Introduction to Mechanical Engineering, CAD REN 1

Render

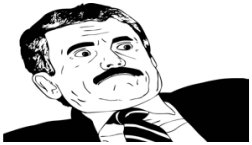
Innopolis University

Plan

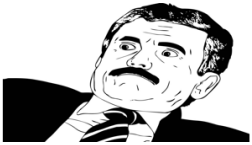
1. What do we want to achieve with the renderer?
2. CAD vs Polygonal
3. What defines the material
4. How to make a photorealistic rendering.
   - 4.1 How do we make sure we don’t mess up the materials?
   - 4.2 How do I adjust the scene?
   - 4.3 How to set up a light, 3-point lightning?
5. How to make it look nice.
   - 5.1 Composition
     - 5.1.1 Guiding lines
     - 5.1.2 Shape silhouettes
     - 5.1.3 Color/brightness highlighting
   - 5.2 Color balance, brightness

What do we want to achieve with the renderer?

A nice picture showing the result of the IRL will look like.



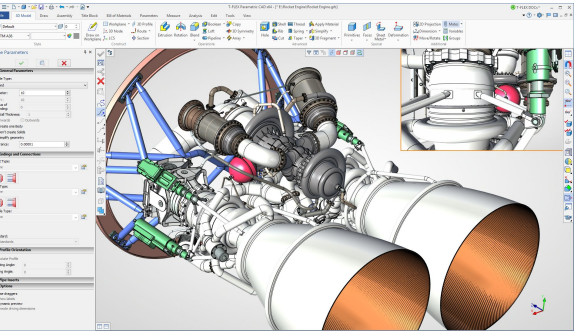
Render and Animation Why?



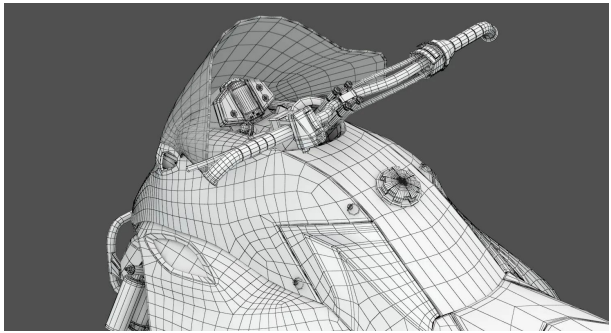
Heavyweights like bells and whistles

What is 3D modelling | CAD vs Polygonal

CAD



Polygonal



What is 3D modelling | CAD vs Polygonal

CAD

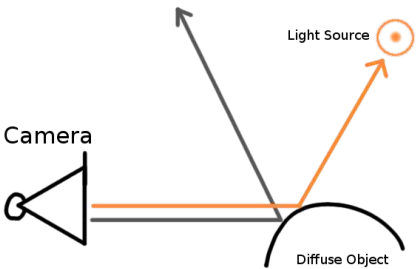
- Precise
- Slow
- Edit history by feature tree
- Accurate simulations
- Tries to look good but fails

Polygonal

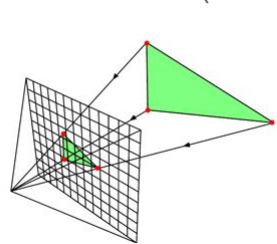
- Looks right? Good
- Faster
- Edit history by *Ctrl+Z*
- Quick physics and key-framed animations
- Can be beautiful

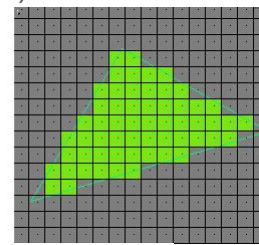
What is 3D modelling | How 3D scene turns into 2D image

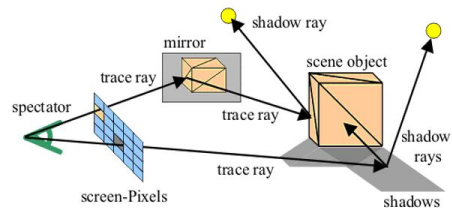
Path tracing (Cycles)



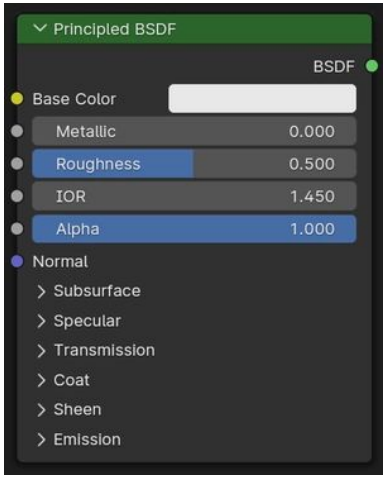
Rasterization (EEVEE)

