5. HW O: Pendulum Simulation	
(1) How do we simulate	(1) (1) create "Geometry" node and step inside it.
a pendulum in Houdini!	and step inside it.
D How do we simulate a pendulum in Houdini? Provide all the steps.	·
	(ii) Create "Add" node. In
(1) Geometry	the "Parameter Editor" (P.E.)
	(ii) Create "Add" node. In the "Parameter Editor" (P.E.) window, add one point. This places a point at
(ii) Add (point)	This places a point at
•	the origin.
(111) Null (parameters)	(iii) Create "Null" node. In P.E. window, click "Gear"
	P.E. window, click "Gear
	icon and choose Edit Parameter
Add Parameters	Interface ". Choose "Float"
Agrical Constitution of the Constitution of th	from left column and click
	right arrow 3 times to add
	3 new parameters.
	· · · · · · · · · · · · · · · · · · ·
	Tout parameter
	First parameter - Name: theta O - Label: initial angle
	Label Mittal angle
	- Range: -3.14: 3.14
	Second parameter
	- Name: VO
	- Label: initial velocity
	- Label: initial velocity - Range: -1:1
	, in the second
	Third parameter
	- Name: dt
	- Label: time step
	- Label: time step - Range: 0:1
	-
	Rename the node "Parameters".
(IV) Point Wrangle (state)	(iv) Add "Point Wrangle" node and connect it to "Add" node.
J	and connect it to "Add" node.
1	We'll use the point in "Add" to
Add Parameters	represent the state as follows.
	•
Point wrangle	Introduce new attributes by
wrangle	adding the following code to
	Point Wrangle node's
	VEX pression editor window.
	£@u
	f@theta = ch (" / Parameters / theta0");
	$f \otimes v = ch("/parameters/v0");$ $f \otimes dt = ch("/parameters/dt");$
	O-Gprey = V
	5 f@theta_prev = @theta-@dt *@v;

	T
	To ensure that the parameters
	are "channelled", open a Geometry spreadsheet (with the "Point Wrangle" node open). Then, click the "Pin" icon in the apper
	Geometry spread sheet (with the
	roint wrangle hode open). Then,
	click the Pin icon in the apper
	right to pin the spreadsheet. Then, select the "Parameters" node and adjust the parameter values to verify that the values in the Geometry Spreadsheet get updated. Be sure to unpin the Geometry
	Then, select the ranameters node
	and adjust the politimeter
	values to verity that the
	Canadalah at Ital Ba
	spreadsheet get updated be
	sure to unpin the beometry
	spreadsneet better moving of
	to the next step.
(v) Tube (rod)	(V) Create "Tube" node.
	CLASSO DESTINATION
	Choose Primitive Type to be "Polygon". Choose Scale = 0.006, Center = (0,-0.5,0).
	be Polygon Choose
(vi) Sphere (mass)	(vi) Add "Sphere" node. Choose "Polygon" for Primitive Type. Choose Frequency = 10, Uniform Scale = 0.05, Center = (0,-1,0)
phere (mouse)	Class 's plete hode.
	house Polygon for
	Francisco La Chouse
	rrequency = 10, Unitorm Scale = 0.03,
	center = (0, -1, 0)

Connect Sphere and Take to Merge This is what we have so far: sphere tube Add Parameters werge PENDULUM PARAMETERS SHAPE (VIII) Create "Copy to Points" node Connect Merge and Paint Wrangle to this new
sphere tube Add Parameters merge Point wrangle PENDULUM PARAMETERS SHAPE (VIII) Create "Copy to Points" node Connect Merge and Paint Wrangle to this new
sphere tube Add Parameters merge Parameters PENDULUM PARAMETERS SHAPE (VIII) Create "Copy to Points" node Connect Merge and Paint Wrangle to this new
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node Connect Merge and Point Wrangle to this new
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node Connect Merge and Point Wrangle to this new
Point Wrangle to this new
node in order to copy
the pendulum geometry fo
the pendulum geometry fo wherever the point is.
r
(ix) Give the pendulum acometry
(ix) Give the pendulum geometry a proper orientation after
it's transformed to the
point. To do this, add a "Point Wrangle #2"
a roint wrangle " a
node in between the
"Copy to Points" and "Point wrongle" nodes. Add a
wrongle nodes. Add a
quaternion to the
VEXpression as follows:
p@orient = quaternion(f@theta, {0,0,1})
angle axis
(x) Fibally up aling to
(x) Finally, we animate
The pendition motion
by Changing the Ta
according to some time-
stepping update. 10 see
KK4 implementation, go
to timestamp [1:48:50]
(x) Finally, we animate the pendulum motion by changing theta according to some time- stepping update. To see RK4 implementation, go to timestamp [1:48:50] in Lecture 1 recording.
To do this, we add a "solver"
add a Solver
node in between the two point wrangle
Taxa Dair Sharahan
Two point wrangle
nodes.
nodes.

(x) Solver contin					
- point wrangle		Dive into the Solver			
, , , , , , , , , , , , , , , , , , , ,	and connect Prev-frame				
		and connect Prove frame to a "Point Wrangle" node. Add your time— stepping scheme in this node.			
		ahimation slower. A value			
		of dt = 0.1 looks pretty			
		realistic. Note: the exported video			
	will run a bit faster than that.				
	This is the final product:				
	Capy to poin	mere mere		Point wrongle Solver Point wrongle # 2	
			Prev_frame		
			Prev_frame Point Wrangle		
			Point Wrangle		
			Point Wrangle		
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