

Package ‘EVchargcost’

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Type Package

Title Computes and Plot the Optimal Charging Strategy for Electric Vehicles

Version 0.1.0

Description The purpose of this library is to compute the optimal charging cost function for a electric vehicle (EV). It is well known that the charging function of a EV is a concave function that can be approximated by a piece-wise linear function, so bigger the state of charge, slower the charging process is. Moreover, the other important function is the one that gives the electricity price. This function is usually step-wise, since depending on the time of the day, the price of the electricity is different. Then, the problem of charging an EV to a certain state of charge is not trivial. This library implements an algorithm to compute the optimal charging cost function, that is, it plots for a given state of charge r (between 0 and 1) the minimum cost we need to pay in order to charge the EV to that state of charge r . The details of the algorithm are described in González-Rodríguez et al (2023) <<https://inria.hal.science/hal-04362876v1>>.

License GPL-3

Language en-US

Imports ggplot2, cowplot

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Encoding UTF-8

NeedsCompilation no

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`minimum_cost`*Computes the minimum cost function*

Description

Function that computes the minimal cost function for a given charging function (given by `a`, `alpha` and `beta`), an electricity price function (given by `delta` and `gamma`), a consumption `tau` and a range `R`

Usage

```
minimum_cost(a, alpha, beta, delta, gamma, tau, R)
```

Arguments

| | |
|--------------------|---|
| <code>a</code> | vector with the breaking points of charging function in the x-axis |
| <code>alpha</code> | vector with the slopes of the charging function on each segment |
| <code>beta</code> | vector with the y-intercepts of the charging function on each segment |
| <code>delta</code> | vector with the times duration of each segment of electricity price function |
| <code>gamma</code> | vector with the prices of the electricity on each segment of electricity price function |
| <code>tau</code> | consumption of the vehicle (numerical value) |
| <code>R</code> | range of the vehicle (numerical value) |

Value

list with the x-values and y-values of the minimum cost function

Examples

```
a <- c(0,3.3,6.6,10)
alpha <- c(0.1757576, 0.07272727, 0.05294118)
beta <- c(0, 0.34, 0.4705882)
delta <- c(4, 3, 5)
gamma <- c(0.45, 0.25, 0.5)
tau <- 0.15
R <- 250
opt_cost_function = minimum_cost(a, alpha, beta, delta, gamma, tau, R)
print(opt_cost_function)
```

| | |
|----------------|--|
| plot_functions | <i>Plots the charging function, the electricity price function and the optimal cost function</i> |
|----------------|--|

Description

Function that plots the charging function, the electricity price function and the optimal cost function

Usage

```
plot_functions(a, alpha, beta, delta, gamma, tau, R, x_values, y_values)
```

Arguments

| | |
|----------|---|
| a | vector with the breaking points of charging function in the x-axis |
| alpha | vector with the slopes of the charging function on each segment |
| beta | vector with the y-intercepts of the charging function on each segment |
| delta | vector with the times duration of each segment of electricity price function |
| gamma | vector with the prices of the electricity on each segment of electricity price function |
| tau | consumption of the vehicle (numerical value) |
| R | range of the vehicle (numerical value) |
| x_values | vector with the x-values of the breaking points of the charging cost function |
| y_values | vector with the y-values of the breaking points of the charging cost function |

Value

A plot with the charging function, the electricity price function and the optimal cost function

Examples

```
a <- c(0,3.3,6.6,10)
alpha <- c(0.1757576, 0.07272727, 0.05294118)
beta <- c(0, 0.34, 0.4705882)
delta <- c(4, 3, 5)
gamma <- c(0.45, 0.25, 0.5)
tau <- 0.15
R <- 250
opt_cost_function = minimum_cost(a, alpha, beta, delta, gamma, tau, R)
xvalues <- opt_cost_function[["xvalues"]]
yvalues <- opt_cost_function[["yvalues"]]
plot_functions(a, alpha, beta, delta, gamma, tau, R, xvalues, yvalues)
```

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