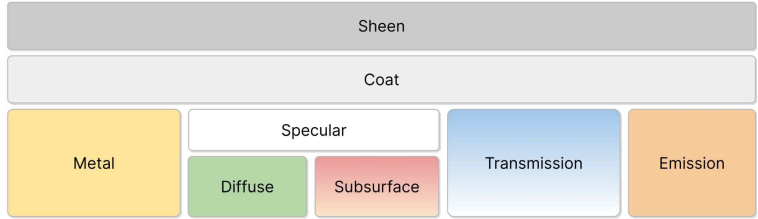






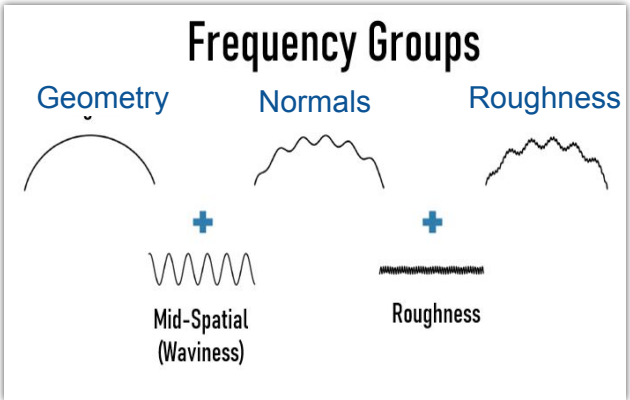
What defines the material | Principled BSDF

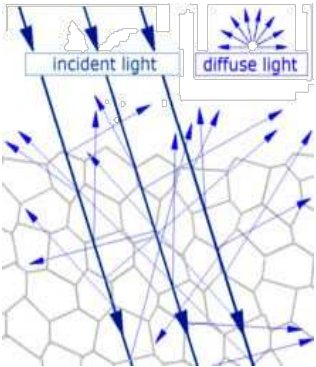




Blender 4.1 Manual
Rendering/Shader nodes/Shaders/ Principled BSDF

What defines the material | Roughness



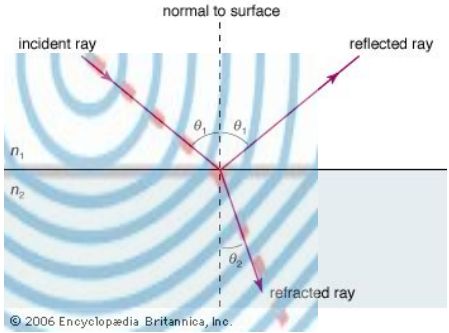


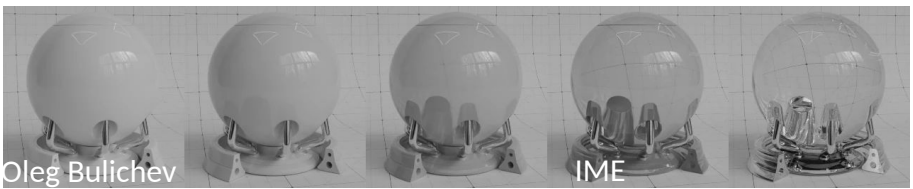
What defines the material | Transmission, IOR

IOR - Index of Refraction

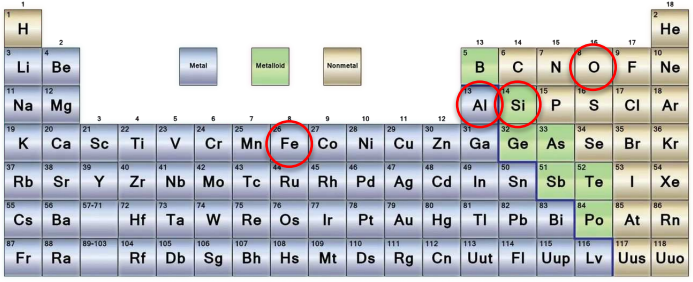
Snell's law:

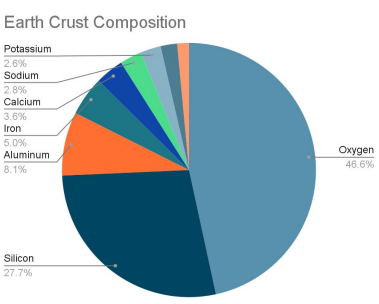
$$n_1 \sin\theta_i = n_2 \sin\theta_t$$



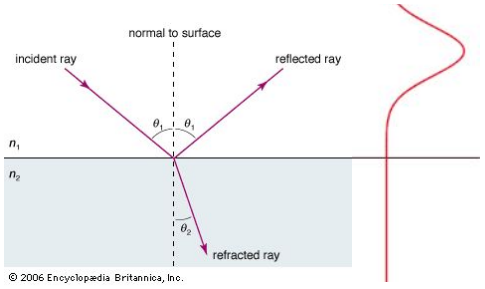


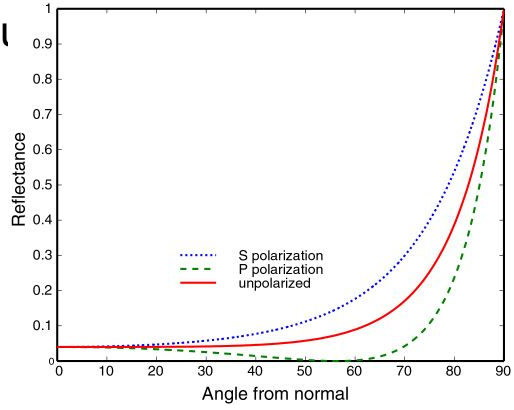
What defines the material | Metallic

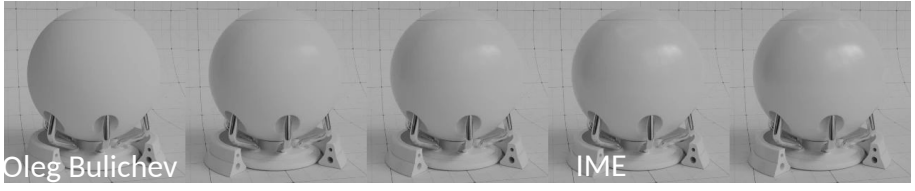


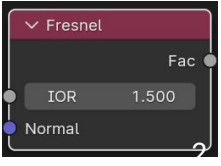


What defines the material | Specu

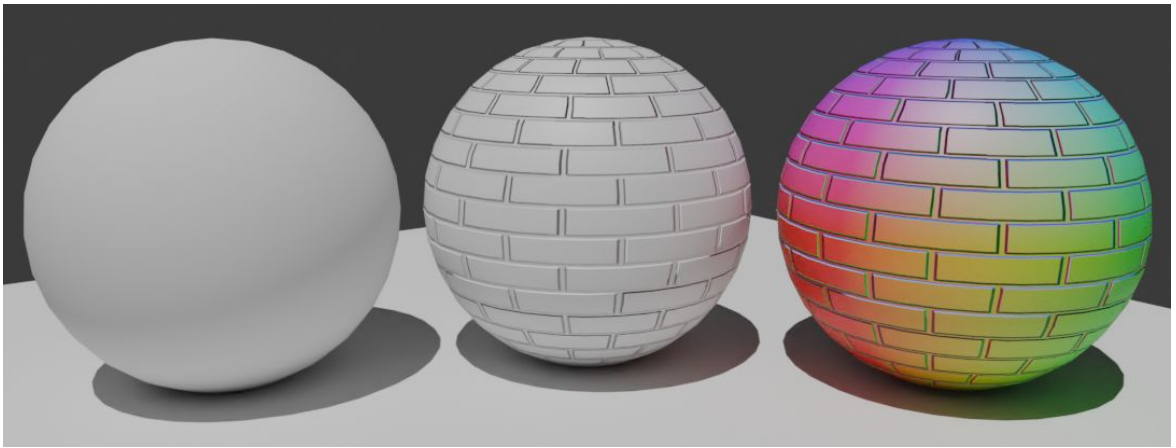




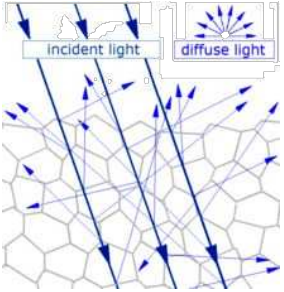


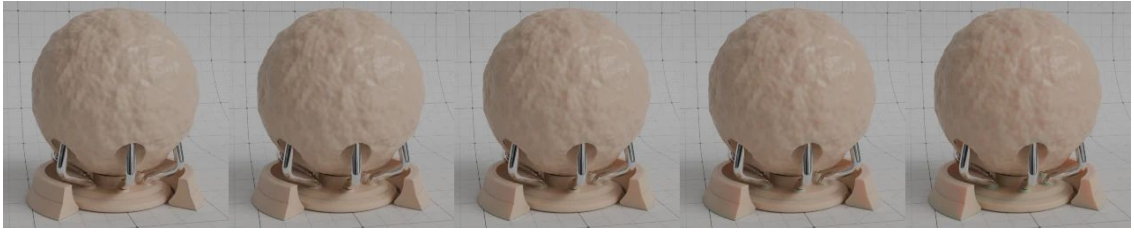


What defines the material | Normal



What defines the material | Subsurface



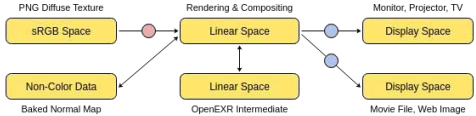


What defines the material | Coat

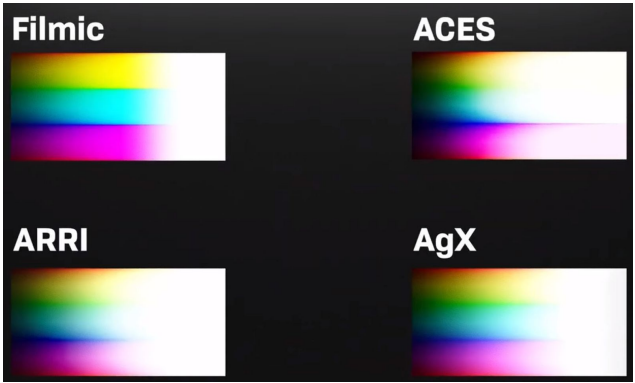
What defines the material | Sheen

Weight from 0.0 to 1.0 / Roughness from 0.0 to 1.0

Render | Color Management



Different views and exposures of the same render



Different color transformations
ARRI - cinema-grade cameras

How to make it look nice

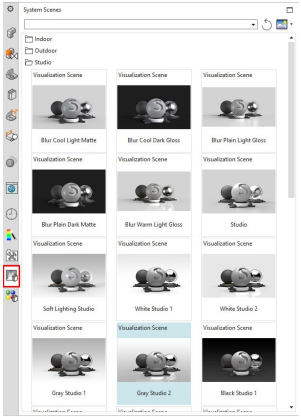
Video

Color balance

Video

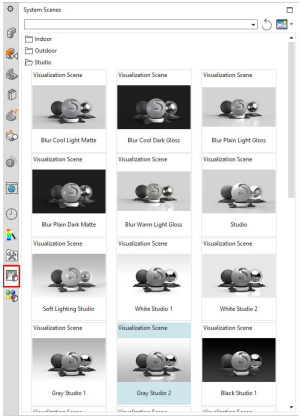
NX aspects (ENG)

- The standard scene is good, the light is already well set up there, and that's the most important thing. What's lacking is a bit more down-to-earth, so we'll take one of the standard scenes (the picture) and go for it.
- Metals from the folder Metals - too perfect. Suitable either for slices or for satellites only from the conveyor. For the rest it's better to use variations from the folder Metals-Brushed. Although there they are exactly machined, but they look closer to what we are familiar with IRL.
