SPCRJointDynamics

A bone physics engine for cloth.

Overview

Do you want to simulate cloth in your game with physics? Then this is the plugin for you.
SPCRJointDynamics requires a basic bone setup, and you are good to go.
Support for Unity Engine 2018.2.0f1 and above.

License

- MIT License

Purpose of development

There was a requirement in one of our games that the skirt of the character should perfectly interact with the character's movement.
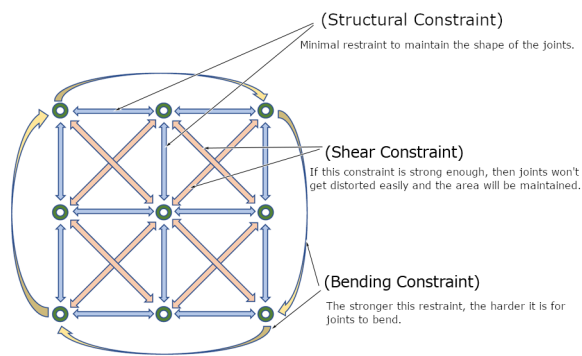
UE4 plugin

Try Unreal engine 4 Plugin: https://github.com/SPARK-inc/SPCRJointDynamicsUE4
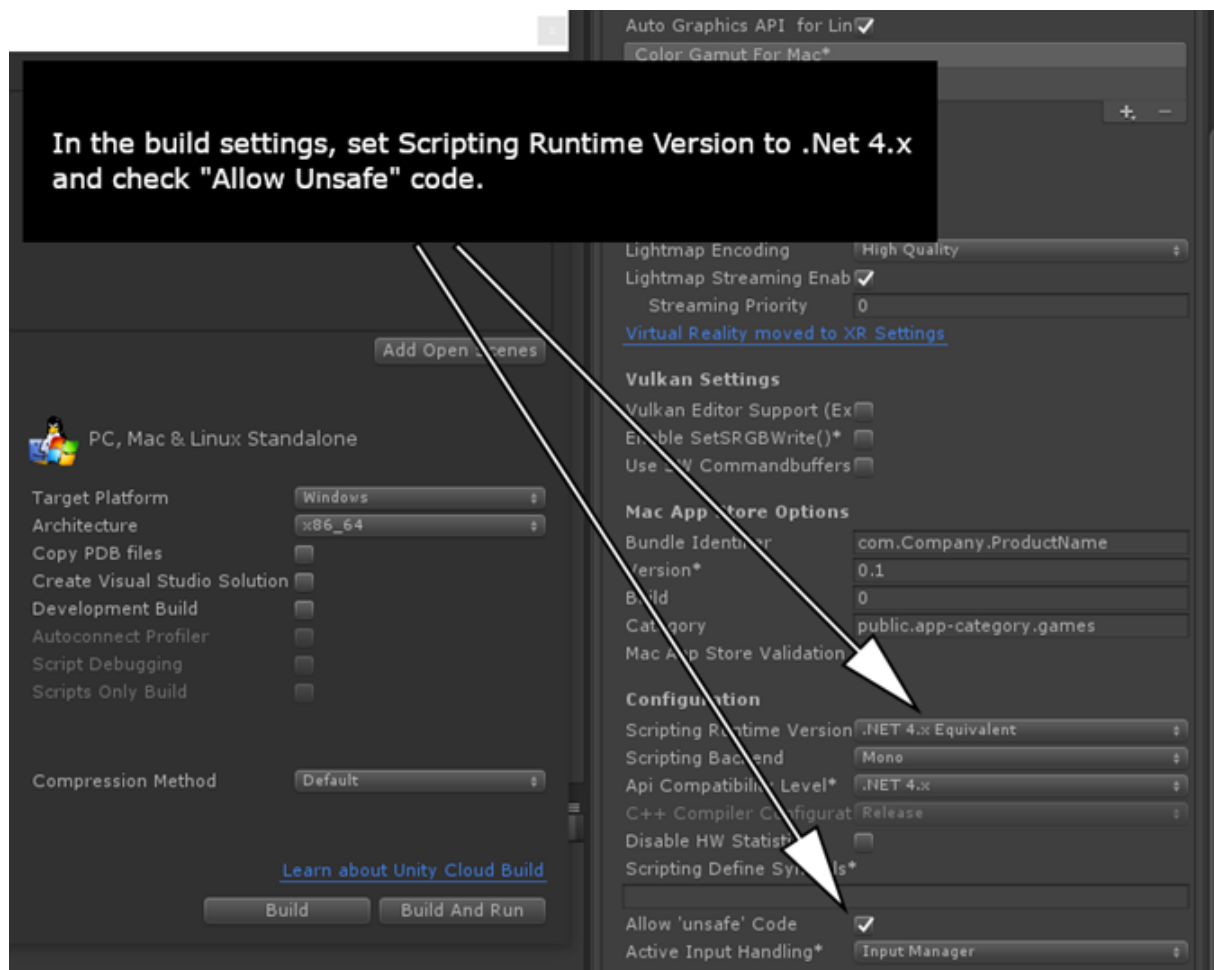
Specifications

