Selected Topics in Mechatronics 0908589

Homework Problems on Basic Kinematics
1st October 2017

1. A building has 10 floors above ground (numbered 1 to 10). Each floor has a height of 4.5 m. The rated speed is 1.6 m/s, the rated acceleration is 1.0 m/s² and the rated jerk is 1.0 m/s³. Answer the following questions:

   a) Is the rated speed attained in one floor journey?
   b) How long does it take to travel one floor? Two floors? Three floors?
   c) What is the starting/stopping tax in this case?
   d) How long would it take the lift to traverse a floor when passing through it at rated speed?
   e) How long does it take to travel between the 2nd and the 10th floors?
   f) How long does it take to travel between the Ground and the 4th floors?

2. A building has 20 floors above the main entrance (numbered 1 to 20). All floors have equal height and each floor has a height of 3.2 m. Assume that the speed is 4 m/s, the rated acceleration is 1 m/s² and the rated jerk is 1 m/s³.

   a. What is the minimum journey length that is required to allow the elevator to attain rated speed?
   b. How long does it take to travel the journey in a. above?

Use the following formula if necessary:

If the following inequality is true:

\[ d \geq \frac{a^2 \cdot v + v^2 \cdot j}{a \cdot j} \]

Where

- \( d \) is the distance to be traversed in m
- \( a \) is the rated acceleration in m/s²
- \( j \) is the rated jerk in m/s³
- \( v \) is the rated speed in m/s

Then the rated speed is attained, and the time required to cover this journey is:

\[ t = \frac{d}{v} + \frac{v}{a} + \frac{a}{j} \]

Where

- \( t \) is time taken to traverse this journey in s