`centerfocus` output format

The result list $\boldsymbol{L}$ consists of points (coefficients of Poincaré differential forms) and some of their properties. These points satisfy all conditions which are required by the `centerfocus` input parameters used.

It is possible to load the `centerfocus` output file in `Macaulay2`.

The *Poincaré differential forms* ω treated by `centerfocus` are of the form

$$\omega := Pdx + Qdy$$

$$\text{with } P = x + p(x, y) \text{ and } Q = y + q(x, y)$$

where p and q are polynomials without constant and linear terms over a finite field F_p.

output format:
The result list $\boldsymbol{L}$ is structured as follows:

$$\textbf{\textit{value(L)}} \quad := \quad \{ \quad \emptyset \mid \textit{result of experiment 0}, \; \ldots, \; \textit{result of experiment } n \quad \}$$

result of experiment i := {
Point,
PointID,
number of successive vanished focal values,
FocalValuesList,
JacobianInfo,
QuadricsInfo,
SmoothnessInfo
}

Point := {
coefficients of degree 2 monomials of the polynomial p ,
coefficients of degree 2 monomials of the polynomial q,
coefficients of degree 3 monomials of the polynomial p,
coefficients of degree 3 monomials of the polynomial q,
. . . ,
coefficients of degree **d** *monomials of the polynomial p*,
coefficients of degree **d** *monomials of the polynomial q*
}

where degree $\boldsymbol{d}$ is $\boldsymbol{max}(deg\ p,\ deg\ q)$

'coefficients of degree k monomials of the polynomial p' := { *coefficient of polynomial p monomial* x^k ,
coefficient of polynomial p monomial $x^{k-1}y$
. . . ,
coefficient of polynomial p monomial y^k
}

PointID := { *-1* or
the ID of a point entry in the centerfocus database, see http://87.230.76.194/centerfocus/
}

FocalValuesList := { *first focal value* s_1,
second focal value s_2,
. . . ,
k-th focal value s_k,
}

Length ***k*** of *FocalValuesList* is variable, and is at least

`min`(*number of vanished focal values + 1*, *maxFocalValuesToCompute*)

where *maxFocalValuesToCompute* is an input parameter. Maximal number of computable focal values is bounded by :

$$0 \leq maxFocalValuesToCompute \leq \frac{char(F_p) - 3}{2}$$

JacobianInfo := { *fullJacobianInfo*
[, *subJacobianInfo*] *(optional)*
}

fullJacobianInfo := { *jacobianMatrix,*
rank(jacobianMatrix)
}

jacobianMatrix is the jacobian of focal value polynomials $s_1(..), ..., s_l(..)$ with the coefficients r_i of the polynomials p and q as function arguments. The order of function arguments used is printed at the end of the result file and is usually

$$(r_1,\ ...,\ r_m) = (p_{20},\ p_{11},\ p_{02},\ \ q_{20},\ q_{11},\ q_{02},\ \ p_{30},\ p_{21},\ p_{12},\ p_{03},\ \ q_{30},\ q_{21},\ q_{12},\ q_{03},\ ...)$$

where p_{ij} is the coefficient of the polynomial p monomial $x^i y^j$.
q_{ij} is defined similarly.

$$\textbf{\textit{jacobianMatrix}} \quad := \quad \text{matrix}\ \{ \quad \begin{array}{c} \{ \ \frac{\partial s_1}{\partial r_1}(\omega), \cdots, \frac{\partial s_1}{\partial r_m}(\omega)\ \}, \\ \vdots \qquad\qquad \vdots \\ \{ \ \frac{\partial s_l}{\partial r_1}(\omega), \cdots, \frac{\partial s_l}{\partial r_m}(\omega)\ \}\ \} \end{array}$$

where the number of rows is

$l =$ `min`(*number of vanished focal values*, *maxFocalValuesToCompute*).

and the number m of the variables r_i is $(d-1)(d+4)$

SubJacobianInfo is currently not used.

QuadricsInfo will be explained in future.

some of the defined `Macaulay2` *objects:*

Fp	$=$	$\mathbb{Z}/characteristic$	:	finite field
Scf	$=$	$F_p[eps]$	:	ring of epsilon-coefficients
Rcf	$=$	$F_p[x, y]$	:	coordinate ring of the plane
Dcf	$=$	$\Lambda_{F_p}[dx, dy]$	:	skew commutative ring of differentials
RDcf	$=$	$Rcf \otimes Dcf$	:	differentials with field-coefficients
SRDcf	$=$	$Scf \otimes Rcf \otimes Dcf$	:	differentials with epsilon-coefficients

some of the defined `Macaulay2` *functions:*

pointDiffCF($L\#i$)	:	get point $L\#i$ as differential form (element of **SRDcf**)
numberZeroValuesCF($L\#i$)	:	number of first successive vanished focal values for $L\#i$
focalValuesListCF($L\#i$)	:	list of computed focal values for $L\#i$ focal values are elements of the **Scf** ring
jacobiMatrixCF($L\#i$)	:	jacobian matrix for focal value functions of the point $L\#i$