

More Arrays and the setAttitudeTarget Function







- In this tutorial you will:
 - Practice using arrays in programming
 - Learn about a new SPHERES control function:

api.setAttitudeTarget—allows you to rotate the satellite to face in whatever direction you want.









- A thruster is used to propel (move) the SPHERES satellite in a certain direction.
- There are 12 thrusters on each SPHERES satellite to help it move in 12 different directions.
 - 3 of the 12 thrusters are visible in the photo to the right.
- How does this work?
 - A tank of carbon dioxide (CO₂) gas is attached to the SPHERES satellite.
 - Each thruster releases CO₂ from the SPHERES satellite, creating a force on the satellite in the opposite direction.
- Multiple thrusters on different sides are activated to rotate the satellite to a specified pointing direction











Aurora





- Are you ready to write a program to rotate a satellite (control satellite attitude)?
- When you set the **position** of the SPHERES satellite, you created an array of 3 values {x,y,z}.
- To rotate (control the attitude) of the SPHERES satellite you will also need an array of 3 values {Nx,Ny,Nz}.
- Remember what you learned about arrays before?
- Okay, let's get started





EDC Learning transforms lives.















- Select light blue "ZR IDE" SPHERES icon on top ribbon
- Select "New Project"
 - Project Name: Project 2
 - Game: FreeMode
 - Editor: Text Editor
- Declare an array called "attitude" to store the attitude of the SPHERES satellite
 - Go to the area before void init() to declare the array.
 - Recall that the type will be float, and that the length will be 3 variables.

1 2	<pre>//Declare any variables shar float attitude[3];</pre>	red bet
- 5	vola init() {	
4	//This function is called	once w
5		
6	//IMPORTANT: make sure to	set ar
7	//Do not assume variables	will b
8		
9		
10	}	
11		
12	void loop(){	
13	//This function is called	once r
14		once p
15	J	
ТĴ		



















- Go to void init() and assign every element of the array a value corresponding to the coordinates (1,0,0) (Remember, the first element has the index 0, not 1).
- Don't forget the semicolons!









- The SPHERES Control Function setAttitudeTarget allows you to set the direction in which the satellite's Velcro (-X) face points.
- Attitude specifies a pointing **direction** (Nx, Ny, Nz), not a pointing **location**.
- Commanding an attitude target makes the satellite fire thrusters to rotate to the target direction, then stop.









- The setAttitudeTarget control can be applied in the same manner as the setPositionTarget control.
- Go to void loop(), and put in api.setAttitudeTarget. Again, to designate which array the control will be applied to, put attitude within parenthesis and end with a semicolon.







Compile, Simulate



- Compile, Simulate
- In the Simulation window:
 - Change "Maximum Time" setting to <u>20</u> seconds
 - Click "Simulate"
- a "Running" window pop up while the simulation is being constructed

	Zer	ro Robot	ics A	bout ZR -	Tourna	ררו		
	File -	Edit -	Simula	ite - He	lp -			
	Pages		Comp Code:	oile size Estima	SPHI te	E		
	Log		Simul	ate e	Varia Logic	b		
	Type h	ere and pr	Subm	it	Math Loop	S		
Zero Hobotics About ZR - Tournaments - IDE - Resources - Simulate X								
Simulate As	 Satellite (E No Opponent 	ilue) O Satell	ite 2 (Red)					
Maximum Time (s)	20	Select]	
Initial Position	x	Y	z	AttX	AttY	AttZ		
Satellite 1	0	0.5	0	0	1	0		
Satellite 2	0	-0.5	0	0	-1	0		
Reset All								
					Cancel	Simulate		

















View Simulation



- Before playing the simulation
 - Click on the zoom-in tool at the bottom of the screen 10 times
- Start the simulation
 - The visible face on the SPHERES satellite will change as the satellite rotates to point in the positive x direction.
 - Look at the scoring box (topleft corner of the screen with blue label) which provides information about the blue SPHERES satellite:
 - Started at Ny = 1.00 Ended at Nx = 1.00



y = 1.00 (pointing in positive y direction) x = 1.00 (pointing in positive x direction)







EDC Learning transforms lives.









- Close the Simulation Window
- Return to the Text Editor page
- Next try pointing in the negative x direction
- Change: "attitude[0] = 1" to:

"attitude[0] = -1"

• Important Notes:

For these exercises, point the satellite by setting only one of the values [0], [1], [2] to +/-1 and leave the rest set to 0 as shown in the table.

 "Quick Compile" and "Simulate" as before

DECTATE ANY AUTIONTED DUGLER NELMEEU TRUCTIOUD UETE float attitude[3]; void init() { //This function is called once when your code is first loa //IMPORTANT: make sure to set any variables that need an i //Do not assume variables will be set to 0 automatically! attitude[0]=-1; 10 attitude[1]=0; attitude[2]=0; 13 14 void loop() { //This function is called once per second. Use it to cont 17 api.setAttitudeTarget(attitude);

directions:							
	+/- x direction	+/- y direction	+/- z direction				
set [0] =	+/-1	0	0				
set [1] =	0	+/-1	0				
set [2] =	0	0	+/-1				

Aurora

• "Run"





EDC Learning transforms lives,







- Congratulations!
- You are getting good at programming with arrays!
- You know how to program a SPHERES satellite to rotate and point in a specific direction!
- Note: the tutorial "setAttitudeTarget revisited" teaches rotation in 3 dimensions.



