

CSC 473 Assignment #2 - Animator Controlled Curves

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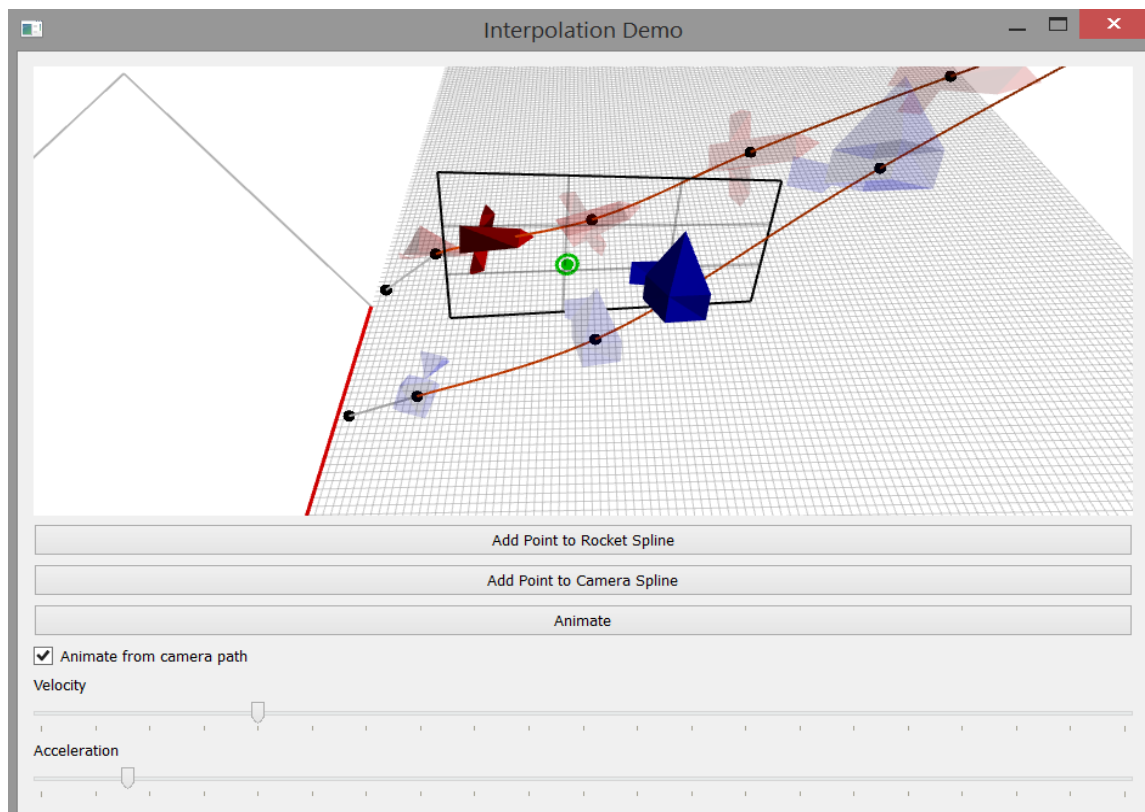
This program animates a space rocket and camera moving along animator controlled curves in 3D space. The animator is able to interactively control acceleration, velocity, and position along the path as well as orientation.

User Interface

The animator adds keyframe frame nodes to the curves by clicking the “Add point to Rocket Spline” and “Add Point to Camera Spline” buttons. Nodes are added to the end of the corresponding curve at a position near the last node on the curve.

The animator can view the animation from either the view in the editing window or from the view of the camera curve. Clicking the “Animate” button starts the animation. Any mouse input or keyboard input during the animation will stop the animation and take the user back to the editing window.

The velocity slider controls the maximum velocity of the rocket ship. The acceleration slider controls how fast the rocket accelerates to it's maximum velocity.



