file next to gfun

7400

> ?convert[ratpoly]

FUNCTION: convert/ratpoly - convert series to a rational polynomial

CALLING SEQUENCE:

```
convert( <series>, ratpoly );
convert( <series>, ratpoly, <numdeg>, <dendeg> );
```

SYNOPSIS:

- Converts a series to a rational polynomial (rational function). If the first argument is a Taylor or Laurent series then the result is a Pade approximation, and if it is a Chebyshev series then the result is a Chebyshev-Pade approximation.

- The first argument must be either of type 'laurent' (hence a Laurent series) or else a Chebyshev series (represented as a sum-of products in terms of the basis functions T(k,x) for integers k).

- If the third and fourth arguments appear, they must be integers specifying the desired degrees of numerator and denominator, respectively. (Note: The actual degrees appearing in the approximant may be less than specified if there exists no approximant of the specified degrees.)

- If the third and fourth arguments are not specified then the degrees of numerator and denominator are chosen to be m and n, respectively, such that m+n+1 = order(<series>) and either m=n or m=n+1. (The order of a Chebyshev series is defined to be d+1 where d is the highest-degree term which appears.)

- For the Pade case, two different algorithms are implemented. For the pure univariate case where the coefficients contain no indeterminates and no floating-point numbers, a ''fast'' algorithm due to Cabay and Choi is used. Otherwise, an algorithm due to Geddes based on fraction-free symmetric Gaussian elimination is used.

- For the Chebyshev-Pade case, the method used is based on transforming the Chebyshev series to a power series with the same coefficients, computing a Pade approximation for the power series, and then converting back to the appropriate Chebyshev-Pade approximation.

- REFERENCES:

K.O. Geddes, Symbolic computation of Pade approximants, ACM Trans. Math. Software, 5(2), June 1979, pp. 218-233.

K.O. Geddes, Block Structure in the Chebyshev-Pade Table, SIAM J. Numer. Anal., 18(5), Oct. 1981, pp. 844-861.

S. Cabay and D.K. Choi, Algebraic computations of scaled Pade fractions, SIAM J. Comput., 15(1), Feb. 1986, pp. 243-270.

EXAMPLES:

> series(exp(x), x);

$$1 + x + 1/2\, x^2 + 1/6\, x^3 + 1/24\, x^4 + 1/120\, x^5 + O(x^6)$$

```
> convert(", ratpoly);
                                              2          3
                           1 + 3/5 x + 3/20 x  + 1/60 x
                           -----------------------------
                                                   2
                                1 - 2/5 x + 1/20 x

> Digits := 5:
> chebyshev(cos(x), x);
    .76520 T(0, x) - .22981 T(2, x) + .0049533 T(4, x) - .000041877 T(6, x)

> convert(", ratpoly, 2,2);
                          .76025 T(0, x) - .19673 T(2, x)
                          -------------------------------
                             T(0, x) + .043088 T(2, x)
```

SEE ALSO: convert[confrac]