TRUST Reference Manual V1.7.6

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Link to: **TRUST Generic Guide**

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1 Syntax to define a mathematical function

In a mathematical function, used for example in field definition, it's possible to use the predifined function (an object parser is used to evaluate the functions) :
ABS : absolute value function
COS : cosinus function
SIN : sinus function
TAN : tan function
ATAN : arctan function
EXP : exponential function
LN : neperian logaithm function
SQRT : root mean square function
INT : integer function
ERF : erf function
RND(x) : random function (values between 0 and x)
COSH : hyperbolic cosinus function
SINH : hyperbolic sinus function
TANH : hyperbolic tangent function
ACOS : inverse cosinus function
ATANH : inverse hyperbolic tangent function

NOT(x) : not equal to x
x_AND_y : and function (returns 1 if x and y true else 0)
x_OR_y : or function (returns 1 if x or y true else 0)
x_GT_y : greater to (returns 1 if x>y else 0)
x_GE_y : greater or equal to (returns 1 if x>=y else 0)
x_LT_y : lesser to (returns 1 if x<y else 0)
x_LE_y : lesser or equal to (returns 1 if x<=y else 0)
x_MIN_y : minimum of x and y
x_MAX_y : maximum of x and y
x_MOD_y : modular division of x per y
x_EQ_y : equal to (returns 1 if x=y else 0)
x_NEQ_y : not equal to (returns 1 if x!=y else 0)

You can also use the following operations:
+ : addition
- : substraction
/ : division
* : multiplication
% : modulo
$: max
^ : power
< : lesser than
> : greater than
[: less or equal to
] : greater of equal to

You can also use the following constants:
Pi : pi value (3,1415...)

The variables which can be used are:
x,y,z : coordinates
t : time

Examples:
Champ_front_fonc_txyz 2 cos(y+x^2) t+ln(y)
Champ_fonc_xyz dom 2 tanh(4*y)*(0.95+0.1*rnd(1)) 0.

Possible error:
Champ_fonc_txyz 1 cos(10*t)*(1<x<2)*(1<y<2)
Previous line is wrong. It should be written:
Champ_fonc_txyz 1 cos(10*t)*(1<x)*(x<2)*(1<y)*(y<2)

2 Existing & predefined fields names

Here is a list of post-processable fields, but it is not the only ones.

Physical values	**Keyword for field_name**	**Unit**
Speed	**Vitesse** or **Velocity**	$m.s^{-1}$
Kinetic energy per elements ($0.5\rho\|\|u_i\|\|^2$)	**Energie_cinetique_elem**	$kg.m^{-1}.s^{-2}$

... continued on next page ...

Physical values	Keyword for field_name	Unit
Total kinetic energy $\left(\frac{\sum_{i=1}^{nb\_elem} 0.5\rho\|\|u_i\|\|^2 vol_i}{\sum_{i=1}^{nb\_elem} vol_i}\right)$	**Energie_cinetique_totale**	$kg.m^{-1}.s^{-2}$
Vorticity	**Vorticite**	s^{-1}
Pressure in incompressible flow $(P/\rho + gz)$ For Front Tracking probleme $(P + \rho gz)$	**Pression** [1]	$Pa.m^3.kg^{-1}$ or Pa
Pressure in incompressible flow (P+ρgz)	**Pression_pa** or **Pressure**	Pa
Pressure in compressible flow	**Pression**	Pa
Hydrostatic pressure (ρgz)	**Pression_hydrostatique**	Pa
Totale pressure (when quasi compressible model is used)=Pth+P	**Pression_tot**	Pa
Pressure gradient $(\nabla(P/\rho + gz))$	**Gradient_pression**	$m.s^{-2}$
Temperature	**Temperature**	^{o}C or K
Phase temperature of a two phases flow	**Temperature_EquationName**	^{o}C or K
Mass transfer rate between two phases	**Temperature_mpoint**	$kg.m^{-2}.s^{-1}$
Temperature variance	**Variance_Temperature**	K^2
Temperature dissipation rate	**Taux_Dissipation_Temperature**	$K^2.s^{-1}$
Temperature gradient	**Gradient_temperature**	$K.m^{-1}$
Heat exchange coefficient	**H_echange_Tref** [2]	$W.m^{-2}.K^{-1}$
Turbulent heat flux	**Flux_Chaleur_Turbulente**	$m.K.s^{-1}$
Turbulent viscosity	**Viscosite_turbulente**	$m^2.s^{-1}$
Turbulent dynamic viscosity (when quasi compressible model is used)	**Viscosite_dynamique_turbulente**	$kg.m.s^{-1}$
Turbulent kinetic energy	**K**	$m^2.s^{-2}$
Turbulent dissipation rate	**Eps**	$m^3.s^{-1}$
Turbulent quantities K and Epsilon	**K_Eps**	($m^2.s^{-2}$,$m^3.s^{-1}$)
Constituent concentration	**Concentration**	
Component velocity along X	**VitesseX**	$m.s^{-1}$
Component velocity along Y	**VitesseY**	$m.s^{-1}$
Component velocity along Z	**VitesseZ**	$m.s^{-1}$
Mass balance on each cell	**Divergence_U**	$m^3.s^{-1}$
Irradiancy	**Irradiance**	$W.m^{-2}$
Q-criteria	**Critere_Q**	s^{-1}
Distance to the wall $Y^+ = yU/\nu$ (only computed on boundaries of wall type)	**Y_plus**	dimensionless
Friction velocity	**U_star**	$m.s^{-1}$

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[1] The post-processed pressure is the pressure divided by the fluid's density $(P/\rho + gz)$ on incompressible laminar calculation. For turbulent, pressure is $P/\rho + gz + 2/3 * k$ cause the turbulent kinetic energy is in the pressure gradient.

[2] Tref indicates the value of a reference temperature and must be specified by the user. For example, H_echange_293 is the keyword to use for Tref=293K.

Physical values	Keyword for field_name	Unit
Cell volumes	**Volume_maille**	m^3
Chemical potential	**Potentiel_Chimique_Generalise**	
Source term in non Galinean referential	**Acceleration_terme_source**	$m.s^{-2}$
Stability time steps	**Pas_de_temps**	S
Listing of boundary fluxes	**Flux_bords**	cf each *.out file
Volumetric porosity	**Porosite_volumique**	dimensionless
Distance to the wall	**Distance_Paroi** [3]	m
Volumic thermal power	**Puissance_volumique**	$W.m^{-3}$
Local shear strain rate defined as $\sqrt{(2SijSij)}$	**Taux_cisaillement**	s^{-1}
Cell Courant number (VDF only)	**Courant_maille**	dimensionless
Cell Reynolds number (VDF only)	**Reynolds_maille**	dimensionless

3 interprete

Description: Basic class for interpreting a data file. Interpretors allow some operations to be carried out on objects.