SPCRJointDynamics uses cross simulation algorithm (mass-spring-damper model) to animate the bones in real-time. For direct use for skirts and hairs, we mainly focused on the overall appearance rather than the physically accurate behaviors.

Since adding bones is still a manual process in most 3D software, and therefore bones are not always correctly aligned. To overcome this issue, we made a constraint base plugin.

Each constraint.

(Structural Constraint)
Minimal restraint to maintain the shape of the joints.

(Shear Constraint)
If this constraint is strong enough, then joints won't get distorted easily and the area will be maintained.

(Bending Constraint)
The stronger this restraint, the harder it is for joints to bend.

Advance Preparation

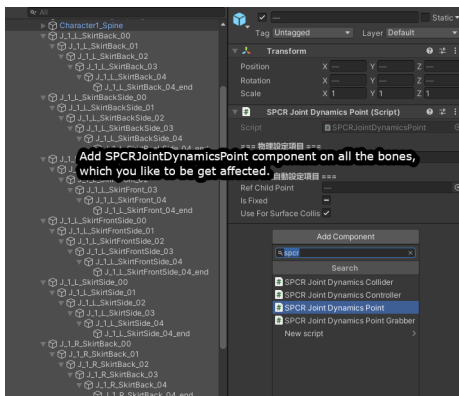Set scripting runtime version to .Net 4 and check the allow unsafe code.

When using the package manager

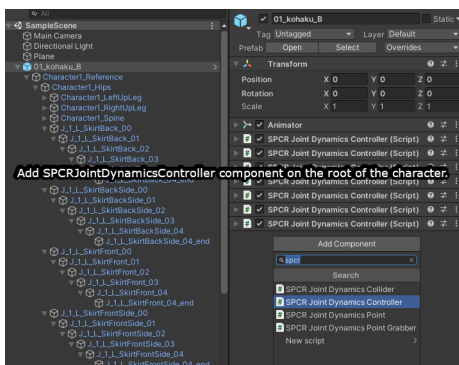URL:https://github.com/SPARK-inc/SPCRJointDynamics.git?path=unity/Packages/SPCRJointDynamics
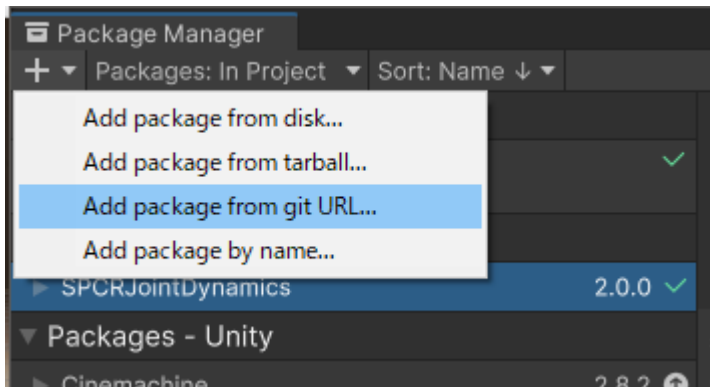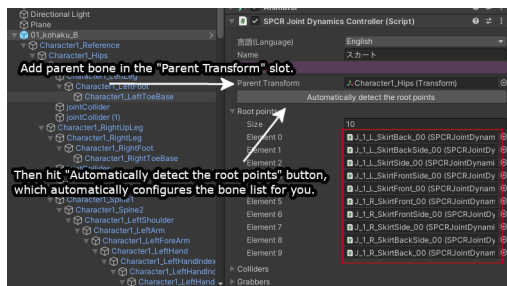
How to use

Add SPCRJointDynamicsPoint component on all the child / hierarchical bones, which you would like to be get affected.

