Rendering

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Figure 1: *Final image*

Abstract

The report outlines the work done as a part of Simulation and Rendering module on modelling a real world object using simple primitives and rendering the outcome.

Figure 2: *The object to be modeled*

Keywords: specularity, BXDF, bump map, displacement map

1 Modelling the Object

The object chosen is a pen. Its a metallic pen with cylindrical cap and body both of which are connected by circular rings. The pen holder is a semi cylinder attached to cap top using another cylinder.

Most of the modelling has been done using cylinders: the cap, cap top, holder, body and the base. The holder has a slight protrusion towards the end which has been modelled using a hemisphere. The middle ring portion is the combination of torus and cylinder placed overlapping each other. These are created using procedural for loop as a combination of torus and cylinder.

Figure 3: *Modelling Process*

The entire object is rotated to make it lay horizontally.

Figure 4: *Modelling Process*

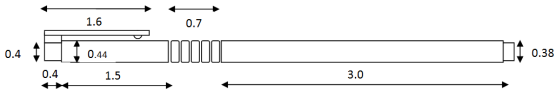

Figure 5: *Dimensions of the model*

2 Material and Maps

2.1 Materials

The entire pen is metallic but the degree varies at different parts of the pen body. Cap top, holder, base and rings on the body are comparatively more shiny/ metallic than the cap and body thus having a greater specular highlight in presence of the light.

The cap and body which are ligher metallic are give a metallic value of 0.3 with PxrDisney BXDF. Similarly the cap top, holder, rings and base which are purely metallic are given a metallic value of 1.0.

2.2 Displacement Map

The cap and body has fine line running throughout. This has been created with a shading using perlin noise in one uniform direction to give the linear texture which is then applied as a displacement map with a scale of 0.1 on the cap and body of the model.

Figure 6: *Displacement Map*

2.3 Bump Map

On the cap towards the top, the logo, LAMY is inscribed in metallic. A bump map with texture created in Photoshop with the logo is embedded on the cap. The original idea was to use logo simply as a texture placed on the cap as is on the original object but the bump appeared to provide a better visual appeal compared to pasting the plain texture.

Figure 7: *Logo on the original object*

2.4 Wear and Tear

The original object has few signs of wear and tear like scratches and peeled off paints at certain areas. I tired creating the shader for

Figure 8: *Logo on the model using bump map*

peeled off area with both plastic and metal surfaces visible on the same surface but it didn't quite work as expected so instead I settled with the application of scratches. Light scratch marks have been implemented on the cap top and body of the model. These scratch marks have been produced in photoshop and applied as PxrBump bump map. Application of scratches reduced the overly perfect appearance of the pen giving it a touch of realism.

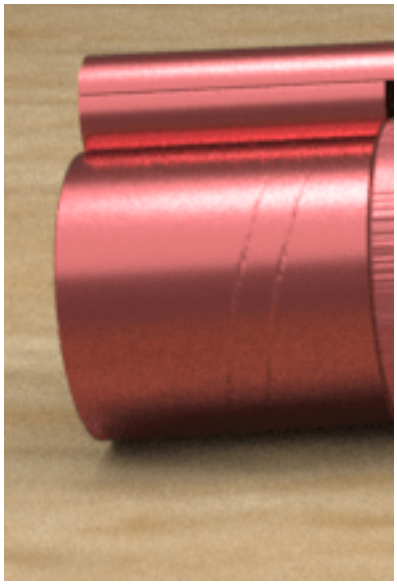

Figure 9: *Scratches on the cap*

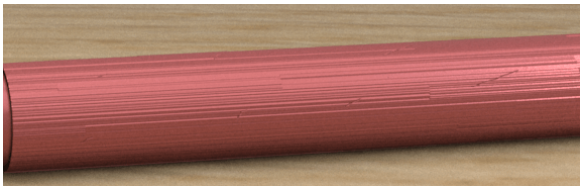

Figure 10: *Minor scratches on the pen body*

2.5 Textures

The object is placed on a simple flat plane with a wooden texture applied as PxrTexture pattern and PxrDisney BXDF to take RGB reference color from the provided texture giving the effect of table

top. In the similar manner a wall texture has been applied on the plane placed vertically upright in the background.

