

リスト 9.1

CookTorrance.frag

```
varying vec3 P;
varying vec3 N;
uniform float rough; //粗さ係数

void main(void)
{
    vec3 L = normalize(gl_LightSource[0].position.xyz - P);
    N = normalize(N);

    vec4 ambient = gl_FrontLightProduct[0].ambient;
    float dotNL = dot(N, L);
    vec4 diffuse = gl_FrontLightProduct[0].diffuse * max(0.0, dotNL);
    vec4 specular = vec4(0.0);
    if(dotNL > 0.0)
    {
        vec3 V = normalize(-P);
        vec3 H = normalize(L + V);
        float dotNH = max(dot(N, H), 0.0);
        float d = dotNH * dotNH;
        float b = d * d;
        float c = (d - 1.0) / (rough * rough * d);
        float dotNV = dot(N, V);
        //分布関数
        float D = min(1.0, exp(c) / (4.0 * 3.14 * rough * rough * b));
        //フレネル係数 (垂直反射係数)
        vec3 F0 = gl_FrontLightProduct[0].specular.rgb;
        //Schlickの近似式
        vec3 F = F0 + (vec3(1.0) - F0) * pow(1.0 - dot(L, H), 5.0);
        //幾何減衰係数
        float dotVH = dot(V, H);
        float Gout = 2.0 * dotNH * dotNV / dotVH;
        float Gin = 2.0 * dotNH * dotNL / dotVH;
        float G = min(1.0, min(Gout, Gin));
        specular.rgb = D * F * G / dotNV;
    }
    //統合
    gl_FragColor = ambient + diffuse + specular;
    if(gl_FragColor.r > 1.0) gl_FragColor.rgb /= gl_FragColor.r;
}
```