See also: objet_u (33) read (3.65) associate (3.4) discretize (3.18) mailler (3.47) maillerparallel (3.49) ecrire_fichier_bin (3.106) ecrire (3.105) read_file (3.66) lire_tgrid (3.68) solve (3.85) execute_parallel (3.23) end (3.36) dimension (3.16) bidim_axi (3.6) axi (3.5) transformer (3.97) rotation (3.81) dilate (3.15) testeur (3.90) test_solveur (3.89) postraiter_domaine (3.61) modif_bord_to_raccord (3.50) remove_elem (3.74) regroupebord (3.73) supprime_bord (3.86) calculer_moments (3.7) imprimer_flux (3.38) decouper_bord_coincident (3.14) raffiner_anisotrope (3.63) raffiner_isotrope (3.64) trianguler (3.98) tetraedriser (3.92) orientefacesbord (3.54) reorienter_tetraedres (3.78) reorienter_triangles (3.79) verifiercoin (3.104) porosites (3.58) porosites_champ (3.60) discretiser_domaine (3.17) { (3.12) } (3.37) export (3.24) debog (3.11) pilote_icoco (3.57) moyenne_volumique (3.51) ecrire_champ_med (3.20) read_med (3.2) lire_ideas (3.46) ecrire_med (3.107) system (3.88) redresser_hexaedres_vdf (3.71) analyse_angle (3.3) remove_invalid_internal_boundaries (3.76) reordonner (3.80) option_vdf (3.53) precisiongeom (3.62) nettoiepasnoeuds (3.52) scatter (3.82) partition (3.55) reordonner_faces_periodiques (3.77) corriger_frontiere_periodique (3.9) distance_paroi (3.19) extrudebord (3.30) extruder (3.32) extract_2d_from_3d (3.25) extruder_en20 (3.34) extrudeparoi (3.31) ecriturelecturespecial (3.22) lata_to_med (3.43) lata_to_other (3.45) decoupebord_pour_rayonnement (3.13) extraire_plan (3.28) extraire_domaine (3.27) extraire_surface (3.29) integrer_champ_med (3.41) orienter_simplexes (3.70) verifier_simplexes (3.103) verifier_qualite_raffinements (3.101) testeur_medcoupling (3.91) interprete_geometrique_base (3.42) Raffiner_isotrope_parallele (3.1) refine_mesh (3.72)

Usage:
interprete

3.1 Raffiner_isotrope_parallele

Description: Refine parallel mesh in parallel

See also: interprete (3)

Usage:
Raffiner_isotrope_parallele {

[3] distance_paroi is a field which can be used only if the mixing length model (see 2.15.1.2) is used in the data file.

name_of_initial_zones *str*
name_of_new_zones *str*
[**ascii**]

}
where

- **name_of_initial_zones** *str*: name of initial Zones
- **name_of_new_zones** *str*: name of new Zones
- **ascii** : writing Zones in ascii format

3.2 read_med

Synonymous: **lire_med**

Description: Keyword to read MED mesh files where domain_name corresponds to the domain name, filename.med corresponds to the file (written in format MED) containing the mesh named mesh_name.
Note about naming boundaries: When reading filename.med, TRUST will detect boundaries between domain (Raccord) when the name of the boundary begins by type_raccord_. For example, a boundary named type_raccord_wall in filename.med will be considered by TRUST as a boundary named wall between two domains.
NB: To read several domains from a mesh issued from a MED file, use Lire_Med to read the mesh then use Create_domain_from_sous_zone keyword.
NB: If the MED file contains one or several subzone defined as a group of volumes, then Lire_MED will read it and will create two files domain_name_ssz.geo and domain_name_ssz_par.geo defining the subzones for sequential and/or parallel calculations. These subzones will be read in sequential in the datafile by including (after Lire_Med keyword) something like:
Lire_Med ....
Read_file domain_name_ssz.geo ;
During the parallel calculation, you will include something:
Scatter { ... }
Read_file domain_name_ssz_par.geo ;

See also: interprete (3)

Usage:
read_med [**vef**] [**family_names_from_group_names**] [**short_family_names**] **nom_dom** **nom_dom_med** **file**
where

- **vef** *str into ['vef']*: Option vef is obsolete and is kept for backward compatibility.
- **family_names_from_group_names** *str into ['family_names_from_group_names']*: The option family_names_from_group_names uses the group names instead of the family names to detect the boundaries into a MED mesh (useful when trying to read a MED mesh file from Gmsh tool which can now read and write MED meshes).
- **short_family_names** *str into ['short_family_names']*: The option shorty_family_names is useful to suppress FAM_-*_ from the boundary names of the MED meshes.
- **nom_dom** *str*: corresponds to the domain name
- **nom_dom_med** *str*: name of the mesh in med file
- **file** *str*: corresponds to the file (written in format MED) containing the mesh

3.3 analyse_angle

Description: Keyword Analyse_angle prints the histogram of the largest angle of each mesh elements of the domain named name_domain. nb_histo is the histogram number of bins. It is called by default during the domain discretization with nb_histo set to 18. Useful to check the number of elements with angles above 90 degrees.

See also: interprete (3)

Usage:
analyse_angle domain_name nb_histo
where

- **domain_name** *str*: Name of domain to resequence.
- **nb_histo** *int*

3.4 associate

Synonymous: **associer**

Description: This interpretor allows one object to be associated with another. The order of the two objects in this instruction is not important. The object objet_2 is associated to objet_1 if this makes sense; if not either objet_1 is associated to objet_2 or the program exits in error because it cannot execute the Associer (Associate) instruction. For example, to calculate water flow in a pipe, a Pb_Hydraulique type object needs to be defined. But also a Domaine type object to represent the pipe, a Schema_euler_explicite type object for time discretisation, a discretisation type object (VDF or VEF) and a Fluide_Incompressible type object which will contain the water properties. These objects must then all be associated with the problem.

See also: interprete (3)

Usage:
associate objet_1 objet_2
where

- **objet_1** *str*: Objet_1
- **objet_2** *str*: Objet_2

3.5 axi

Description: This keyword allows a 3D calculation to be executed using cylindrical co-ordinates (R,θ,Z). If this instruction is not included, calculations are carried out using Cartesian co-ordinates.

See also: interprete (3)

Usage:
axi

3.6 bidim_axi

Description: Keyword allowing a 2D calculation to be executed using axisymetric co-ordinates (R, Z). If this instruction is not included, calculations are carried out using Cartesian co-ordinates.

See also: interprete (3)

Usage:
bidim_axi

3.7 calculer_moments

Description: Calculate and print the torque (moment of force) exerted by the fluid on each boundaries in output files (.out) of the domain nom_dom.

See also: interprete (3)

Usage:
calculer_moments nom_dom mot
where

- **nom_dom** *str*: Name of domain.
- **mot** *lecture_bloc_moment_base* (3.8): Keyword.

3.8 lecture_bloc_moment_base

Description: Auxiliary class for calcul and print of the moments.

See also: objet_lecture (32) calcul (3.8.1) centre_de_gravite (3.8.2)

Usage:

3.8.1 calcul

Description: The centre of gravity will be calculated.

See also: (3.8)

Usage:
calcul

3.8.2 centre_de_gravite

Description: To specify a specific centre of gravity.

See also: (3.8)

Usage:
centre_de_gravite point
where

- **point** *un_point* (3.8.3): A centre of gravity.

3.8.3 un_point

Description: A point.

See also: objet_lecture (32)

Usage:

pos
where

- **pos** *x1 x2 (x3)*: Point co-ordinates.

3.9 corriger_frontiere_periodique

Description: The Corriger_frontiere_periodique keyword is mandatory to first define the periodic boundaries, to reorder the faces and eventually fix unaligned nodes of theses boundaries. Faces on one side of the periodic domain are put first, then the faces on the opposite side, in the same order. It must be run in sequential before mesh splitting.