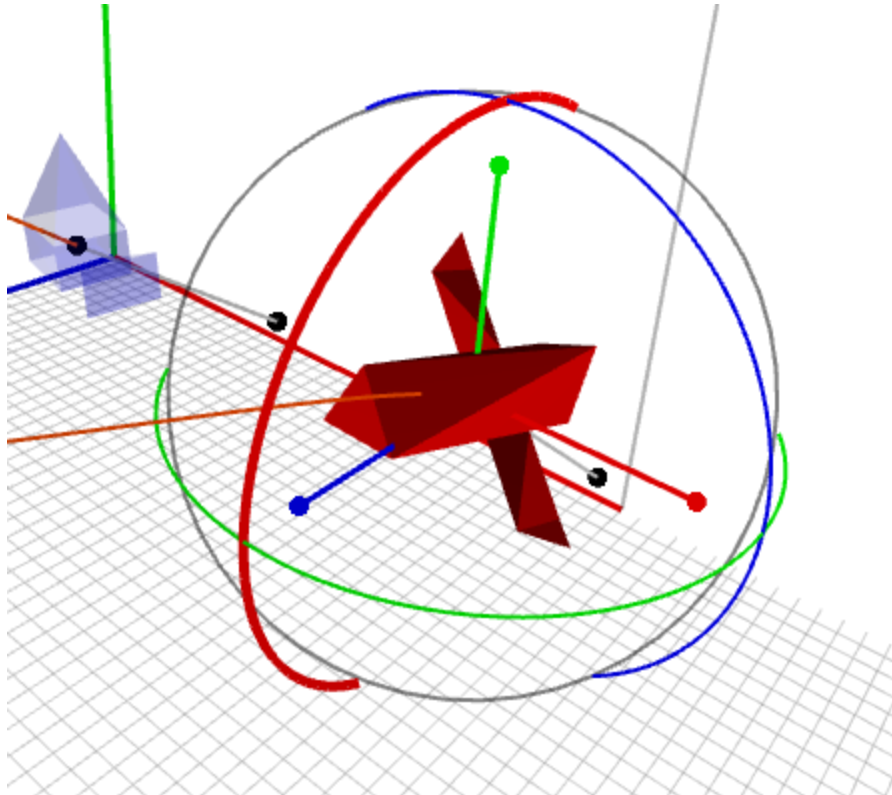
Editing Interface

3D Editing interface

Use the left mouse button to select and edit a keyframe node. Clicking the right mouse button will deselect the node.

