

**NAME**

`bsdf2ttree` - generate XML tensor tree description of a BSDF

**SYNOPSIS**

```
bsdf2ttree [ -pC ][ {+|-}a ][ -g Nlog2 ][ -t pctcull ][ -n nss ][ -s thresh ][ -l maxlobes ][ bsdf.sir .. ]
or
bsdf2ttree -t{3|4} [ -pC ][ {+|-}a ][ -g Nlog2 ][ -t pctcull ][ -n nss ][ -s thresh ][ {+|-}forward ][
{+|-}backward ][ -e expr ][ -f file ] bsdf_func
```

**DESCRIPTION**

*Bsdf2ttree* produces a tensor tree representation of a bidirectional scattering distribution function (BSDF) based on an intermediate representation (in the first form) or a functional description (in the second form). A complete XML description is written to the standard output, which is normally redirected to a file.

The *-p* option by itself turns off the progress bar, whose length may be set by an immediately following integer argument. (The default progress bar length is 79 characters.)

The *+a* option turns on reciprocity averaging for isotropic scattering or anisotropic reflection. Normally off (*-a*), this enforces each tensor-tree hemisphere to follow symmetry implied by Helmholtz reciprocity, and is designed to reduce noise in measured data. However, for some data, reciprocity averaging can make the output worse.

The maximum resolution of the tensor tree may be controlled by the *-g* option, which defaults to a value of 6. This corresponds to a peak resolution of  $2^6$  (64) in each dimension. Due to memory and time constraints, it is not recommended to set *-g* higher than 7, which corresponds to a 128x128x128x128 initial sampling, or 268 million values.

The initial sampling is pared down by the percentage specified with the *-t* option, which defaults to 90. Setting this parameter to -1 turns culling off entirely, which may be useful for comparisons.

The *-n* option controls the number of super-samples to send in patches whose difference to its neighbors exceeds some threshold. The default number of super-samples is 64. The difference threshold for super-sampling is controlled by the *-s* option, and defaults to 0.35.

The first invocation form takes a intermediate scattering representation as produced by *pabopto2bsdf(1)* or similar, and produces a tensor tree representation with as many components as there are independent input distributions. Each intermediate scattering file contains one of the four components, and if the first component is isotropic, all components must be isotropic. A similar rule holds for anisotropic inputs. The *-l* option may be used to specify the maximum number of lobes in any interpolated radial basis function. The default value is 15000, which generally keeps the interpolation tractable. Setting the value to 0 turns off this limit. Parameter options may be altered between input files, in case a different resolution or culling percentage is indicated for transmission versus reflection for example.

In the second invocation form, *bsdf2ttree* takes a functional specification of a BSDF. The named function should accept 6 parameters corresponding to the normalized incident and exiting vectors, respectively. By convention, these vectors point away from the surface, and a positive Z-component corresponds to the front side. The Y-component corresponds to the "up" orientation of the surface, as specified in the eventual scene description that references the XML output. If the function only takes 3 parameters, then the variables "Dx", "Dy", and "Dz" will be assigned to the reverse of the outgoing direction at each evaluation. (I.e., the vector will point into the surface and Dz will be negative on the front side.) This simplifies conversion of functional BSDF specifications using the legacy material primitives "plasfunc", "metfunc", and "transfunc".

The function is defined by one or more *-e* and *-f* options, and should obey both Helmholtz reciprocity and integrate to less than 1 over each projected incident hemisphere for energy conservation. The variable and function definitions in each *-f source* file are read and compiled from the RADIANCE library where it is found. If the *-t3* option is specified, the defined function is assumed to be isotropic. If the *-t4* option is given, the function is assumed to be anisotropic.

Similar to the *genBSDF(1)* command, the *+backward* option (default) specifies that rays arriving from the front side of the surface will be tested for reflection and transmission. If both forward and backward (front and back) distributions are needed, the *+forward* option may be given. To turn off the backward

components, use the *-backward* option. Computing both incident hemispheres takes about twice as long as one, but is recommended when rays will be impinging from either side.

### EXAMPLE

To take two components of an intermediate BSDF representation and create a high-resolution tensor tree with 85% culling on transmission and 95% culling on reflection:

```
bsdf2ttree -g 7 -t 85 transmitted.sir -t 95 reflected.sir > combined.xml
```

To create a low-res BSDF corresponding to a one-sided, isotropic Phong distribution:

```
bsdf2ttree -g 5 -t3 -e 'phong(ix,iy,iz,ox,oy,oz) = if(iz,
.1+((iz+oz)/sqrt((ix+ox)^2+(iy+oy)^2+(iz+oz)^2))^50, 0)' phong > phong.xml
```

### ENVIRONMENT

RAYPATH the directories to check for auxiliary files.

### AUTHOR

Greg Ward

### SEE ALSO

bsdf2klems(1), icalc(1), genBSDF(1), pabopto2bsdf(1), pabopto2xyz(1), pkgBSDF(1), rcontrib(1), rfluxmtx(1), wrapBSDF(1)