See also: interprete (3)

Usage:
corriger_frontiere_periodique {

> **domaine** *str*
> **bord** *str*
> [**direction** *n x1 x2 ... xn*]
> [**fichier_post** *str*]

}
where

- **domaine** *str*: Name of domain.
- **bord** *str*: the name of the boundary (which must contain two opposite sides of the domain)
- **direction** *n x1 x2 ... xn*: defines the periodicity direction vector (a vector that points from one node on one side to the opposite node on the other side. This vector must be given if the automatic algorithm fails, that is:
  - when the node coordinates are not perfectly periodic
  - when the periodic direction is not aligned with the normal vector of the boundary faces
- **fichier_post** *str*: .

3.10 create_domain_from_sous_zone

Description: These keyword fills the domain domaine_final with the subzone par_sous_zone from the domain domaine_init. It is very useful when meshing several mediums with Gmsh. Each medium will be defined as a subzone into Gmsh. A MED mesh file will be saved from Gmsh and read with Lire_Med keyword by the TRUST data file. And with this keyword, a domain will be created for each medium in the TRUST data file.

See also: interprete_geometrique_base (3.42)

Usage:
create_domain_from_sous_zone {

> **domaine_final** *str*
> **par_sous_zone** *str*
> **domaine_init** *str*

}
where

- **domaine_final** *str*: new domain in which faces are stored
- **par_sous_zone** *str*: a sub-area allowing to choose the elements
- **domaine_init** *str*: initial domain

3.11 debog

Description: Class to debug some differences between two TRUST versions on a same data file.
If you want to compare the results of the same code in sequential and parallel calculation, first run (mode=0) in sequential mode (the files fichier1 and fichier2 will be written first) then the second run in parallel calculation (mode=1).
During the first run (mode=0), it prints into the file DEBOG, values at different points of the code thanks to the C++ instruction call. see for example in Noyau/Resoudre.cpp file the instruction: Debog::verifier(msg,value); Where msg is a string and value may be a double, integer or array.
During the second run (mode=1), it prints into a file Err_Debog.dbg the same messages than in the DEBOG file and checks if the differences between results from the two codes are less than error. If not, it prints Ok else show the differences and the lines where it occured.

See also: interprete (3)

Usage:
debog pb fichier1 fichier2 seuil mode
where

- **pb** *str*: Name of the problem to debug.
- **fichier1** *str*: Name of the file where domain will be written in sequential calculation.
- **fichier2** *str*: Name of the file where faces will be written in sequential calculation.
- **seuil** *float*: Minimal value (by default 1.e-20) for the differences between the two codes.
- **mode** *int*: By default -1 (nothing is written in the different files), you will set 0 for the run with the first code, and 1 for the run with the second code.

3.12 {

Description: Block's beginning.

See also: interprete (3)

Usage:
{

3.13 decoupebord_pour_rayonnement

Description: To subdivide the external boundary of a domain in several parts (may be useful for better accuracy when using radiation model in transparent medium). to specify the boundaries of the fine_domain_name domain to be splitted. These boundaries will be cut according the coarse mesh defined by either the keyword domaine_grossier (each boundary face of the coarse mesh coarse_domain_name will be used to group boundary faces of the fine mesh to define a new boundary), either by the keyword nb_parts_naif (each boundary of the fine mesh is splitted into a partition with nx*ny*nz elements), either by a geometric condition given by a formulae with the keyword condition_geometrique. If used, the coarse_domain_name domain should have the same boundaries name of the fine_domain_name domain.
A mesh file (ASCII format, except if binaire option is specified) named by default newgeom (or specified by the nom_fichier_sortie keyword) will be created and will contain the fine_domain_name domain with the splitted boundaries named boundary_name

See also: interprete (3)

Usage:
decoupebord_pour_rayonnement {

domaine *str*

[**domaine_grossier** *str*]
[**nb_parts_naif** *n n1 n2 ... nn*]
[**nb_parts_geom** *n n1 n2 ... nn*]
bords_a_decouper *n word1 word2 ... wordn*
[**nom_fichier_sortie** *str*]
[**condition_geometrique** *n word1 word2 ... wordn*]
[**binaire** *int*]

}
where

- **domaine** *str*
- **domaine_grossier** *str*
- **nb_parts_naif** *n n1 n2 ... nn*
- **nb_parts_geom** *n n1 n2 ... nn*
- **bords_a_decouper** *n word1 word2 ... wordn*
- **nom_fichier_sortie** *str*
- **condition_geometrique** *n word1 word2 ... wordn*
- **binaire** *int*

3.14 decouper_bord_coincident

Description: In case of non-coincident meshes and a paroi_contact condition, run is stopped and two external files are automatically generated in VEF (connectivity_failed_boundary_name and connectivity-_failed_pb_name.med). In 2D, the keyword Decouper_bord_coincident associated to the connectivity-_failed_boundary_name file allows to generate a new coincident mesh.

See also: interprete (3)

Usage:
decouper_bord_coincident domain_name bord
where

- **domain_name** *str*: Name of domain.
- **bord** *str*: connectivity_failed_boundary_name

3.15 dilate

Description: Keyword to multiply the whole coordinates of the geometry.

See also: interprete (3)

Usage:
dilate domain_name alpha
where

- **domain_name** *str*: Name of domain.
- **alpha** *float*: Value of dilatation coefficient.

3.16 dimension

Description: Keyword allowing calculation dimensions to be set (2D or 3D), where dim is an integer set to 2 or 3. This instruction is mandatory.

See also: interprete (3)

Usage:
dimension dim
where

- **dim** *int into [2, 3]*: Number of dimensions.

3.17 discretiser_domaine

Description: Useful to discretize the domain domain_name (faces will be created) without defining a problem.

See also: interprete (3)

Usage:
discretiser_domaine domain_name
where

- **domain_name** *str*: Name of the domain.

3.18 discretize

Synonymous: **discretiser**

Description: Keyword to discretise a problem problem_name according to the discretisation dis.
IMPORTANT: A number of objects must be already associated (a domain, time scheme, central object) prior to invoking the Discretiser (Discretise) keyword. The physical properties of this central object must also have been read.

See also: interprete (3)

Usage:
discretize problem_name dis
where

- **problem_name** *str*: Name of problem.
- **dis** *str*: Name of the discretisation object.

3.19 distance_paroi

Description: Class to generate external file Wall_length.xyz devoted for instance, for mixing length modelling. In this file, are saved the coordinates of each element (center of gravity) of dom domain and minimum distance between this point and boundaries (specified bords) that user specifies in data file (typically, those which are associated to walls). A field Distance_paroi is available to post process the distance to the wall.

See also: interprete (3)

Usage:
distance_paroi dom bords format
where

- **dom** *str*: Name of domain.
- **bords** *n word1 word2 ... wordn*: Boundaries.
- **format** *str into ['binaire', 'formatte']*: Value for format may be binaire (a binary file Wall_length.xyz is written) or formatte (moreover, a formatted file Wall_length_formatted.xyz is written).

3.20 ecrire_champ_med

Description: Keyword to write a field to MED format into a file. Useful with Homard.

