TABULATED PLANAR SOURCE (tabulated_planar_source)

Purpose

This class is used to transform a field specified in a plane to equivalent currents in the same plane. These currents are then integrated when the radiated field shall be determined.

A typical application is the radiation from a plane aperture. The field in the aperture can be determined by objects of the *Field Storage* class and stored on a file.

Links

Classes→*Electrical Objects*→*Other Sources*→*Tabulated Planar Source*

Remarks

Syntax

<object name> *tabulated_planar_source*
(

frequency	: ref(<n>),
coor_sys	: ref(<n>),
e_file	: struct(*status*:<si>, *file_name*:<f>),
h_file	: struct(*status*:<si>, *file_name*:<f>),
file_attributes	: struct(*file_type*:<si>, *unit*:<si>, *obsolete_file_form*:<si>),
max_m_mode_index	: <i>,
power_norm	: struct(*status*:<si>, *method*:<si>),
po_points	: struct(*po1*:<i>, *po2*:<i>),
factor	: struct(*db*:<r>, *deg*:<r>),
ray_output	: <si>,
far_field_convergence	: struct(*status*:<si>, *cone_angle*:<r>),
near_field_convergence	: struct(*status*:<si>, *near_dist*:<rl>, *rho*:<rl>),
scatterer_convergence	: struct(*status*:<si>, *scatterer*:ref(<n>))

)
where
<i> = integer
<n> = name of an object
<r> = real number
<rl> = real number with unit of length
<f> = file name
<si> = item from a list of character strings

Attributes

Frequency (*frequency*) [name of an object].

Reference to a *Frequency* object. See the remarks below.

Coordinate System (*coor_sys*) [name of an object], default: **blank**.

Reference to an object of one of the *Coordinate Systems* classes. The *Tabulated Planar Source* is located in the xy-plane and with phase centre at the origin of this coordinate system. A standard polar ρ ϕ coordinate system is defined in the xy-plane.

E File (*e_file*) [struct].

Specifies input in the form of E-fields.

Status (*status*) [item from a list of character strings], default: **off**.

Determines if the E-fields are used as input:

off

No E-fields will be read.

on

A file with E-fields will be read (see the remarks below).

File Name (*file_name*) [file name].

For *'status*: on' the name of the file containing the tabulated E-field shall be specified. The file format shall be in accordance with the file_type (see file attributes).

H File (*h_file*) [struct].

Specifies input in the form of H-fields.

Status (*status*) [item from a list of character strings], default: **off**.

Determines if the H-fields are used as input:

off

No H-fields will be read.

on

A file with H-fields will be read (see the remarks below).

File Name (*file_name*) [file name].

For *'status*: on' the name of the file containing the tabulated H-field shall be specified. The file format shall be in accordance with the file_type (see file attributes).

File Attributes (*file_attributes*) [struct].

When both an E-field and an H-field are read, the file attributes are the same for the two files.

File Type (*file_type*) [item from a list of character strings], default: **grid**.

The field data may be organised.

grid

The file format of a field grid is described in Section *Field Data in Rectangular Grid*.

cut

The file format of cuts is described in Section *Field Data in Cuts*.

Unit (*unit*) [item from a list of character strings], default: **m**.

Defines the unit of length by which the field positions are given of the file(s). The unit must be a valid unit of length (mm, cm, m, km, in, ft).

File Form (Obsolete) (*obsolete_file_form*) [item from a list of character strings], default: **formatted**.

Determines the file format (obsolete):

formatted

The files are written as an formatted file.

unformatted_single

The files are written as an unformatted file.

Max M Mode Index (*max_m_mode_index*) [integer], default: **-1**.

Only applicable for cut-file(s), *file_type*:cut. Maximum number of azimuthal m-modes to be used in the azimuthal ϕ-interpolation of tabulated cut data. If -1, all azimuthal modes are retained (default).(This interpolation in ϕ is a Fourier interpolation while the interpolation in ρ applies cubic interpolation).

Power Norm (*power_norm*) [struct].

The total radiated power may be normalised to 4π watts whereby the pattern is normalised to dBi.

Status (*status*) [item from a list of character strings], default: **off**.

Determines if the pattern is normalised:

off

No normalisation is carried out.

on

The field is power normalised to 4π.

Method (*method*) [item from a list of character strings], default: **approximate**.

The power normalisation may be carried out by one of the two methods.

approximate

The field is normalised by integration of Poynting's vector over the plane. This method is adequate when the *Tabulated Planar Source* is large in wavelengths and the tabulated fields are in phase. If only the E-field or the H-field is input, Poynting's vector is determined assuming locally a plane wave propagating orthogonally to the input plane. The approximate method becomes more correct if both the E-field and H-field are input. The approximate method is faster than the exact method.

exact

The field is normalised by integration over the far field sphere (half sphere if only an E-field or an H-field is read and full sphere if both fields are read). The exact method is preferable if the *Tabulated Planar Source* is small in wavelengths. The exact method is time consuming if the source is large (e.g. >20λ).

Po Points (*po_points*) [struct].

The integration grid is specified by `po1` and `po2`. The current elements in this grid are obtained by interpolation in the input field data. A description of the necessary number of points can be found in the remarks to the class *PO, Single-Face Scatterer*.

po1 (*po1*) [integer], default: **0**.