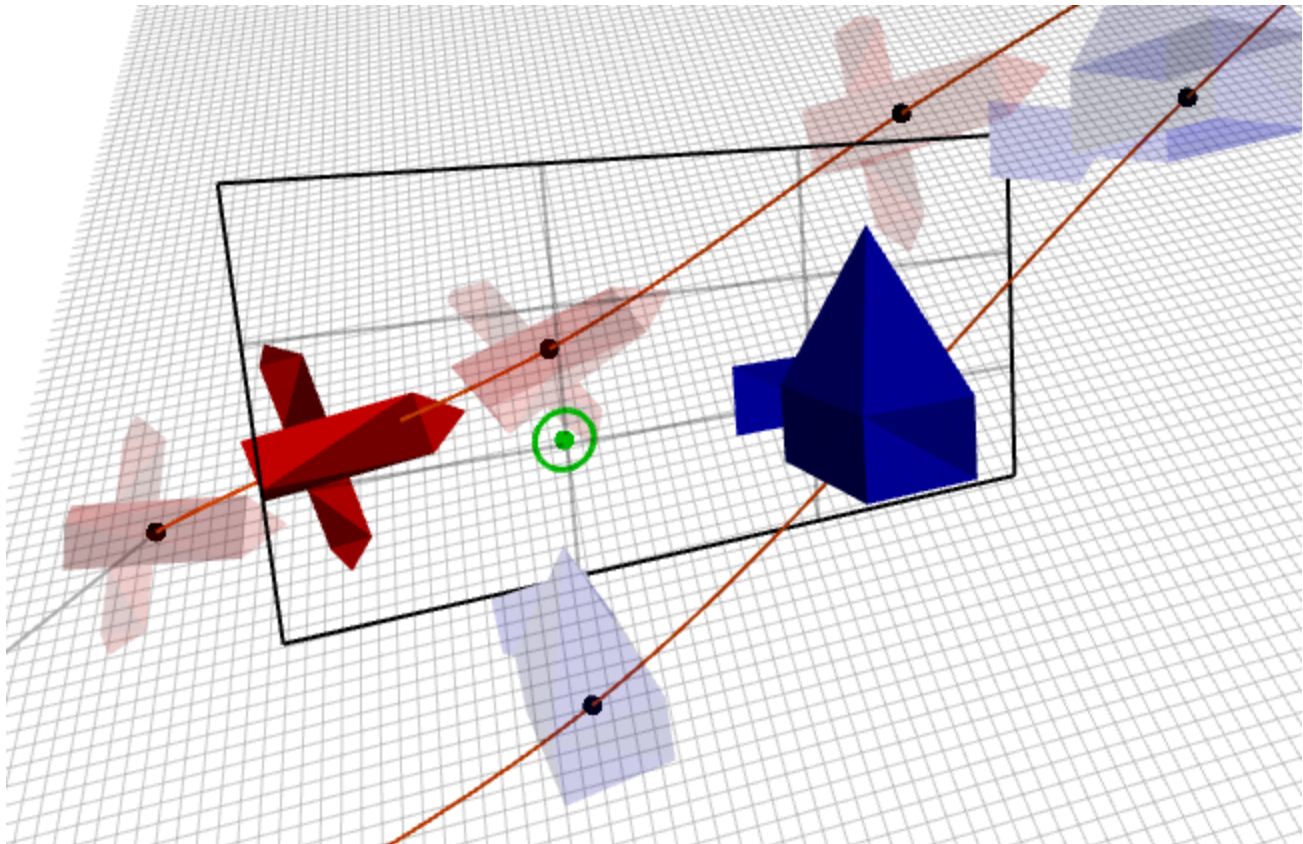
To edit the position of a node, click and drag one of the axis aligned handles to move the node in the direction of the corresponding axis.

To edit the rotation of a node, either click and drag across the screen to rotate about an arbitrary axis or click and drag one of the rotation axis' to rotate about the corresponding axis.



Editing position and rotation of a node

While no nodes are selected, hover the mouse over one of the curves to view where the rocket ship and camera would be at that point in the animation. A virtual screen displays where the rocket ship would appear on a screen from the point of view from the animation camera.



Animation Preview

Editing View Camera Controls

The editing view camera is controlled using keyboard input:

W/S - Move forward/backward in the direction of camera

A/D - Move camera left/right

T/G - Move up/down along camera's up vector

Q/E - Rotate camera left/right (about up vector)

R/F - Rotate camera down/up (about right side vector)

Z/X - Roll camera left/right about it's direction vector

Algorithms and Data Structures

Catmull-Rom Splines are used to interpolate position between keyframe nodes. The splines are parameterized by arc length along the curve.

Quaternions are used to interpolate between keyframe rotations using the spherical linear interpolation method.

The arcball algorithm is used to rotate a node from the 3D perspective window.

Description of Important Files

File	Description
quaternion.cpp	Implements the Quaternion data structure
catmullromspline.cpp	Data structure for interpolating position along a curve controlled by keyframe positions
camera3d.cpp	Interface to control perspective and movement in the 3D scene
arcball.cpp	Implements arcball method of rotation in 3D perspective window
translationnode.cpp	Interface for controlling the position of a keyframe node from the 3D perspective window
splinenode.cpp	Combines ArcBall and TranslationNode to implement an interface for controlling and storing both translation and rotation of a keyframe node.
splinenodeset.cpp	Manages set of SplineNode keyframe nodes for a curve
orientationcurve.cpp	Uses a SplineNodeSet along with a CatmullRomSpline to generate data to query the position and rotation of a keyframe node at a point on the curve.
virtualcamera.cpp	Draws a virtual screen in the editing window to show the user where an object would be located in the animation view.
spaceship.cpp	Data for drawing the space rocket model
cameramodel.cpp	Data for drawing the camera model
utils.cpp	Contains miscellaneous shared functions