See also: interprete (3)

Usage:
ecrire_champ_med nom_dom nom_chp file
where

- **nom_dom** *str*: domain name
- **nom_chp** *str*: field name
- **file** *str*: file name

3.21 ecrire_fichier_formatte

Description: Keyword to write the object of name name_obj to a file filename in ASCII format.

See also: ecrire_fichier_bin (3.106)

Usage:
ecrire_fichier_formatte name_obj filename
where

- **name_obj** *str*: Name of the object to be written.
- **filename** *str*: Name of the file.

3.22 ecriturelecturespecial

Description: Class to write or not to write a .xyz file on the disc at the end of the calculation.

See also: interprete (3)

Usage:
ecriturelecturespecial type
where

- **type** *str*: If set to 0, no xyz file is created. If set to EFichierBin, it uses prior 1.7.0 way of reading xyz files (now LecFicDiffuseBin). If set to EcrFicPartageBin, it uses prior 1.7.0 way of writing xyz files (now EcrFicPartageMPIIO).

3.23 execute_parallel

Description: This keyword allows to run several computations in parallel on processors allocated to TRUST. The set of processors is split in N subsets and each subset will read and execute a different data file. Error messages usualy written to stderr and stdout are redirected to .log files (journaling must be activated).

See also: interprete (3)

Usage:
execute_parallel {

> **liste_cas** *n word1 word2 ... wordn*
> [**nb_procs** *n n1 n2 ... nn*]

}
where

- **liste_cas** *n word1 word2 ... wordn*: N datafile1 ... datafileN. datafileX the name of a TRUST data file without the .data extension.
- **nb_procs** *n n1 n2 ... nn*: nb_procs is the number of processors needed to run each data file. If not given, TRUST assumes that computations are sequential.

3.24 export

Description: Class to make the object have a global range, if not its range will apply to the block only (the associated object will be destroyed on exiting the block).

See also: interprete (3)

Usage:
export

3.25 extract_2d_from_3d

Description: Keyword to extract a 2D mesh by selecting a boundary of the 3D mesh. To generate a 2D axisymmetric mesh prefer Extract_2Daxi_from_3D keyword.

See also: interprete (3) extract_2daxi_from_3d (3.26)

Usage:
extract_2d_from_3d dom3D bord dom2D
where

- **dom3D** *str*: Domain name of the 3D mesh
- **bord** *str*: Boundary name. This boundary become the new 2D mesh and all the boundaries, in 3D, attached to the selected boundary, give their name to the news boundaries, in 2D.
- **dom2D** *str*: Domain name of the new 2D mesh

3.26 extract_2daxi_from_3d

Description: Keyword to extract a 2D axisymetric mesh by selecting a boundary of the 3D mesh.

See also: extract_2d_from_3d (3.25)

Usage:
extract_2daxi_from_3d dom3D bord dom2D
where

- **dom3D** *str*: Domain name of the 3D mesh
- **bord** *str*: Boundary name. This boundary become the new 2D mesh and all the boundaries, in 3D, attached to the selected boundary, give their name to the news boundaries, in 2D.
- **dom2D** *str*: Domain name of the new 2D mesh

3.27 extraire_domaine

Description: Keyword to create a new new domain built with the domain elements of the pb_name problem verifying the two conditions given by Condition_elements. The problem pb_name should have been discretized.

Keyword Discretiser should have already be used to read the object.
See also: interprete (3)

Usage:
extraire_domaine {

> **domaine** *str*
> **probleme** *str*
> [**condition_elements** *str*]
> [**sous_zone** *str*]

}
where

- **domaine** *str*: domaine dans lequel stocke les faces
- **probleme** *str*: Probleme duquel il faut extraire les faces
- **condition_elements** *str*
- **sous_zone** *str*

3.28 extraire_plan

Description: This keyword extract a plan mesh named domain_name (this domain should have be declared before) from the mesh of the pb_name problem. The plan can be either a triangle (defined by the keywords Origine, Point1, Point2 and Triangle), either a regular quadrangle (with keywords Origine, Point1 and Point2), or either a generalized quadrangle (with keywords Origine, Point1, Point2, Point3). The keyword Epaisseur specifies the thickness of volume around the plan which contains the faces of the extracted mesh. The keyword via_extraire_surface will create a plan and use Extraire_surface algorithm. Inverse_condition_element keyword then will be used in the case where the plan is a boundary not well oriented, and avec_certains_bords_pour_extraire_surface is the option related to the Extraire_surface option named avec_certains_bords.

Keyword Discretiser should have already be used to read the object.
See also: interprete (3)

Usage:
extraire_plan {

> **domaine** *str*

probleme *str*
epaisseur *float*
origine *n x1 x2 ... xn*
point1 *n x1 x2 ... xn*
point2 *n x1 x2 ... xn*
[**point3** *n x1 x2 ... xn*]
[**triangle**]
[**via_extraire_surface**]
[**inverse_condition_element**]
[**avec_certains_bords_pour_extraire_surface** *n word1 word2 ... wordn*]

}
where

- **domaine** *str*: domain_namme
- **probleme** *str*: pb_name
- **epaisseur** *float*
- **origine** *n x1 x2 ... xn*
- **point1** *n x1 x2 ... xn*
- **point2** *n x1 x2 ... xn*
- **point3** *n x1 x2 ... xn*
- **triangle**
- **via_extraire_surface**
- **inverse_condition_element**
- **avec_certains_bords_pour_extraire_surface** *n word1 word2 ... wordn*

3.29 extraire_surface

Description: This keyword extract a surface mesh named domain_name (this domain should have be declared before) from the mesh of the pb_name problem. The surface mesh is defined by one or two conditions. The first condition is about elements with Condition_elements. For example: Condition_elements x*x+y*y+z*z<1
Will define a surface mesh with external faces of the mesh elements inside the sphere of radius 1 located at (0,0,0). The second conditions Condition_faces is useful to give a restriction.
By default, the faces from the boundaries are not added to the surface mesh excepted if option avec_les_bords is given (all the boundaries are added), or if the option avec_certains_bords is used to add only some boundaries.

Keyword Discretiser should have already be used to read the object.
See also: interprete (3)

Usage:
extraire_surface {

domaine *str*
probleme *str*
[**condition_elements** *str*]
[**condition_faces** *str*]
[**avec_les_bords**]
[**avec_certains_bords** *n word1 word2 ... wordn*]

}
where

- **domaine** *str*: domaine dans lequel stocke les faces

- **probleme** *str*: Probleme duquel il faut extraire les faces
- **condition_elements** *str*
- **condition_faces** *str*
- **avec_les_bords**
- **avec_certains_bords** *n word1 word2 ... wordn*

3.30 extrudebord

Description: Class to generate an extruded mesh from a boundary of a tetrahedral or an hexahedral mesh.
Warning: If the initial domain is an tetrahedral mesh, the boundary will be moved in the XY plan then extrusion will be applied (you should may be use the Transformer keyword on the final domain to have the domain you really want). You can use the keyword Ecrire_Fichier_Meshtv to generate a meshtv file to visualize your initial and final meshes.
This keyword can be used for example to create a periodic box extracted from a boundary of a tetrahedral or a hexaedral mesh. This periodic box may be used then to engender turbulent inlet flow condition for the main domain.
Note that ExtrudeBord in VEF generates 3 or 14 tetrahedra from extruded prisms.

