Simulink report



Part 1-Simulink1



We build a system which is made up of 15 solar cells.





Most parameters are given by script.

Block Parameters: Mass	Block Parameters: Gear Box				
	Gear Box				
The block represents an ideal mechanical translational mass. The block has one mechanical translational conserving port. The block positive direction is from its port to the reference point. This means that the inertia force is positive if mass	The block represents an ideal, non-planetary, fixed gear ratio gear box. The gear box is characterized by its only parameter, Gear ratio, which can be positive or negative. Connections S and 0 are mechanical rotational conserving ports associated with the box input and output shaft, respectively. The gear ratio is determined as the ratio of the input cheft environment to that of the current defe				
is accelerated in positive direction. <u>View source for Mass</u>	the ratio of the input shaft angular velocity to that of the output shaft. The block generates torque in positive direction if a positive torque is applied to the input shaft and the ratio is assized a nonsitive value.				
Parameters	View source for Gear Box				
Mass: n kg •	Parameters				
Initial velocity: 0 n/s -	rear ratio: r				
QK <u>Cancel</u> <u>Help</u> <u>Apply</u>	OK Cancel Help Apply				
Block Parameters: DC Motor	Block Parameters: DC Motor				
This block represents the electrical and torque characteristics of a DC motor. This block argumes that no electromagnetic energy i lost, and hence the back-enf and torque constant have the same numerical value when in 31 muits. Moto pramaeters can either be available on armiture inductance, this parameter can be set to some small non-zero value. Mena populing current flows from the electrical + 0 - ports, a portivity or cure are from the mechanical C to K ports. Motor torque direction can be changed by altering the sign of the back- enf or torque constants. Parameters	This block represents the electrical and torque characteristics of a DC notor. The block assumes that no electromagnetic energy is lost, and hence the back-east and torque constants have the same summeric or value when no illumits. Notor parameters can either be available on arrature inductions, this parameter can be set to some small non-zero value. When a positive current flow from the electrical + to - ports, a positive torque actif from the each and the set of				
Electrical arranterization.	Rotor inertia: 4.29				
Arnature resistance: Ra Ohm -	Rotor damping: 1e-8 N*n/(rad/s) •				
Armsture inductance: La nH -	Initial rotor spol: 0 rpm -				
constant: Specity Back-emi constant Back-emi constant: 8.93e-4 V/rm					
OK Cancel Help Apply	QK Cancel Help Apply				
Editor - C:\Users\huang\Documents\MATLAB\SSV_script_2010_2011_g ar_ratio_student.m					
Eile Edit Iext Go Cell Iools Debug Desktop Window Hip T C III & IIIIIIIIIIIIIIIIIIIIIIIIIIIIII					
2 - Ir = 1000; % W/m ² 3 - Isc 0.91; %Mappere 4 - Voce0.6; %Volt 5 - N = 1.5; 6 %M% Motor parameters 7 - Ra = 3.2 ; %ohm 8 - Kt = 6.876e+1 ; %Nm/A 9 - La=0.000222 ; %H 10 - Lm = 4.29e-7 ;% Kg*m ² 2					
11 - Cm = 1e-8 :% N*m/(rad/s) 12 %%% SSV parameter	_				
13 - n =1; % kg					
15 - n = 8.94; % gear ratio	F				
16 17 - tn=[]: %% initialize empty vector 18 - result=[]:	-				
19 20for n=1:20 21 tm=[tn n];	-				
<pre>22 - sim('untitled',10): % Simulate Simulink model for 10 sec.</pre>					
<pre>24 25 - [i, j]=find(yout(:, 2)>14); % find when position of 14 m is achieved</pre>					
26 - if isempty(i) 27 - result =[result 10]: %% if not achieved take time =10 sec					
28 - else					
29 - result=[result tout(i(1))]; %% put travel time in vector 30					
31 - end 32 - end					
33 34 - figure(1)					
	script In 1 Col 1 OVR				
29 - result=[result tout(i(1))]; %% put travel time in vector	IEII 				
30	-				
end 32 - end					
33 34 - figure(1)					
35 - plot(tn, result, '*') %% plot gear ratio versus travel time					
so - topy, ij-mintrebuit/, www.iinka minimai travel time					
38 - n=tn(i): %% take gear ratio corresponding with minimal travel time 39 - sim('untitled',10);					
40					
42	-				

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The result Displacement:



From this diagram, we can see that when the dispalcement is 14 meters. The time is nearly 5.8 secons.

Velocity:



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Through this , we can see that the time is the smallest when the gear ratio is 11. So after that we will select this gear ratio, when we made the gear box.

Part 2-simulink 2



simulink2--structure i

This is the structure of our simulink 2 which is to measure the distance when we make the SSV go from 1 meter up the ramp used in the race, which is the distance not the height, without any propulsion, motor and



solar panel.

Now we will explain our design.

1. Air resistance



 $\ensuremath{\mathsf{F}_{\mathsf{cn}}}$ is the resistance which comes from air.

Air resistance (no wind):

 $F_{w} = \frac{1}{2} \cdot C_{w} \cdot A \cdot \rho \cdot v^{2}$

This is the function to calculate the air resistance.

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🙀 Function Block Parameters: Fcn						
Fcn General expression block. Use "u" as the input variable name. Example: sin(u(1)*exp(2.3*(-u(2))))						
- Parameters Expression:						
-0.5*0.47*3.14*0.04^2*1.29*u^2						
Sample time (-1 for inherited):						
-1						
<u>QK</u> <u>Cancel H</u> elp <u>Apply</u>						

In our function of $F_{cn,}$

 C_w =0.47; A=3.14*0.04^2; ρ =1.29

2. Ramp



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This switch is used to control the ramp's distance. When the s(the displacement) is shorter than 1 meter(on the slope or ramp)the F the

SSV get (expect the air resistance) is:

 $F{=}m^{*}g^{*}sin\theta$ ${-}C_{\rm rr}^{*}m^{*}g^{*}cos\theta$;

In our condition m=1kg; g=9.81m/s^2; θ =3, so we get the F=0.4155N





🙀 Source Block Parameters: Constant	X							
Constant								
Output the constant specified by the 'Constant value' parameter. 'Constant value' is a vector and 'Interpret vector parameters as on, treat the constant value as a 1-D array. Otherwise, output a p with the same dimensions as the constant value.	If 1−D'is matrix							
Main Jenal Attributes								
Constant value:								
0.4155								
🗹 Interpret vector parameters as 1-D								
Sampling mode: Sample based	-							
Sample time:								
inf								
OK Cancel	Help							

3. Velocity

We use this switch to control the velocity. Because when our SSV gets on the flat, the SSV only gets the resistance when the V>0m/s. So we use the switch to change the force to 0N when the V<0m/s.





4. The result of our simulink

1) The s(displacement)



In this diagram, we can get the displacement increases from 0 when t=0s,

and stops at 5.2m when t=11.5s.

2) The v(velocity)

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We find that the velocity is increasing from 0m/s to 0.9m/s,during the t from 0s to 2.2s,because of the gravity. And then is decreasing from 0.9m/s to 0m/s,during the t form 2.2s to 11.4s because of the resistance.

3) The F(force)



The force is 0.4155N during t=0s to t=2.2s, and then it changes to

0.0981N(the Fcn is so small) from t=2.2s till t=11.4s.