CAD PROJEKT K&A

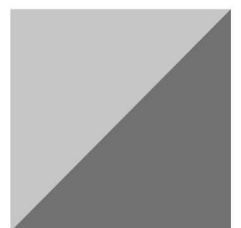# the Professional Rendering Module
features description

CONTENTS

Click on the chapter title to go to the description of the function

The module of Professional Rendering is a modern tool for a very advanced visualization. Its main task is to ensure a perfect quality of the visualization in a relatively short time. The shortening of the time necessary for proceeding all calculation was possible thanks to cooperation of the graphic card processor (GPU) and a multicore nature of a modern processor (CPU). Two main processes proceeded by this module are: Radiosity – in other words Global Illumination algorithm, and Raytracing – a method of calculating the reflections and refractions of light rays.

ADVANCED RENDER FEATURES

Radiosity

- **Radiosity** is the main **Global Illumination** algorithm,
- calculates data and estimates the overall distribution of light in 3D scenes (indirect light),
- it takes into consideration reflection and absorption of light by different objects and colours,
- parameters of Global Illumination calculated this way are remembered by the program and used for visualization in a real time,
- improves the efficiency of the rendering and enables to attain a natural look of the scene,
- effects are independent of the position of the observer,
- the calculation process has two stages – in the first one the program prepares data for analysis, in the second one – displays the calculated illumination of the visualization in cycles (their interval can be adjusted by the user from 0 to 20 seconds),
- the final look is obtained by the gradual improvement of the rendered scene.

1. A scene with a direct light – in order to gain a better visibility it is slightly brightened
2. A scene with both direct and indirect lighting. It is well noticeable that the light reflects from the worktop and from the bottoms of the cabinets
3. A scene with both direct and indirect lighting after 60 second. It is well noticeable the 'stains' on the ceiling has been replaced by the shadows coming from cabinets. These shadows were generated thanks to the analyze of the reflected light

Scene diagnostics and repair

- every scene undergoing the calculations has to be first properly prepared,
- this feature is designed especially for this – it repairs errors in the scene, this is reversed surfaces of 3D models, which may cause irregularities in the light distribution – objects with reversed surfaces are always much darker than they should after switching on the lights,
- putting all surfaces in the proper order is vital for the correct light distribution calculation and because of that this function is active by default.

1. The look of the scene after activating the option **Show inverted surfaces** – wrongly drawn sufaces are marked in magenta
2. **Global Illumination** for the scene with incorrectly drawn objects – it is clearly noticeable that objects that were previously marked in magenta are now much darker than they should
3. **Global Illumination** in the repaired scene – objects properly illuminated and displayed

Global Illumination parameters

- available settings of **Global Illumination** are designed to adjust rendering to designer's preferences,
- **Global Illumination** is a lighting model in which not only the direct light emitted by the light sources is taken into account (local light), but also beams reflected by objects such as walls, floors, furniture and equipment (indirect, global light),
- using this function ensures obtaining a realistic light distribution in the room.

Global Illumination - example

GI Influence

- this function regulates the influence of the diffused light on the general light distribution,
- when the slider is moved to the left, diffused light has no influence at all,
- this parameter can be adjusted during the Radiosity calculations and after they are completed.

1. **GI Influence** 0% - minimum
2. GI Influence 50% - default
3. GI Influence 100% - maximum

GI Contrast

- influences the way in which the number values are converted into components of RGB colours,
- the **Global Illumination Contrast** can be increased or decreased in real-time during or after the **Radiosity** calculations.

Standard contrast

Increased contrast

Ambient

- The term **Ambient** relates to the ambient light (light diffused in the scene), which illuminates the room evenly and without shadows,
- ambient adds some white colour to the scene, which makes it look brighter,
- this function is useful in the scenes that should be bright but the current settings of light sources do not allow to attain such an effect.

