gfun[algeqtodiffeq] - compute a differential equation satisfied by an algebraic function

Calling Sequence

algeqtodiffeq(**p**, **y(z)**, **ini, options**)

Parameters

`p` – polynomial in **y** and **z** (or a polynomial equation)

`y` – name of the holonomic function

`z` – name of the generic variable associated with **y**

`ini` – (optional) initial conditions to specify a solution of **eq** `options` – (optional) equation(s) of the form homogeneous=true and/or ini_cond=false

Description

The polynomial **p** defines an algebraic function, **RootOf(p,y)** in Maple terms. This procedure computes a linear differential equation with polynomial coefficients verified by the function **y(z)**. This equation is of order at most **degree(p,y)-1**.

The output contains initial conditions in zero (**y(0)**, **D(y)(0)**, and so on), and can thus be given directly to dsolve. In general, **y(0)** is a **RootOf** a polynomial, **D(y)(0)** a rational expression in **y(0)**, **(D@@2)(y)(0)** a rational expression in **y(0)**,**D(y)(0)**, and so on.

If the optional argument "homoegenous=true" is given, the differential equation will be forced to be homogeneous.

If the optional argument "ini_cond=false" is given, no attempt at computing initial conditions at 0 will be made and the equation will be returned without initial conditions.

Examples

```
> with(gfun):
  algeqtodiffeq(y=1+z*y^2,y(z));
```

$$1 + (-1 + 2z)\,y(z) + \left(-z + 4z^2\right)\left(\frac{d}{dz}\,y(z)\right) \qquad (2.1)$$

```
> algeqtodiffeq(56*a^3+7*a^3*y^3-14*y*z,y(z),{y(0)=-2});
```

$$\left\{-y(z)\,z + 3\left(\frac{d}{dz}\,y(z)\right)z^2 + \left(-108\,a^9 + 2z^3\right)\left(\frac{d^2}{dz^2}\,y(z)\right), y(0) = -2, D(y)(0) = -\frac{1}{3a^3}\right\} \qquad (2.2)$$

We can use **algeqtodiffeq** with **diffeqtorec** to determine fast Taylor expansions.

```
> p:=y=1+z*y+z*y^5;
```

$$p := y = 1 + z\,y + z\,y^5 \qquad (2.3)$$

```
> deq:=algeqtodiffeq(p,y(z)):
```

```
rec:=diffeqtorec(deq,y(z),u(n)):
p_generator:=rectoproc(rec,u(n),list):
p_geneator(30);
```

$$p\_geneator(30) \tag{2.4}$$

See Also

gfun, gfun[parameters], dsolve, gfun[diffeqtorec]