Figure 11: *Floor Texture*

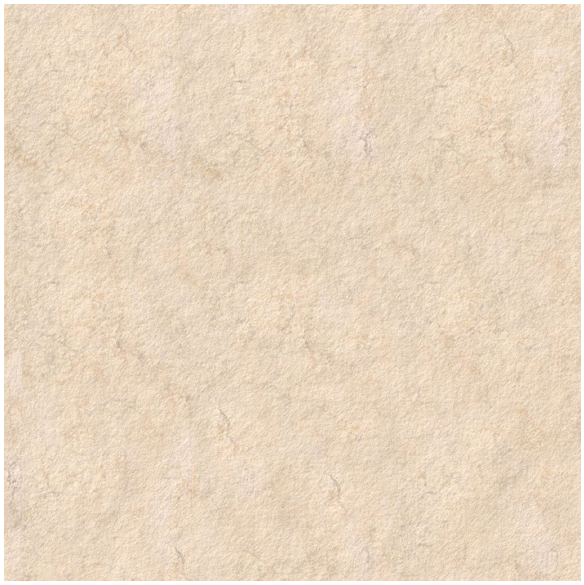

Figure 12: *Wall Texture*

3 Camera and Lighting

To have a properly well lit scene a total of six lights have been used. Three PxrStdAreaLight to illuminate the top, middle and base of the pen, two sphere lights placed towards the top corners and one PxrStdEnvMapLight to add-on to the general illumination. Initially only area lights were placed in the scene. This posed a problem as with high exposure certain areas were washed out and with low exposure the scene was dimly lit. Then i decided to tone down the exposure to the required minimum, just enough to give the specularity and add sphere lights for illuminating the scene.

The area lights focus primarily on the areas they have been placed near and help enhance the specular highlights especially on the purely metallic parts of the pen. The sphere lights provide the additional brightness to light especially towards the back part of the scene. A PxrStdEnvMapLight using HDR image is applied to further enhance the overall lighting in the scene.

A max sample of 720 has been used to reduce the amount of noise in the scene and even smoothness. Depth of field is applied to give a sense of depth, blurring out the further end of the table and the wall and bringing out the focus on pen and the nearby area.

Figure 13: *Positioning area lights*

Figure 14: *Positioning sphere lights*

Figure 15: *The Environment Map Light*

4 Trial and Error

I tried writing a shader for the peeled off area by applying different colors based on position but even though I was able to segregate the section to have different colors I was unable to apply separate materials on each color.

Figure 16: *Final Output*

Secondly, I tried a bit easier method of using multiple surfaces overlapping each other and then assigning to them different materials. The idea did work but the look was patchy and segmented without a proper flow. I tried reorienting the added bits but without much success.

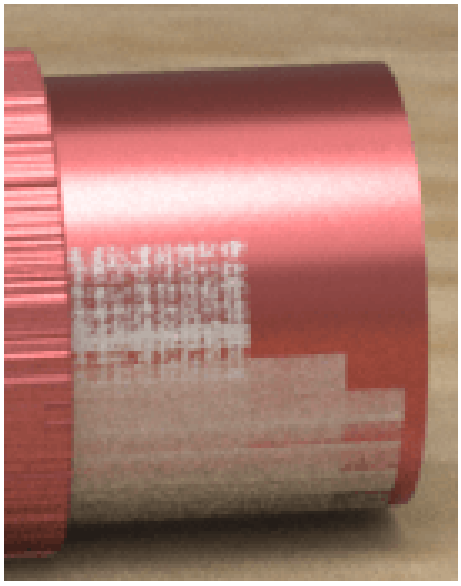

Figure 17: *Plastic material on separate segments*

5 Result and Conclusion

The project helped me gain a good understanding of the process of modelling an object using simple primitives, working and application of shaders, use of maps and textures. The model though still comparatively close to real object still requires certain improvements in terms of making the look more realistic with the help of an additional shader to show the paints peeled off at certain areas. Also improving the lighting a bit to further bring out the specular effect on the purely metallic parts of the pen. Though slightly lacking in certain areas I'm pleased with the overall outcome of the project.

6 References

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