Then add SPCRJointDynamicsController component on the root of the character.

Set the parent transform bone in the Parent Transform slot.

Now press the [Automatically detect the root points] button, which automatically configures the child bone list, and adds the root bones to the Root Points list.

(Which you can see in the red box in the above image)
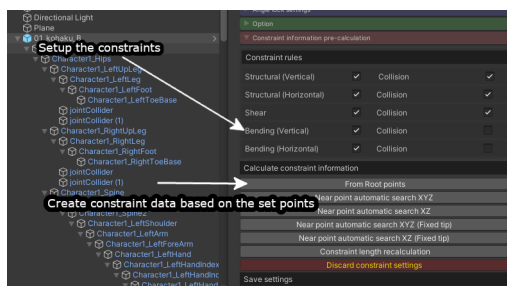
In the [Constraints information pre-calculation] section, some predefined constraint presets are available to use.

Here is a simple explanation of those constraints.

Structural vertical → creates vertical bone constraints.

Structural horizontal → creates horizontal bone constraints.

Shear → Creates diagonal bone constraints.

Bending vertical → This will create constraints with every alternate bone in the vertical list.

(Ex. ABC → Bending Vertical [A→C])

Bending Horizontal → This will create constraints with every alternate bone in the horizontal list.

(Ex. ABC → Bending Horizontal [A→C])

From Root Points → Update/Apply selected preset.

Near point automatic search XYZ → Rearrange the points by distance and updates/applies selected preset.

Near point automatic search XZ → Rearrange the points by distance, ignoring the Y-axis, and update/apply selected preset.

Near point automatic search XYZ (Fixed UP) → Rearrange the points by distance, the first and last bones are fixed. Then updates/applies selected preset.

Near point automatic search XZ (Fixed UP) → Rearrange the points by distance by ignoring the Y-axis, the first and last bones are fixed. Then updates/applies selected preset.

Constraint length calculation → Recalculates and updates the restraint length. This option is useful when you move the game object in the Hierarchy.

Adding a collider

SPCRJointDynamics engine uses a special collider component to work with. Please note that this collider is different from Unity's built-in collider.

1. Create a new game object in the scene.

2. Add SPCRJointDynamicsCollider component, by clicking on the Add Component button.
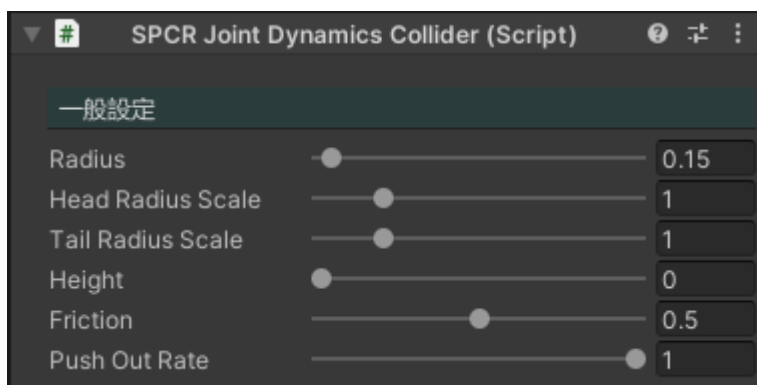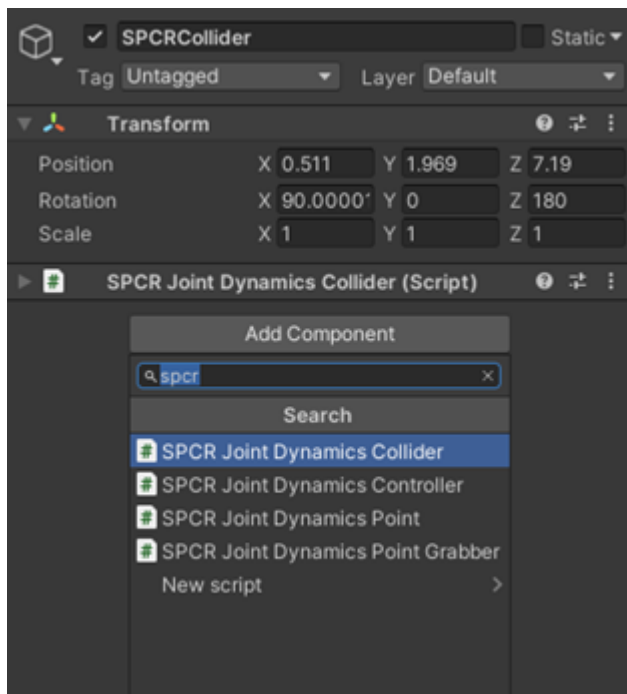
There are two types of colliders SPCRJointDynamicsCollider is having, sphere collider and capsule