See also: interprete (3)

Usage:
extrudebord {

domaine_init *str*
[**direction** *x1 x2 (x3)*]
[**nb_tranches** *int*]
[**domaine_final** *str*]
[**nom_bord** *str*]
[**non_perio**]
[**hexa_old**]
[**trois_tetra**]
[**vingt_tetra**]
[**sans_passer_par_le2D** *int*]

}
where

- **domaine_init** *str*: Initial domain with hexaedras or tetrahedras.
- **direction** *x1 x2 (x3)*: Directions for the extrusion.
- **nb_tranches** *int*: Number of elements in the extrusion direction.
- **domaine_final** *str*: Extruded domain.
- **nom_bord** *str*: Name of the boundary of the initial domain where extrusion will be applied.
- **non_perio** : Extruded domain will not have periodic boundaries. So, the boundaries will be named DEVANT and DERRIERE instead of PERIO.
- **hexa_old** : Old algorithm for boundary extrusion from a hexahedral mesh.
- **trois_tetra** : To extrude in 3 tetrahedras instead of 14 tetrahedras.
- **vingt_tetra** : To extrude in 20 tetrahedras instead of 14 tetrahedras.
- **sans_passer_par_le2D** *int*: Only for non regression

3.31 extrudeparoi

Description: Keyword dedicated in 3D (VEF) to create prismatic layer at wall. Each prism is cut in 3 tetraedra.

See also: interprete (3)

Usage:
extrudeparoi {

domaine *str*
nom_bord *str*
[**epaisseur** *n x1 x2 ... xn*]
[**critere_absolu** *int*]
[**projection_normale_bord**]

}
where

- **domaine** *str*: Name of the domain.
- **nom_bord** *str*: Name of the (no slide) boundary for creation of prismatic layers.
- **epaisseur** *n x1 x2 ... xn*: n r1 r2 .... rn : (relative or absolute) width for each layer.
- **critere_absolu** *int*: relative (0, the default) or absolute (1) width for each layer.
- **projection_normale_bord** : keyword to project layers on the same plane that contiguous boundaries. defaut values are : epaisseur_relative 1 0.5 projection_normale_bord 1

3.32 extruder

Description: Class to create a 3D tetrahedral/hexahedral mesh (a prism is cut in 14) from a 2D triangular/quadrangular mesh.

See also: interprete (3) extruder_en3 (3.35)

Usage:
extruder {

domaine *str*
direction *troisf*
nb_tranches *int*

}
where

- **domaine** *str*: Name of the domain.
- **direction** *troisf* (3.33): Direction of the extrude operation.
- **nb_tranches** *int*: Number of elements in the extrusion direction.

3.33 troisf

Description: Auxiliary class to extrude.

See also: objet_lecture (32)

Usage:
lx ly lz
where

- **lx** *float*: X direction of the extrude operation.
- **ly** *float*: Y direction of the extrude operation.
- **lz** *float*: Z direction of the extrude operation.

3.34 extruder_en20

Description: It does the same task as Extruder except a prism is cut in 20 instead of 3. The nem of the boundaries will be devant and derriere. But you can change this name with the keyword RegroupeBord.

See also: interprete (3)

Usage:
extruder_en20 {

> **domaine** *str*
> [**direction** *troisf*]
> **nb_tranches** *int*

}
where

- **domaine** *str*: Name of the domain.
- **direction** *troisf* (3.33): 0 Direction of the extrude operation.
- **nb_tranches** *int*: Number of elements in the extrusion direction.

3.35 extruder_en3

Description: Class to create a 3D tetrahedral/hexahedral mesh (a prism is cut in 3) from a 2D triangular/quadrangular mesh. The names of the (by default, devant and derriere) may be renamed by the keyword nom_cl_devant and nom_cl_derriere. If NULL is written for nom_cl, then no boundary condition is generated at this place.
Recommendation : to ensure conformity between meshes (in case of fluid/solid coupling) it is recommended to extrude all the domains at the same time.

See also: extruder (3.32)

Usage:
extruder_en3 {

> **domaine** *n word1 word2 ... wordn*
> [**nom_cl_devant** *str*]
> [**nom_cl_derriere** *str*]
> **direction** *troisf*
> **nb_tranches** *int*

}
where

- **domaine** *n word1 word2 ... wordn*: List of the domains
- **nom_cl_devant** *str*: New name of the first boundary.
- **nom_cl_derriere** *str*: New name of the second boundary.
- **direction** *troisf* (3.33) for inheritance: Direction of the extrude operation.
- **nb_tranches** *int* for inheritance: Number of elements in the extrusion direction.

3.36 end

Synonymous: **fin**

Description: Keyword which must complete the data file.

See also: interprete (3)

Usage:
end

3.37 }

Description: Block's end.

See also: interprete (3)

Usage:
}

3.38 imprimer_flux

Description: This keyword allows the flux per face at the edges (boundaries) of a domain defined by the user in the data set to be printed. The flux are written to the .face files at a frequency defined by dt_impr, the evaluation printing frequency (refer to time scheme keywords). By default, flux are incorporated onto the edges before being displayed.

See also: interprete (3) imprimer_flux_sum (3.40)

Usage:
imprimer_flux domain_name noms_bord
where

- **domain_name** *str*: Name of the domain.
- **noms_bord** *bloc_lecture* (3.39): Liste des noms des bords ex: { Bord1 Bord2 }

3.39 bloc_lecture

Description: pour lire entre deux accolades

See also: objet_lecture (32)

Usage:
bloc_lecture
where

- **bloc_lecture** *str*

3.40 imprimer_flux_sum

Description: This keyword allows the sum of the flux per face at the boundaries of a domain defined by the user in the data set to be printed. The flux are written into the .out files at a frequency defined by dt_impr, the evaluation printing frequency (refer to time scheme keywords).

See also: imprimer_flux (3.38)

Usage:
imprimer_flux_sum domain_name noms_bord
where

- **domain_name** *str*: Name of the domain.
- **noms_bord** *bloc_lecture* (3.39): Liste des noms des bords ex: { Bord1 Bord2 }

3.41 integrer_champ_med

Description: his keyword is used to calculate a flow rate from a velocity MED field read before. The method is either debit_total to calculate the flow rate on the whole surface, either integrale_en_z to calculate flow rates between z=zmin and z=zmax on nb_tranche surfaces. The output file indicates first the flow rate for the whole surface and then lists for each tranche : the height z, the surface average value, the surface area and the flow rate. For the debit_total method case, only one tranche is considered.
file :z Sum(u.dS)/Sum(dS) Sum(dS) Sum(u.dS)

See also: interprete (3)

Usage:
integrer_champ_med {

> **champ_med** *str*
> **methode** *str into ['integrale_en_z', 'debit_total']*
> [**zmin** *float*]
> [**zmax** *float*]
> [**nb_tranche** *int*]
> [**fichier_sortie** *str*]

}
where

- **champ_med** *str*
- **methode** *str into ['integrale_en_z', 'debit_total']*: permet de choisir si l on veut l integrale suivant z ou sur toute la hauteur (debit_total correspond a zmin=-DMAXFLOAT, ZMax=DMAXFLOAT, nb_tranche=1)
- **zmin** *float*
- **zmax** *float*
- **nb_tranche** *int*
- **fichier_sortie** *str*: nom du fichier de sortie par defaut : integrale.

