About Primitive Variables

About PrimVars for Maya

It is often useful to attach data to the surface of an object. In RenderMan this is done by including the data as a token value pair when a surface primitive is declared. Once data is attached it is available as parameters to the shaders that are assigned to the surface primitive. Parameters that are attached to surface geometry in this way are called primitive variables, or primvars, for short. RenderMan for Maya provides both simple and flexible access to primvars.

At the simplest level, RfM includes Prim Var nodes, accessible via the Maya Hypershade, that can be attached to Maya nodes as needed. The various tools can then leverage those primvars at shading time. This effectively drives parameters or provides them with the data they need to achieve special effects. One such example could be to supply a color based on vertices locations on the mesh

Nodes are provided for Color, Float (1, 2, and 3), Normal, Point, and Vector types of primvars.

Under the Covers

RenderMan for Maya infers the request for a primitive variable by combining the Maya attribute type with the naming convention:

```
rman?[?[?]]primvarname
```

A special character must be provided to hint at the Ri primvar type. Additional special characters can be provided to request specific detail and array representation. It is up to the user to provide properly sized Maya attributes.

The three forms for special names are:

1. rmanTprimvarName: where T is one of:

   'F', 'C', 'V', 'N', 'P', 'H', 'M', 'S'

   which are interpreted as the RenderMan types:

   float, color, vector, normal, point, hpoint, matrix, string

2. rmanDTprimvarname: where T is as above and D provides a detail hint:

   'c', 'u', 'f', 'v', 'x'

   indicating standard RenderMan details:

   constant, uniform, facevarying, varying, vertex

3. rmanaDTprimvarname: where T and D are as above and the letter *a* indicates that an array of the given type and detail is requested.

Available (or possible) PrimVars

Some of these options are automatically provided even if they are empty but some, like radiusPP or Radius Per Particle, must be supplied by the user in any case. Below are some of these settings not included on the Geometric Settings page since they may already be provided or have limited or special use.

Meshes

Cs, each color set goes out as a primvar	This could be used to provide color based on the mesh data
s	The one-dimensional S texture value
t	The one-dimensional T texture value
u_uvSet	The one-dimensional U texture value if UVsets are defined
v_uvSet	The one-dimensional V texture value if UVsets are defined
tangent	Tangent space normals if specified
N	Shape Normals if supplied by the mesh

NURBS

s	The one-dimensional S texture value
t	The one-dimensional T texture value

Subdivision Surfaces

s	The one-dimensional S texture value
t	The one-dimensional T texture value

Hair (does not apply to Xgen)

P	Position
varying color Os	Opacity
varying color Cs	Color
varying float width	Hair width
vertex float t	Vertex number
constant string linetype	Returns the type of PaintFX curve
uniform float diffuseRand	Diffuse Randomization/Noise
uniform float specularRand	Specular Randomization/Noise
uniform float hueRand	Randomized Hue
uniform float satRand	Randomized Saturation
uniform float valRand	Randomized Value
uniform float scalpS	One-dimensional scalp S coordinate
uniform float scalpT	One-dimensional scalp T coordinate
vertex normal N	Hair vertex normals

Particles

P	Position
varying float width	Varying particle width (if they have assigned radii)
constant float width	If there is no specified radii
varying color Cs	Varying color if there is colorRed, colorGreen, colorBlue, or rgbPP
varying color Os	Varying opacity if there is opacity or opacityPP
constant float __threshold	Specified particle threshold
ageNormPP*	Particle Age Normalized (0-1) per particle
incandescencePP*	Incandescence specified per particle
spriteNumPP*	The assigned sprite number per particle
falloffpower	Used to create "fuzzy" particles

These attributes influence other settings, like Cs, Os, orientation of particle:

opacityPP*	Opacity specified per particle

radiusPP*	Radius specified per particle
spriteScaleXPP*	Sprite scale in X axis
spriteScaleYPP*	Sprite scale in Y axis
spriteTwistPP*	Sprite twist if specified

⚠ Attributes marked with an asterisk * must be supplied by the user. An example of this are Per Particle attributes added to Maya particles in the attribute editor.

Fluids

color Cs	Fluid color
float density	Fluid density
vector dPdtime	Motion vector
vector velocity	Motion velocity
float pressure	Fluid pressure
float temperature	Fluid temperature
float fuel	Fluid fuel
float falloffField	Falloff
float[3] UVW	UVW output