The glass in both windows emits light, no other light sources in the scene

55% of ambient light added, the scene is significantly brighter

GI Colours

- regulates the coefficient of light reflected by all surfaces in the scene (in other words: decreases the level of light absorption),
- as a result the image gets brighter and at the same time there is stronger colour bleeding effect (this phenomenon takes place when the light reflects from a diffusive surface and takes over its colour),
- the **Global Illumination Colours** function determines the intensity of which the colours spread in the scene,
- it is useful when there is a lot of dark materials used in the scene, that have a high level of absorption, and share little of their colour with the rest of the scene.

1. Basic visualization before changing the level of GI Colours parameter
2. GI Colours increased by 20%
3. Well illustrated effect of colour bleeding. In this case the yellow colour is visible on a white ceiling opposite the window emitting the daylight

GI Emission

- it is a multiplier of all emissive materials in the scene,
- Global Illumination Emission enables to quickly modify the intensity of advanced light emission of all emissive objects at once,
- the scale for this factor is from 0 to 200 % (with default a level of 100%).

| 6 emissive objects – GI emission 100%
6 x 5 W = 30 W | The same 6 objects - GI emission 200%
6 x 10 W = 60 W |

Final Gathering

- The final calculation of the distribution of light for the chosen objects,
- if some little object in the project does not look properly, it can be subjected to an additional treatment – the program will proceed some extra calculations of the amount of light beams reaching its surface,
- this option is particularly useful with objects consisting of a big number of small surfaces – they may be not properly illuminated by the indirect light,
- it is recommended also while creating illustrations of the project with blow-ups of some particular elements of interior design.

| Without the Final Gathering | After the Final Gathering |

Raytracing

- it is an algorithm analyzing reflections and refractions of light rays, which reaches the observer of the scene,
- it calculates reflections and refractions generated by glass and mirror objects,
- adds to the scene those light rays, which have been omitted by radiosity, which takes into account light diffused in the whole scene,
- creates lusters on metal surfaces, refractions on glass and – what is worth noticing – multiple reflections in mirrors.

Quality (Raytracing)

- there are 8 available levels of Raytracing: 1x1, 2x2, 1x1 AA, 2x2 AA, 3x3, 3x3 AA, 4x4 and 4x4 AA (where AA stands for anti-aliasing),
- anti-aliasing is a technique that minimizes distortion errors (aliasing), occurring while creating representations of the image of a high resolution in a lower resolution,
- 1x1 mode is usually used to quickly see the initial results of Raytracing,
- the level of quality of Raytracing depends on the processing power of the computer – the better quality the higher memory consumption and a longer time of performing the operation.

Reflections (Raytracing)

- you can decide how many rays should be taken into account by the Raytracing algorithm,
- the program can analyze from 1 to 10 reflected rays,
- a standard setting is 1 reflected ray for 20 refracted ones.

Refractions (Raytracing)

- here you can define how many refracted rays will be analyzed (from 0 to 20 rays),
- the level of this function greatly influence the look of transparent objects such as glass,
- the program counts how many rays go through such objects, so the more rays we decide to analyze, the more realistic will be the picture we get.

Examples of using the Raytracing function

Advanced options

- calculation of the light distribution is done only for the corners of objects mesh,
- the mesh for walls is by default established to fit the calculations and divided into faces of 100x100 mm,
- the rest of the objects in the project is not divided automatically and they may require a modification of mesh density,
- there are 2 options of mesh modification available:
  - **adaptive mesh division** – changes the division of walls and platforms, to which other objects adjoin (e. g. kitchen cabinets) and cover some of the corners of the mesh (what artificially increases the range of the shadow); this function enables to automatically substracts such corners from the calculation and improves the distribution of indirect shadow on the border between the wall and the object,
  - scene mesh division – thanks to this option you can choose by yourself the size of the mesh of the whole scene – from 40 mm to 200 mm (by default it is 100 mm) to improve the shadows distribution; the smaller is size of a single surface – the more surfaces are in the entire project, and more memory and time is needed to perform calculations.