3.42 interprete_geometrique_base

Description: Class for interpreting a data file

See also: interprete (3) create_domain_from_sous_zone (3.10)

Usage:
interprete_geometrique_base

3.43 lata_to_med

Description: To convert results file written with LATA format to MED file. Warning: Fields located to faces are not supported yet.

See also: interprete (3)

Usage:
lata_to_med [**format**] **file** **file_med**
where

- **format** *format_lata_to_med* (3.44): generated file post_med.data use format (MED or LATA or LML keyword).
- **file** *str*: LATA file to convert to the new format.
- **file_med** *str*: Name of file med.

3.44 format_lata_to_med

Description: not_set

See also: objet_lecture (32)

Usage:
mot [**format**]
where

- **mot** *str into ['format_post_sup']*
- **format** *str into ['lml', 'lata', 'lata_v1', 'lata_v2', 'med']*: generated file post_med.data use format (MED or LATA or LML keyword).

3.45 lata_to_other

Description: To convert results file written with LATA format to MED or LML format. Warning: Fields located to faces are not supported yet.

See also: interprete (3)

Usage:
lata_to_other [**format**] **file** **file_post**
where

- **format** *str into ['lml', 'lata', 'lata_v1', 'lata_v2', 'med']*: Results format (MED or LATA or LML keyword).
- **file** *str*: LATA file to convert to the new format.
- **file_post** *str*: Name of file post.

3.46 lire_ideas

Description: Read a geom in a unv file. 3D tetra mesh elements only may be read by TRUST.

See also: interprete (3)

Usage:
lire_ideas **nom_dom** **file**
where

- **nom_dom** *str*: Name of domain.
- **file** *str*: Name of file.

3.47 mailler

Description: The Mailler (Mesh) interpretor allows a Domain type object domaine to be meshed with objects objet_1, objet_2, etc...

See also: interprete (3)

Usage:
mailler domaine bloc
where

- **domaine** *str*: Name of domain.
- **bloc** *list_bloc_mailler* (3.48): Instructions to mesh.

3.48 list_bloc_mailler

Description: List of block mesh.

See also: listobj (31.3)

Usage:
{ object1 , object2 .... }
list of *mailler_base* (3.48.1) separeted with ,

3.48.1 mailler_base

Description: Basic class to mesh.

See also: objet_lecture (32) pave (3.48.2) epsilon (3.48.12) domain (3.48.13)

Usage:

3.48.2 pave

Description: Class to create a pave (block) with boundaries.

See also: mailler_base (3.48.1)

Usage:
pave name bloc list_bord
where

- **name** *str*: Name of the pave (block).
- **bloc** *bloc_pave* (3.48.3): Definition of the pave (block).
- **list_bord** *list_bord* (3.48.4): Definition of boundaries of domain.

3.48.3 bloc_pave

Description: Class to create a pave.

See also: objet_lecture (32)

Usage:
{

[**Origine** *x1 x2 (x3)*]
[**longueurs** *x1 x2 (x3)*]
[**nombre_de_noeuds** *n1 n2 (n3)*]
[**facteurs** *x1 x2 (x3)*]
[**symx**]
[**symy**]
[**symz**]
[**tanh** *float*]
[**tanh_dilatation** *int into [-1, 0, 1]*]
[**tanh_taille_premiere_maille** *float*]

}
where

- **Origine** *x1 x2 (x3)*: Keyword to define the pave (block) origin, that is to say one of the 8 block points (or 4 in a 2D system).
- **longueurs** *x1 x2 (x3)*: Keyword to define the block dimensions, that is to say knowing the origin, length along the axes.
- **nombre_de_noeuds** *n1 n2 (n3)*: Keyword to define the discretization (nodenumber) in each direction.
- **facteurs** *x1 x2 (x3)*: Keyword to define stretching factors for mesh discretisation in each direction. This is a real number which must be positive (by default 1.0). A stretching factor other than 1 allows refinement on one edge in one direction.
- **symx** : Keyword to define a block mesh that is symmetrical with respect to the YZ plane (respectively straight Y in 2D) passing through the block centre.
- **symy** : Keyword to define a block mesh that is symmetrical with respect to the XZ plane (respectively straight X in 2D) passing through the block centre.
- **symz** : Keyword defining a block mesh that is symmetrical with respect to the XY plane passing through the block centre.
- **tanh** *float*: Keyword to generate mesh with tanh (hyperbolic tangent) variation.
- **tanh_dilatation** *int into [-1, 0, 1]*: Keyword to generate mesh with tanh (hyperbolic tangent) variation. tanh_dilatation: The value may be -1,0,1 (0 by default): 0: coarse mesh at the middle of the channel and smaller near the walls 1: coarse mesh at the bottom of the channel and smaller near the top -1: coarse mesh at the top of the channel and smaller near the bottom.
- **tanh_taille_premiere_maille** *float*: Size of the first cell of the mesh with tanh (hyperbolic tangent) variation in the Y direction.

3.48.4 list_bord

Description: The block sides.

See also: listobj (31.3)

Usage:
{ object1 object2 .... }
list of *bord_base* (3.48.5)

3.48.5 bord_base

Description: Basic class for block sides. Block sides that are neither edges nor connectors are not specified. The duplicate nodes of two blocks in contact are automatically recognised and deleted.

See also: objet_lecture (32) bord (3.48.6) raccord (3.48.10) internes (3.48.11)

Usage:

3.48.6 bord

Description: The block side is not in contact with another block and limitation conditions are applied to it.

See also: bord_base (3.48.5)

Usage:
bord nom defbord
where

- **nom** *str*: Name of block side.
- **defbord** *defbord* (3.48.7): Definition of block side.

3.48.7 defbord

Description: Class to define an edge.

See also: objet_lecture (32) defbord_2 (3.48.8) defbord_3 (3.48.9)

Usage:

3.48.8 defbord_2

Description: 1-D edge (straight) in the 2-D space.

See also: (3.48.7)

Usage:
dir eq pos pos2_min inf1 dir2 inf2 pos2_max
where

- **dir** *str into ['X', 'Y']*: Edge is perpendicular to this direction.
- **eq** *str into ['=']*: Equality sign.
- **pos** *float*: Position value.
- **pos2_min** *float*: Value minimal.
- **inf1** *str into ['<=']*: Less or equal sign.
- **dir2** *str into ['X', 'Y']*: Edge is parallel to this direction.
- **inf2** *str into ['<=']*: Less or equal sign.
- **pos2_max** *float*: Value maximal.

3.48.9 defbord_3

Description: 2-D edge (plane) in the 3-D space.

See also: (3.48.7)

Usage:
dir eq pos pos2_min inf1 dir2 inf2 pos2_max pos3_min inf3 dir3 inf4 pos3_max
where

- **dir** *str into ['X', 'Y', 'Z']*: Edge is perpendicular to this direction.
- **eq** *str into ['=']*: Equality sign.
- **pos** *float*: Position value.
- **pos2_min** *float*: Value minimal.
- **inf1** *str into ['<=']*: Less or equal sign.

- **dir2** *str into ['X', 'Y']*: Edge is parallel to this direction.
- **inf2** *str into ['<=']*: Less or equal sign.
- **pos2_max** *float*: Value maximal.
- **pos3_min** *float*: Value minimal.
- **inf3** *str into ['<=']*: Less or equal sign.
- **dir3** *str into ['Y', 'Z']*: Edge is parallel to this direction.
- **inf4** *str into ['<=']*: Less or equal sign.
- **pos3_max** *float*: Value maximal.