Number of current samples in first grid coordinate (i.e. ρ for cuts and x for grids).

po2 (*po2*) [integer], default: **0**.

Number of current samples in second grid coordinate (i.e. ϕ for cuts and y for grids).

Factor (*factor*) [struct].

The radiated field will be multiplied by a complex factor.

Amplitude in dB (*db*) [real number], default: **0**.

Amplitude of the factor, in dB.

Phase in degrees (*deg*) [real number], default: **0**.

Phase of the factor, in degrees.

Ray Output (*ray_output*) [item from a list of character strings], default: **none**.

This attribute defines how the field of the *Tabulated Planar Source* shall be calculated if it is used as source in a GTD or PTD analysis. The attribute is also actual for a subsequent PO-analysis of a scatterer with electrical properties specified (the direction of propagation is not used in a PO analysis of a scatterer which is perfectly conducting, i.e. without electrical properties specified). For this particular PO case, `Ray Output` has the same meaning as stated below for PTD.

none

The direction of propagation of the radiated field will not be computed. This means that the field cannot be used as input to a GTD analysis. In a subsequent PTD analysis, the direction of propagation is assumed to be the direction of Poynting's vector at the field point.

all

The field is computed as a ray field with one ray from each current element. A subsequent GTD or PTD analysis is then carried out for each ray separately. This is the most accurate method for GTD/PTD analysis, but it may be time consuming.

spherical

The field from the *Tabulated Planar Source* will be treated as a single ray which emanates from the origin of the coordinate system specified by `Coordinate System`. This procedure is only accurate if the scatterer in the following GTD/PTD analysis is in the far field from the source or the array elements are phased such that they radiate a field at the scatterer with a spherical phase front centred at the origin.

plane

The field from the elements will be treated as a single ray which is parallel to the z-axis of the coordinate system specified by *coor_sys*. This procedure is only accurate if the elements radiate a field in the direction of the z-axis of the coordinate system and if this field has a nearly plane phase front at the scatterer to be analysed by GTD/PTD.

Far Field Convergence (*far_field_convergence*) [struct].

When the far field of the source shall be determined, *po1* and *po2* of the attribute *po_points* may be determined automatically, see also the remarks below.

Status (*status*) [item from a list of character strings], default: **off**.

Determines if the parameters are found automatically:

off

po1 and *po2* are not determined.

on

po1 and *po2* are determined automatically.

Cone Angle (*cone_angle*) [real number], default: **90**.

The convergence of the PO integral is secured for a far field within a cone where the half cone angle is *cone_angle* (in degrees) and the z-axis of *coor_sys* is the cone axis.

Near Field Convergence (*near_field_convergence*) [struct].

When the near field of the source shall be determined on a plane, *po1* and *po2* of the attribute *po_points* may be determined automatically, see also the remarks below.

Status (*status*) [item from a list of character strings], default: **off**.

Determines if the parameters are found automatically:

off

po1 and *po2* are not determined.

on

po1 and *po2* are determined automatically.

Near Dist (*near_dist*) [real number with unit of length], default: **0**.

The near field shall be determined on a plane parallel to the xy-plane of *coor_sys* and z-value equal to *near_dist*.

rho (*rho*) [real number with unit of length], default: **0**.

The convergence of the PO integral is secured for the near field within a circle of radius *rho* on the above plane. The centre of the circle is on the z-axis of *coor_sys*

Scatterer Convergence (*scatterer_convergence*) [struct].

When the near field of the source shall be determined on a scatterer, *po1* and *po2* of the attribute *po_points* may be determined automatically, see also the remarks below.

Status (*status*) [item from a list of character strings], default: **off**.

Determines if the parameters are found automatically:

off

po1 and *po2* are not determined.

on

po1 and *po2* are determined automatically.

Scatterer (*scatterer*) [name of an object], default: **blank**.

Reference to an object of the class *Scatterer* on which the field shall be determined.

Remarks

If the cut or grid file(s) contain more than one frequency, the number of frequencies shall agree with the number of frequencies in the frequency object.

When the *file_type* is specified to 'cut', the field in the file(s) may be given as asymmetrical cuts (the field is given in the interval $0 \leq \rho \leq \rho_{\max}$ in cuts for $0 \leq \phi < 360°$) or symmetrical cuts (the field is given in the interval $-\rho_{\max} \leq \rho \leq \rho_{\max}$ in cuts for $0 \leq \phi < 180°$). In both cases, the field at $\rho = 0$ shall be included which means that for a symmetrical cut an uneven number of points must be read. Furthermore, the file must begin with the cut along $\phi = 0$.

The number of asymmetrical cuts N_a must be even and the maximum azimuthal mode index M becomes$M = N_a/2 - 1$. For N_s symmetrical cuts M becomes $M = N_s - 1$.

The field is interpolated by a Fourier method along ϕ and by a third order interpolation along ρ.

When the *file_type* is specified to 'grid', the interpolation is a third order interpolation along the two grid coordinates.

If any of the three convergence-attributes are set, the number of PO points specified by the user (*po1* and *po2*) will be used in the PO integral only if

they turn out to be larger than the numbers obtained from the convergence tests. If more than one convergence attribute is set the one that gives the largest values of *po1* and *po2*will be used. The convergence tests are performed by evaluating the field values at a number of test points on the desired surface (far field, near-field plane or scatterer) with an accuracy of approximately 80 dB below peak.