

NewtonGF[GFSeries] - returns a procedure to compute generating series by Newton iteration

Calling Sequence

GFSeries(**Sys**, **labelling**, **z**, **order**)

Parameters

Sys – set of equations: a grammar in the combstruct syntax

labelling: one of labelled, labeled, unlabelled, unlabeled, as in [comstruct](#)

z – name: name of the variable in the series

order – order of the series (default: Order)

Description

- The **GFSeries** command returns the expansions of the generating series of Sys to the order prescribed by the parameter order (or the global variable **Order**, if no order is specified).
- This command is part of the **NewtonGF** package, so it can be used in the form **GFSeries(..)** only after executing the command **with(NewtonGF)**. However, it can always be accessed through the long form of the command by using **NewtonGF[GFSeries](..)**.

Examples

```
> with(NewtonGF);
[BoltzmannExpectedSize, BoltzmannParameter, GFSeries, NumericalNewtonIteration,
  Radius, SeriesNewtonIteration] (2.1)
```

A grammar for general plane trees.

```
> P := { T = Prod(Z, Sequence(T)) };
      P := { T = Prod(Z, Sequence(T)) } (2.2)
```

```
> GFSeries(P, labelled, z);
      [T = z + z^2 + 2 z^3 + 5 z^4 + 14 z^5 + O(z^6), Z = z + O(z^6)] (2.3)
```

```
> GFSeries(P, labelled, z, 15);
      [Z = z + O(z^15), T = z + z^2 + 2 z^3 + 5 z^4 + 14 z^5 + 42 z^6 + 132 z^7 + 429 z^8
      + 1430 z^9 + 4862 z^10 + 16796 z^11 + 58786 z^12 + 208012 z^13 + 742900 z^14 +
      O(z^15)] (2.4)
```

```
> Order:=20:
> GFSeries(P, labelled, z);
      [Z = z + O(z^20), T = z + z^2 + 2 z^3 + 5 z^4 + 14 z^5 + 42 z^6 + 132 z^7 + 429 z^8
      + 1430 z^9 + 4862 z^10 + 16796 z^11 + 58786 z^12 + 208012 z^13 + 742900 z^14
      + 2674440 z^15 + 9694845 z^16 + 35357670 z^17 + 129644790 z^18 + 477638700 z^19
      + O(z^20)] (2.5)
```

A grammar for general non-plane trees.

```
> NP := { T = Prod(Z, Set(T)) };
      NP := { T = Prod(Z, Set(T)) } (2.6)
```

```
> GFSeries(NP, labelled, z); (2.7)
```

$$\begin{aligned}
 & \left[Z = z + O(z^{20}), T = z + z^2 + \frac{3}{2} z^3 + \frac{8}{3} z^4 + \frac{125}{24} z^5 + \frac{54}{5} z^6 + \frac{16807}{720} z^7 \right. \\
 & + \frac{16384}{315} z^8 + \frac{531441}{4480} z^9 + \frac{156250}{567} z^{10} + \frac{2357947691}{3628800} z^{11} + \frac{2985984}{1925} z^{12} \\
 & + \frac{1792160394037}{479001600} z^{13} + \frac{7909306972}{868725} z^{14} + \frac{320361328125}{14350336} z^{15} \\
 & + \frac{35184372088832}{638512875} z^{16} + \frac{2862423051509815793}{20922789888000} z^{17} + \frac{5083731656658}{14889875} z^{18} \\
 & \left. + \frac{5480386857784802185939}{6402373705728000} z^{19} + O(z^{20}) \right] \quad (2.7)
 \end{aligned}$$

> GFSeries(NP, unlabelled, z);

$$\begin{aligned}
 & \left[Z = z + O(z^{20}), T = z + z^2 + 2 z^3 + 4 z^4 + 9 z^5 + 20 z^6 + 48 z^7 + 115 z^8 + 286 z^9 \right. \\
 & + 719 z^{10} + 1842 z^{11} + 4766 z^{12} + 12486 z^{13} + 32973 z^{14} + 87811 z^{15} \\
 & \left. + 235381 z^{16} + 634847 z^{17} + 1721159 z^{18} + 4688676 z^{19} + O(z^{20}) \right] \quad (2.8)
 \end{aligned}$$

See Also

[combstruct\[gfseries\]](#), [NewtonGF\[NumericalNewtonIteration\]](#), [NewtonGF\[Radius\]](#), [NewtonGF](#), [NewtonGF\[SeriesNewtonIteration\]](#)