Introduction to the gfun Package

Calling Sequence

function(args)
gfun[function](args)

Description

The gfun package has been designed as a help for the manipulation and discovery of functions or sequences satisfying linear differential or recurrence equations. The name of the package comes from its combinatorial application to generating functions.

The basic principle of the package is that linear differential equations or recurrences can be used as data-structures to represent their solutions. Procedures that convert to such a representation are:

\begin{verbatim}
algfuntoalgeq  algeqtodiffeq  holexprtodiffeq
\end{verbatim}

The differential equations and recurrences can then be manipulated by

\begin{verbatim}
algebraicsubs  diffgetorec  rectodiffeq
poltodiffeq  poltorec  reducerecorder
\end{verbatim}

and the following ones that perform more elementary operations

\begin{verbatim}
borel  cauchyproduct  diffeg+diffeq
diffeq+diffeq  diffegtohomdiffeq  hadamardproduct
invborel  Laplace  minimizediffeq (new)
rec+rec  rec*rec  rectohomrec
\end{verbatim}

Useful information can then be extracted from these equations by one of

\begin{verbatim}
algeqtoseries  ratpolytocoeff  rectoproc  the NumGfun subpackage
the ContFrac subpackage
\end{verbatim}

Given the first terms of the sequence, the gfun package also contains functions that will help conjecture what the generating function is. In some cases, this answer will be `explicit'. In most cases though, such an explicit expression will not exist, and the answer will be an equation (either differential or algebraic) satisfied by the generating function. The functions dealing with numbers and series are:

\begin{verbatim}
listtodiffeq  seriestodiffeq
listtorec  seriestorec
listtoalgeq  seriestoalgeq
listtoratpoly  seriestoratpoly
listtohypergeom  seriestohypergeom
guessseqn  guessgf
\end{verbatim}

All these guessing functions are based on a fast implementation that can be called directly, also for nonlinear problem:
The way the guessing proceeds can be controlled by modifying Parameters.

There are different types of generating functions that can be manipulated in gfun, such as ordinary (ogf) and exponential generating functions. The following conversion routines transform from one type to another:

- listtolist
- listtoseries
- seriestolist
- seriestoseries

Information about the computations that are being done can be obtained by setting infolevel[gfun] to anything between 1 and 5.

References


See also the web page of gfun: http://perso.ens-lyon.fr/bruno.salvy/software/the-gfun-package/

See Also

with gfun[Parameters]