Exercise

Speed Control of a SF-DC Motor for Traction

A DC self excited motor is used to move an ATM tramway vehicle
" *Carelli 1928* " with the following characteristics:

- Line voltage : $600\,V$
- Motor rated speed : $314\,rad/s$
- Efficiency: 0.9 (neglecting excitation losses and iron losses)
- Armature circuit time constant :$10\,ms$
- Excitation circuit rated voltage : $120\,V$
- Excitation circuit rated current : $1\,A$
- Excitation circuit time constant : $1\,s$

The tramway should accelerate from 0 to $60\,km/h$ in $25\,s$. The tramway mass is $10\,T$ and you should consider 200 people as the tramway trainload with a standard weight of $80\,kg$. The friction force is proportional to the speed and at rated speed ($60\,km/h$ or $314\,rad/s$) is 1/3 of traction force.

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ATM project (Milan)

- Find the design parameters of the DC motor according to the data
- Design and simulate speed and current control in order to cover a $10 km$ track considering the Table I characteristics. The slope is $s\% = 100\tan(\theta)$

track	slope %	speed
$0 - 1\,km$	0	$35\,km/h$
$1 - 3\,km$	0	$60\,km/h$
$3 - 4\,km$	$5\,\%$	$60\,km/h$
$4 - 6\,km$	0	$75\,km/h$
$6 - 8\,km$	0	$60\,km/h$
$8 - 9\,km$	$-5\,\%$	$60\,km/h$
$9 - 10\,km$	0	$35\,km/h$