Before the adaptive mesh division	After the adaptive mesh division – artificial shadows between the walls and the ceiling are gone

Diagnostics

There are 2 features of scene diagnostics available:

- **show emissive objects** – marks these objects which hale been attributed an **advanced light emission**; function useful when the modification of the light distribution in the room is necessary and it is not clear which objects are emitting the light,

- **show inverted surfaces** – shows those surfaces which hale been drawn in an inappropriate (opposite) direction, what has a negative influence on the light distribution on the object (the surfaces can be drawn clockwise or counterclockwise).

|	
Marked emissive obcjests	The view after switching the lights on

Statistics

- **Surfaces** – provides an information regarding the overall number of surfaces in the project (this number changes when the mesh division is modified) - the amount of surfaces influences the time of calculations and system resources,
- **FPS** – the number of frames per second,
- **Calculation time** – the time necessary for calculation of the direct light sources, and when the Radiosity is turned on – the time from the beginning of the calculation process,
- **Memory** – the current memory consumption. Only occupied memory is shown, including CAD environment. The **Radiosity** calculations are performed in a separate process, so they are not included here. If the memory consumption is less than 1 GB the inscription **Memory** is green, and if it exceeds 1 GB - the inscription changes to red. This may mean a possible lack of memory to perform further tasks.

Statistics panel

Downloading own IES files

- the selection of a style of the light sources is available from the standard level of rendering,
- the style (saved in a form of an IES file) determines the way the light is distributed by a light source, e.g. a halogen),
- there are 32 ready-to-use styles for your disposition,
- if you have the **Professional Rendering Module** you can also download your own IES files, found in the Internet or created by you.
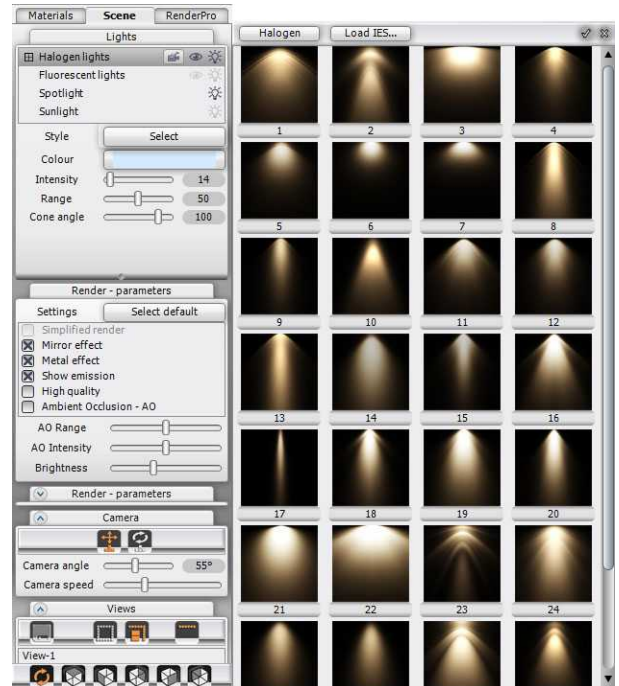
Selection of styles of the light sources

Advanced light emission

- in the **Professional Rendering Module** it is possible to attribute objects not only with a **basic light emission**, available on the standard level of rendering, but also with a property of an **advanced light emission**,
- the difference between them is that objects attributed with **advanced light emission** have real and visible influence on the light distribution in the entire scene,
- this feature is available in the **Material properties** dialog box – in the **Advanced** tab,

Advanced light emission in red colour

- the power of emitted light is given in Watts per m^2, so the intensity of this light depends on the size of the emissive object,
- another difference is that the light in advanced light emission can have any colour, not only white, as in basic emission – as shown in the illustration,
- for best results, attribute both kinds of light emission to the object and use the feature **Show emission** function in the standard rendering level, responsible for creating the glow effect.

Colour tones

- This function enables the user to quickly change the influence of the light distribution, calculated by the **Radiosity** process, on the overall colouring of the scene,
- changes can be introduced during or after the completion of the **Radiosity** calculations,
- the **Colour tones** are filters that change the scene exposition, so it is worth it to set the lighting parameters to match the particular filter during the **Radiosity** calculations,
- this feature gives the designer a greater flexibility in creating the final visualization.

Examples of using the Colour tones **filters**

standard

agfa-scala-200xCDPush1

ektachrome-100-plusCD

ektachrome-400XCD

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