collider.

You can interchange the sphere collider with the capsule collider and vice versa by using the height of the collider.

If the height is 0 then SPCRJointDynamics treats it as a sphere collider, and if the height is more than 0 then it will be treated as a capsule collider.

Now select the main game object on which SPCRJointDynamicsController is attached, then add the collider in the collider array.

SPCR Joint Dynamics Controller (Script)

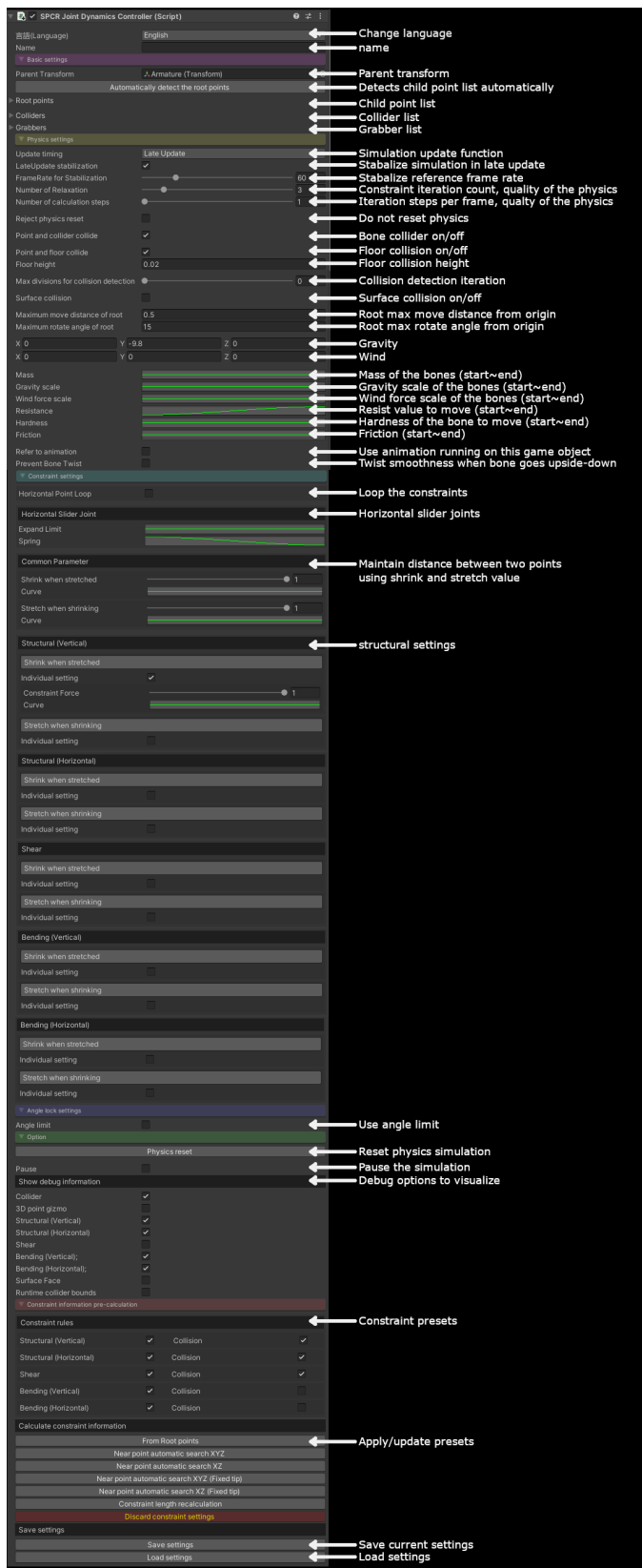| Field	Value	Annotation
言語(Language)	English	Change language
Name		name
Basic settings		
Parent Transform	♪ Armature (Transform)	Parent transform
Automatically detect the root points		Detects child point list automatically
Root points		Child point list
Colliders		Collider list
Grabbers		Grabber list
Physics settings		
Update timing	Late Update	Simulation update function
LateUpdate stabilization	✓	Stabalize simulation in late update
FrameRate for Stabilization	60	Stabalize reference frame rate
Number of Relaxation	3	Constraint iteration count, quality of the physics
Number of calculation steps	1	Iteration steps per frame, quality of the physics
Reject physics reset		Do not reset physics
Point and collider collide	✓	Bone collider on/off
Point and floor collide	✓	Floor collision on/off
Floor height	0.02	Floor collision height
Max divisions for collision detection	0	Collision detection iteration
Surface collision		Surface collision on/off
Maximum move distance of root	0.5	Root max move distance from origin
Maximum rotate angle of root	15	Root max rotate angle from origin
X 0 Y -9.8 Z 0		Gravity
X 0 Y 0 Z 0		Wind
Mass		Mass of the bones (start~end)
Gravity scale		Gravity scale of the bones (start~end)
Wind force scale		Wind force scale of the bones (start~end)
Resistance		Resist value to move (start~end)
Hardness		Hardness of the bone to move (start~end)
Friction		Friction (start~end)
Refer to animation		Use animation running on this game object
