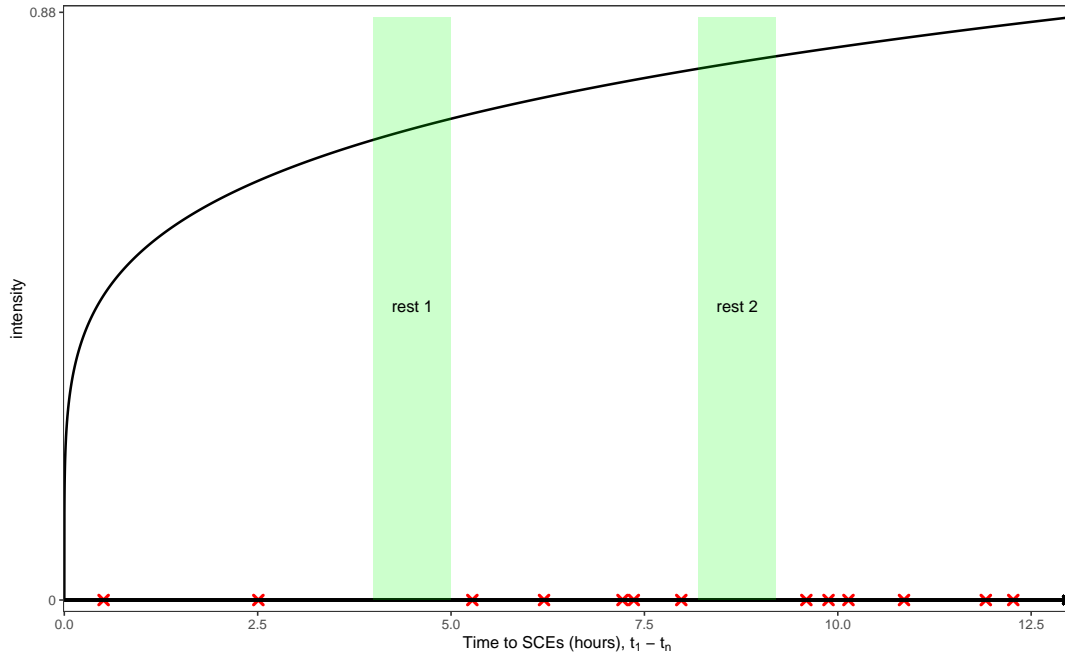


Figure 1: Intensity function, time to SCEs, and rest time within a shift generated from a NHPP with a PLP intensity function, $\beta = 1.2$, $\theta = 2$

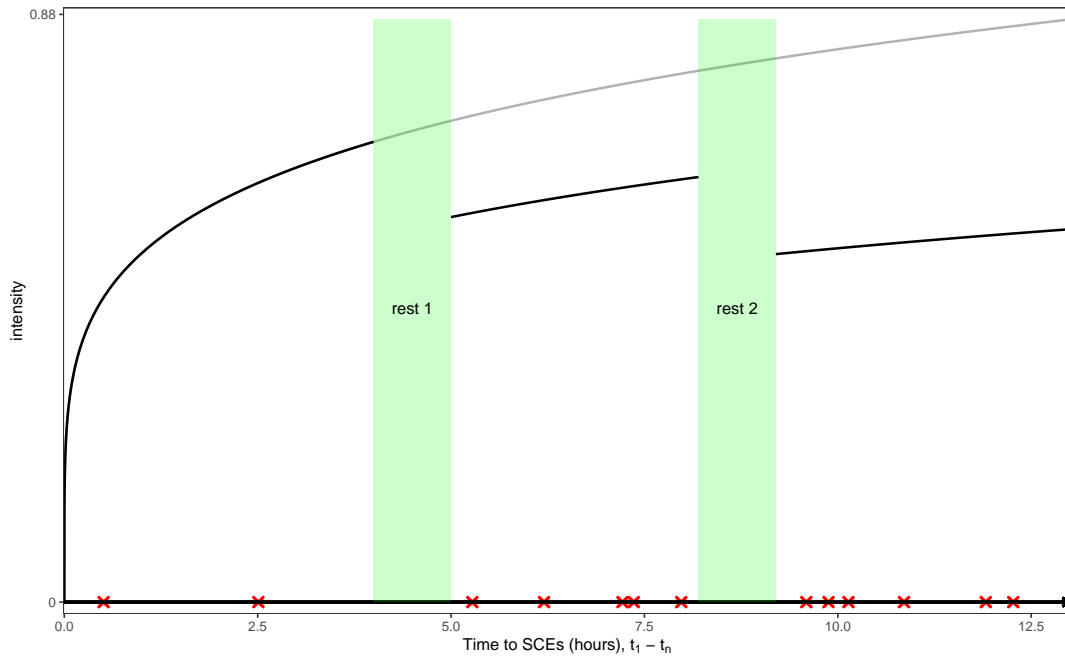


Figure 2: Intensity function, time to SCEs, and rest time within a shift with a jump-point PLP intensity function, $\beta = 1.2$, $\theta = 2$, $\kappa = 0.8$