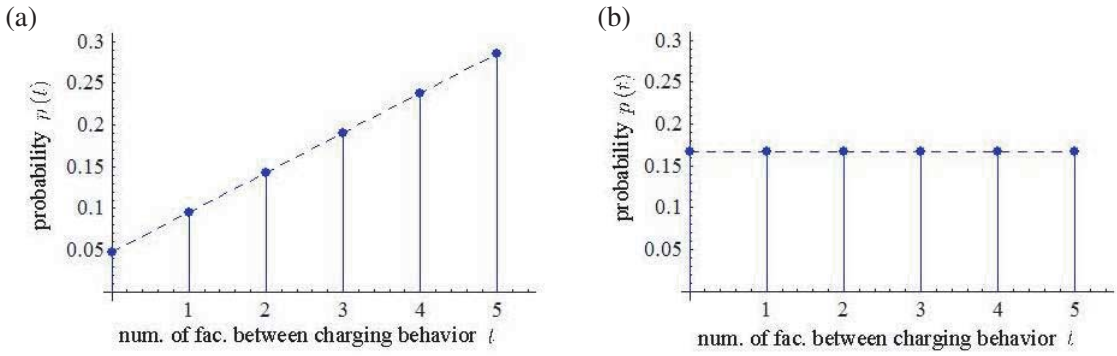


Fig. 3. Examples of $p(t)(T = 6)$. (a) Linear function. (b) Uniform function.

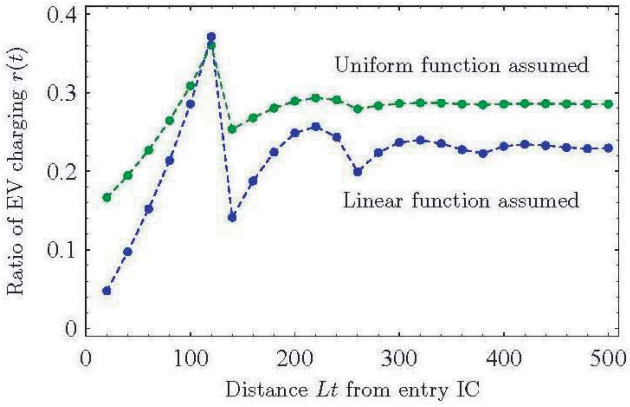


Fig. 4. $r(t)$ according to the various power-feed patterns $p(t)$.

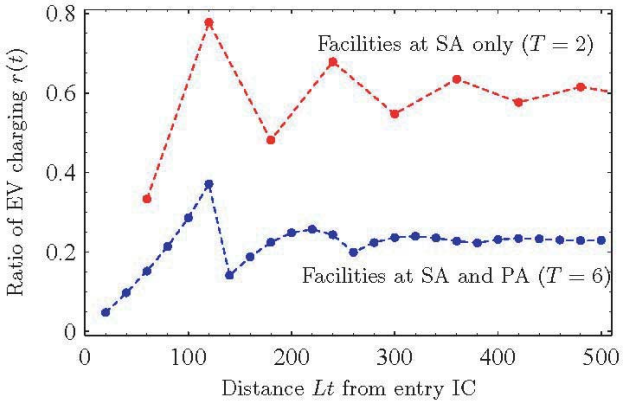


Fig. 5. $r(t)$ at various maximum power-feed intervals $T$.

the following equation is obtained:

$$R(z) = \frac{1}{1 - zP(z)}. \tag{10}$$

Therefore, $r(t)$ to be solved can be derived by calculating $R(z)$ using an inverse $z$ transform:

$$r(t) = Z^{-1}\left[\frac{1}{1 - zP(z)}\right]. \tag{11}$$

### 3.4 Numerical examples

Using the example in Fig. 3, a numerical example is given with $p(t)$ as a linear function,

$$p_L(t) = \begin{cases} \alpha(t+1) & t = 0, \ldots, T-1 \\ 0 & t \geq T, \end{cases} \tag{12}$$

$$\alpha = \left[\sum_{t=0}^{T-1} t + 1\right]^{-1}, \tag{13}$$

and a uniform function,

$$p_U(t) = \begin{cases} \dfrac{1}{T} & t = 0, \ldots, T-1 \\ 0 & t \geq T, \end{cases} \tag{14}$$

where $T - 1$ is the maximum number of facilities that can be skipped with one charge.

If each case is calculated using the $z$ transform, the following equations are obtained:

$$p_L(z) = \frac{\alpha(1 - (T+1)z^T + Tz^{T+1})}{(1-z)^2}, \tag{15}$$

$$p_U(z) = \frac{1 - z^T}{T(1-z)}. \tag{16}$$

Therefore, $r(t)$ can be calculated by substituting these parameters into Eq. (11). However, in such generalization functions, it is difficult to derive the inverse $z$ transform using simple calculations. Therefore, in this research, we used the differential theorem

$$\lim_{z \to 0} \frac{1}{t!} \frac{d^t}{dz^t} F(z) = f(t) \tag{17}$$

for the $z$ transform, and derived the inverse $z$ transform by an analytical calculation using Mathematica (Wolfram, 2013).

Assuming that SAs and PAs are located at intervals of approximately 20 km and the continuous driving range after quick charging is 120 km, $r(t)$ for the linear and uniform functions when $L = 20$ and $T = 6$ are shown in Fig. 4. As is clear from this figure, the first power-feed peak occurs at the continuous driving range limit of 120 km ($T = 6$); at the second and third power-feed peaks, the probability ratio becomes constant. This result indicates that the EV power-feed patterns become more widespread when the facility is