Prevent Bone Twist		Twist smoothness when bone goes upside-down
Constraint settings		
Horizontal Point Loop		Loop the constraints
Horizontal Slider Joint		Horizontal slider joints
Expand Limit		
Spring		
Common Parameter		Maintain distance between two points using shrink and stretch value
Shrink when stretched	1	
Curve		
Stretch when shrinking	1	
Curve		
Structural (Vertical)		structural settings
Shrink when stretched		
Individual setting	✓	
Constraint Force	1	
Curve		
Stretch when shrinking		
Individual setting		
Structural (Horizontal)		
Shrink when stretched		
Individual setting		
Stretch when shrinking		
Individual setting		
Shear		
Shrink when stretched		
Individual setting		
Stretch when shrinking		
Individual setting		
Bending (Vertical)		
Shrink when stretched		
Individual setting		
Stretch when shrinking		
Individual setting		
Bending (Horizontal)		
Shrink when stretched		
Individual setting		
Stretch when shrinking		
Individual setting		
Angle lock settings		
Angle limit		Use angle limit
Option		
Physics reset		Reset physics simulation
Pause		Pause the simulation
Show debug information		Debug options to visualize
Collider	✓	
3D point gizmo		
Structural (Vertical)	✓	
Structural (Horizontal)	✓	
Shear		
Bending (Vertical)	✓	
Bending (Horizontal);	✓	
Surface Face		
Runtime collider bounds		
Constraint information pre-calculation		
Constraint rules		Constraint presets
Structural (Vertical)	✓ Collision	✓
Structural (Horizontal)	✓ Collision	✓
Shear	✓ Collision	✓
Bending (Vertical)	✓ Collision	
Bending (Horizontal)	✓ Collision	
Calculate constraint information		
From Root points		Apply/update presets
Near point automatic search XYZ		
Near point automatic search XZ		
Near point automatic search XYZ (Fixed tip)		
Near point automatic search XZ (Fixed tip)		
Constraint length recalculation		
Discard constraint settings		
Save settings		
Save settings		Save current settings
Load settings		Load settings

Enjoy!!!

Also, if you have some issues, feel free to add them in the issues section.