Lattice Grammar

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This is a summary of the GLPS lattice grammar and parser developed by Lingyun Yang, 2010.

The grammar is context free[1] and the text is in case independent free-format[2] style.

Comments

Single line

```
#
```

Statements

A statement may run over several lines and is terminated by ";":

```
<statement>;
```

Constants

Constants are defined by:

```
<constant name> = <arithmetic expression>;
```

Lattice File

The lattice file contains:

```
beam, energy = <real eV>, delta = <real>;
lattice, cod_eps = <real>;
```

[1] Chomsky type 2: grammars that only allow one symbol on the left hand side of a production, e.g. Algol-60 (specified by the Bachus-Nauer Form), Pascal, C or C++ (but not Fortran, i.e. DATA statements).

[2] White space (space, tab, and newline) has no significance (except in strings), i.e. can be inserted anywhere between tokens.

Elements

Marker

<element name>: marker;

Example: M1: Marker; # add mis-aligments

Drift

<element name>: drift, L = <length [m]>;

Example: L1 : Drift, L = 0.30;

Corrector

<element name>: Corrector,
L = <length [m]>,
Plane = <"HV"|"H"|"V">;

Example: COH : Corrector, L = 0, Plane="HV";

Dipole

<element name>: Dipole,
L = <length (ρ [m] · φ [rad])>,
[Roll[3] = <Design roll angle [°]>,]
Angle = <bend angle [°]>,
[e1 = <entrance angle [°]>,]
[e2 = <exit angle [°]>,]
[gap = <gap [m]>,
[b2 = < b_2 [m^{-2}] (gradient)>,
N_step = <no of integration steps>,
[HOM = <n, an, bn, …>;]
Example

B: Dipole, L = 0.70, angle = 10.0, e1 = 5.0, e2 = 5.0, b2 = -1.0, n_step = 8;

Quadrupole

[3] Due to sloppy notation inherited from the ALS in the early 90s, i.e., backwards capability has been kept.

<element name>: Quadrupole,
L = <length [m]>,
[Roll[3] = <Design roll angle [˚]>,]
B2 = <b_2 [m^{-2}] (gradient)>,
N_step = <no of integration steps>,
[HOM = <n, an, bn, …>

Example

QF: Quadrupole, L = 0.5, b2 = 2.2134, N_step = 4;

Sextupole

<element name>: Sextupole,
[L = <length [m], default 0 (thin kick)>,]
[Roll[3] = <Design roll angle [˚]>,]
B3 = <b_3 [m^{-3}] (sextupole strength)>;
N_step = <no of integration steps>,
[HOM = <n, an, bn, …>;]

Example

SF: Sextupole, b3 = -10.2363;

Multipole

<element name>: Multipole,
L = <length [m]>,
[Roll[3] = <Design roll angle [˚]>,]
[angle = <bend angle [˚]>,]
[e1 = <entrance angle [˚]>,]
[e2 = <exit angle [˚]>,]
N_step = <no of integration steps>,
[HOM = <n, an, bn, …>;]

Examples:

B: multipole, L = 0.70, T = 10.0, T1 = 5.0, T2 = 5.0, HOM = (2, -1.0, 0), N_step = 8;

QF: multipole, L = 0.70, HOM = (2, 2.50, 0.0, 4, 1.01e7, 0.0), N = 8;

Wiggler

<name> : Wiggler,
L = <length [m]>,
B = <B [T]>,
Lambda = <period [m]>,
k_x = <[m]>,
N_step = <no of integration steps>,

<name> : Kick_map,
L = <length [m]>,
File_name = <file name>,
N_step = <no of integration steps>;

Example

U143: wiggler, L = 4.80, BoBrho = 0.5, Lambda = 0.15, N = 20;

Cavity

<name> : Cavity,
f = <Frequency [Hz])>,
V = <RF amplitude [V])>,
h = <harmonic number>

Example CAV : Cavity, f = 499.95e6, V = 1.22e6, h = 328;

Sections

<line name>: line = (<element | line name> {, <element | line name>});

Operations

Reversal

-<element | line name>

Note, this commend reverses the list of elements, i.e., it does not change the parameters of the elements. In particular, the resulting list is only mirror symmetric if the individual elements are mirror symmetric.