- Chamfers. A mouthpiece is not enough to fully convey how important smoothing the corners is for an adequate looking picture. If the corner is not a blade, then give it at least a millimeter chamfer. It will look a level better.



NX aspects (RUS)

- Стандартная сцена хороша, там свет уже хорошо настроен, а это самое главное. Не хватает приземлённости, для этого выбираем одну из стандартных сцен (картинка) и радуемся
- Металлы из папки Metals - слишком идеальные. Подойдут либо для срезов, либо для спутников только с конвеера. Для остального лучше использовать вариации из папки Metals-Brushed. Хотя там они именно обработаны, но выглядят более приближенно к тому что нам знакомо ИРЛ.
- ФАСКИ. Капса не хватит что бы в полной мере передать насколько важно сглаживание углов для адекватно выглядящей картинки. Если угол не является лезвием, то дайте ему хотя бы миллиметровую фаску. Выглядеть станет на уровень лучше.

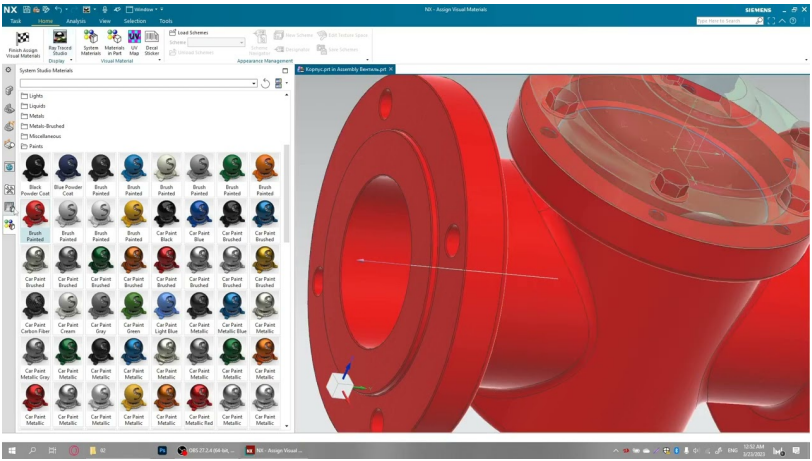


NX Ray Traced Studio material

1. How to use NX Ray Traced Studio
2. Rendering (docs)
3. Case study

Practical Task: Repeat the video

Video



Invited Lecturer Egor (RUS)

Video

Deserve “A” grade!

– Oleg Bulichev

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Room 105 (Underground robotics lab)