3.48.10 raccord

Description: The block side is in contact with the block of another domain (case of two coupled problems).

See also: bord_base (3.48.5)

Usage:
raccord type1 type2 nom defbord
where

- **type1** *str into ['local', 'distant']*: Contact type.
- **type2** *str into ['homogene']*: Contact type.
- **nom** *str*: Name of block side.
- **defbord** *defbord* (3.48.7): Definition of block side.

3.48.11 internes

Description: To indicate that the block has a set of internal faces (these faces will be duplicated automatically by the program and will be processed in a manner similar to edge faces).
Two boundaries with the same limitation conditions may be given the same name (whether or not they belong to the same block).
The keyword Internes (Internal) must be used to execute a calculation with plates, followed by the equation of the surface area covered by the plates.

See also: bord_base (3.48.5)

Usage:
internes nom defbord
where

- **nom** *str*: Name of block side.
- **defbord** *defbord* (3.48.7): Definition of block side.

3.48.12 epsilon

Description: Two points will be confused if the distance between them is less than eps. By default, eps is set to 1e-12. The keyword Epsilon allows an alternative value to be assigned to eps.

See also: mailler_base (3.48.1)

Usage:
epsilon eps
where

- **eps** *float*: New value of precision.

3.48.13 domain

Description: Class to reuse a domain.

See also: mailler_base (3.48.1)

Usage:
domain domain_name
where

- **domain_name** *str*: Name of domain.

3.49 maillerparallel

Description: creates a parallel distributed hexaedral mesh of a parallelipipedic box. It is equivalent to creating a mesh with a single Pave, splitting it with Decouper and reloading it in parallel with Scatter. It only works in 3D at this time. It can also be used for a sequential computation (with all NPARTS=1)}

See also: interprete (3)

Usage:
maillerparallel {

domain *str*
nb_nodes *n n1 n2 ... nn*
splitting *n n1 n2 ... nn*
ghost_thickness *int*
[**perio_x**]
[**perio_y**]
[**perio_z**]
[**function_coord_x** *str*]
[**function_coord_y** *str*]
[**function_coord_z** *str*]
[**file_coord_x** *str*]
[**file_coord_y** *str*]
[**file_coord_z** *str*]
[**boundary_xmin** *str*]
[**boundary_xmax** *str*]
[**boundary_ymin** *str*]
[**boundary_ymax** *str*]
[**boundary_zmin** *str*]
[**boundary_zmax** *str*]

}
where

- **domain** *str*: the name of the domain to mesh (it must be an empty domain object).
- **nb_nodes** *n n1 n2 ... nn*: dimension defines the spatial dimension (currently only dimension=3 is supported), and nX, nY and nZ defines the total number of nodes in the mesh in each direction.
- **splitting** *n n1 n2 ... nn*: dimension is the spatial dimension and npartsX, npartsY and npartsZ are the number of parts created. The product of the number of parts must be equal to the number of processors used for the computation.
- **ghost_thickness** *int*: he number of ghost cells (equivalent to the epaisseur_joint parameter of Decouper.
- **perio_x** : change the splitting method to provide a valid mesh for periodic boundary conditions.

- **perio_y** : change the splitting method to provide a valid mesh for periodic boundary conditions.
- **perio_z** : change the splitting method to provide a valid mesh for periodic boundary conditions.
- **function_coord_x** *str*: By default, the meshing algorithm creates nX nY nZ coordinates ranging between 0 and 1 (eg a unity size box). If function_coord_x} is specified, it is used to transform the [0,1] segment to the coordinates of the nodes. funcX must be a function of the x variable only.
- **function_coord_y** *str*: like function_coord_x for y
- **function_coord_z** *str*: like function_coord_x for z
- **file_coord_x** *str*: Keyword to read the Nx floating point values used as nodes coordinates in the file.

- **file_coord_y** *str*: idem file_coord_x for y
- **file_coord_z** *str*: idem file_coord_x for z
- **boundary_xmin** *str*: the name of the boundary at the minimum X direction. If it not provided, the default boundary names are xmin, xmax, ymin, ymax, zmin and zmax. If the mesh is periodic in a given direction, only the MIN boundary name is used, for both sides of the box.
- **boundary_xmax** *str*
- **boundary_ymin** *str*
- **boundary_ymax** *str*
- **boundary_zmin** *str*
- **boundary_zmax** *str*

3.50 modif_bord_to_raccord

Description: Keyword to convert a boundary of domain_name domain of kind Bord to a boundary of kind Raccord (named boundary_name). It is useful when using meshes with boundaries of kind Bord defined and to run a coupled calculation.

See also: interprete (3)

Usage:
modif_bord_to_raccord domaine nom_bord
where

- **domaine** *str*: Name of domain
- **nom_bord** *str*: Name of the boundary to transform.

3.51 moyenne_volumique

Description: This keyword should be used after Resoudre keyword. It computes the convolution product of one or more fields with a given filtering function.

See also: interprete (3)

Usage:
moyenne_volumique {

nom_pb *str*
nom_domaine *str*
noms_champs *n word1 word2 ... wordn*
[**nom_fichier_post** *str*]
[**format_post** *str*]
[**localisation** *str into ['elem', 'som']*]
fonction_filtre *bloc_lecture*

}
where

- **nom_pb** *str*: name of the problem where the source fields will be searched.
- **nom_domaine** *str*: name of the destination domain (for example, it can be a coarser mesh, but for optimal performance in parallel, the domain should be split with the same algorithm as the computation mesh, eg, same tranche parameters for example)
- **noms_champs** *n word1 word2 ... wordn*: name of the source fields (these fields must be accessible from the postraitement) N source_field1 source_field2 ... source_fieldN
- **nom_fichier_post** *str*: indicates the filename where the result is written
- **format_post** *str*: gives the fileformat for the result (by default : lata)
- **localisation** *str into ['elem', 'som']*: indicates where the convolution product should be computed: either on the elements or on the nodes of the destination domain.
- **fonction_filtre** *bloc_lecture* (3.39): to specify the given filter
  Fonction_filtre {
  type filter_type
  demie-largeur l
  [omega w]
  [expression string]
  }

  type filter_type : This parameter specifies the filtering function. Valid filter_type are:
  Boite is a box filter, $f(x, y, z) = (abs(x) < l) * (abs(y) < l) * (abs(z) < l)/(8l^3)$
  Chapeau is a hat filter (product of hat filters in each direction) centered on the origin, the half-width of the filter being l and its integral being 1.
  Quadra is a 2nd order filter.
  Gaussienne is a normalized gaussian filter of standard deviation sigma in each direction (all field elements outside a cubic box defined by clipping_half_width are ignored, hence, taking clipping_half_width=2.5*sigma yields an integral of 0.99 for a uniform unity field).
  Parser allows a user defined function of the x,y,z variables. All elements outside a cubic box defined by clipping_half_width are ignored. The parser is much slower than the equivalent c++ coded function...

  demie-largeur l : This parameter specifies the half width of the filter
  [omega w] : This parameter must be given for the gaussienne filter. It defines the standard deviation of the gaussian filter.
  [expression string] : This parameter must be given for the parser filter type. This expression will be interpreted by the math parser with the predefined variables x, y and z.

3.52 nettoiepasnoeuds

Description: Keyword NettoiePasNoeuds does not delete useless nodes (nodes without elements) from a domain.

See also: interprete (3)

Usage:
nettoiepasnoeuds domain_name
where

- **domain_name** *str*: Name of domain.

3.53 option_vdf

Description: Class of VDF options.

See also: interprete (3)

Usage:
option_vdf {

[**traitement_coins** *str into ['oui', 'non']*]
[**p_imposee_aux_faces** *str into ['oui', 'non']*]

}
where

- **traitement_coins** *str into ['oui', 'non']*: Treatment of corners (yes or no).
- **p_imposee_aux_faces** *str into ['oui', 'non']*: Pressure imposed at the faces (yes or no).

3.54 orientefacesbord

Description: Keyword to modify the order of the boundary verteces included in a domain, such that the surface normals are outer pointing.

See also: interprete (3)

Usage:
orientefacesbord domain_name
where

- **domain_name** *str*: Name of domain.

3.55 partition

Synonymous: **decouper**

Description: Class for parallel calculation to cut a domain for each processor. By default, these keyword is commented in the reference test cases.

See also: interprete (3)

Usage:
partition domaine bloc_decouper
where

- **domaine** *str*: Name of the domain to be cut.
- **bloc_decouper** *bloc_decouper* (3.56): Description how to cut a domain.

3.56 bloc_decouper

Description: Auxiliary class to cut a domain.

See also: objet_lecture (32)

Usage:
{

[**Partition_tool|partitionneur** *partitionneur_deriv*]
[**larg_joint** *int*]
[**zones_name|nom_zones** *str*]
[**ecrire_decoupage** *str*]
[**ecrire_lata** *str*]
[**nb_parts_tot** *int*]
[**formatte**]
[**periodique** *n word1 word2 ... wordn*]
[**reorder** *int*]

}
where

- **Partition_tool|partitionneur** *partitionneur_deriv* (23): Defines the partitionning algorithm (the effective C++ object used is 'Partitionneur_ALGORITHM_NAME').
- **larg_joint** *int*: This keyword specifies the thickness of the virtual ghost zone (data known by one processor though not owned by it). The default value is 1 and is generally correct for all algorithms except the QUICK convection scheme that require a thickness of 2. Since the 1.5.5 version, the VEF discretization imply also a thickness of 2 (except VEF P0). Any non-zero positive value can be used, but the amount of data to store and exchange between processors grows quickly with the thickness.
- **zones_name|nom_zones** *str*: Name of the files containing the different partition of the domain. The files will be :
  name_0001.Zones
  name_0002.Zones
  ...
  name_000n.Zones. If this keyword is not specified, the geometry is not written on disc (you might just want to generate a 'ecrire_decoupage' or 'ecrire_lata').
- **ecrire_decoupage** *str*: After having called the partitionning algorithm, the resulting partition is written on disc in the specified filename. See also partitionneur Fichier_Decoupage. This keyword is useful to change the partition numbers: first, you write the partition into a file with the option ecrire_decoupage. This file contains the zone number for each element's mesh. Then you can easily permute zone numbers in this file. Then read the new partition to create the .Zones files with the Fichier_Decoupage keyword.
- **ecrire_lata** *str*
- **nb_parts_tot** *int*: Keyword to generates N .Zone files, instead of the default number M obtained after the partitionning algorithm. N must be greater or equal to M. This option might be used to perform coupled parallel computations. Supplemental empty zones from M to N-1 are created. This keyword is used when you want to run a parallel calculation on several domains with for example, 2 processors on a first domain and 10 on the second domain because the first domain is very small compare to second one. You will write Nb_parts 2 and Nb_parts_tot 10 for the first domain and Nb_parts 10 for the second domain.
- **formatte** : Optional keyword to have formatted format for .Zones files. By default, it is binary format.
- **periodique** *n word1 word2 ... wordn*: N BOUNDARY_NAME_1 BOUNDARY_NAME_2 ... : N is the number of boundary names given. Periodic boundaries must be declared by this method. The partitionning algorithm will ensure that facing nodes and faces in the periodic boundaries are located on the same processor.
- **reorder** *int*: If this option is set to 1 (0 by default), the partition is renumbered in order that the processes which communicate the most are nearer on the network. This may slighlty improves parallel performance.

3.57 pilote_icoco

Description: not_set

See also: interprete (3)

Usage:
pilote_icoco {

pb_name *str*
main *str*

}
where

- **pb_name** *str*
- **main** *str*

3.58 porosites

Description: To define the volume porosity and surface porosity that are uniform in every direction in space on a sub-area.
Porosity was only usable in VDF discretization, and now available for VEF P1NC/P0.
Observations :
- Surface porosity values must be given in every direction in space (set this value to 1 if there is no porosity),
- Prior to defining porosity, the problem must have been discretized.
Can 't be used in VEF discretization, use Porosites_champ instead.

See also: interprete (3)

Usage:
porosites pb sous_zone bloc
where

- **pb** *str*: Name of the problem to which the sub-area is attached.
- **sous_zone** *str*: Name of the sub-area to which porosity are allocated.
- **bloc** *bloc_lecture_poro* (3.59): Surface and volume porosity values.

3.59 bloc_lecture_poro

Description: Surface and volume porosity values.

See also: objet_lecture (32)

Usage:
{

volumique *float*
surfacique *n x1 x2 ... xn*

}
where

- **volumique** *float*: Volume porosity value.
- **surfacique** *n x1 x2 ... xn*: Surface porosity values (in X, Y, Z directions).

3.60 porosites_champ

Description: The porosity is given at each element and the porosity at each face, Psi(face), is calculated by the average of the porosities of the two neighbour elements Psi(elem1), Psi(elem2) : Psi(face)=2/(1/Psi(elem1)+1/Psi(elem2)).

Keyword Discretiser should have already be used to read the object.
See also: interprete (3)

Usage:
porosites_champ pb ch
where

- **pb** *str*: Name of the problem to which the sub-area is attached.
- **ch** *champ_base* (15.1): field used to define the porosity field

3.61 postraiter_domaine

Description: To write one or more domains in a file with a specified format (MED,LML,LATA).

See also: interprete (3)

Usage:
postraiter_domaine {

> **format** *str into ['lml', 'lata', 'lata_v1', 'lata_v2', 'med']*
> [**file|fichier** *str*]
> [**domaine** *str*]
> [**domaines** *bloc_lecture*]
> [**joints_non_postraites** *int into [0, 1]*]
> [**binaire** *int into [0, 1]*]
> [**ecrire_frontiere** *int into [0, 1]*]

}
where

- **format** *str into ['lml', 'lata', 'lata_v1', 'lata_v2', 'med']*: File format.
- **file|fichier** *str*: The file name can be changed with the fichier option.
- **domaine** *str*: Name of domain
- **domaines** *bloc_lecture* (3.39): Names of domains : { name1 name2 }
- **joints_non_postraites** *int into [0, 1]*: The joints_non_postraites (1 by default) will not write the boundaries between the partitioned mesh.
- **binaire** *int into [0, 1]*: Binary (binaire 1) or ASCII (binaire 0) may be used. By default, it is 0 for LATA and only ASCII is available for LML and only binary is available for MED.
- **ecrire_frontiere** *int into [0, 1]*: This option will write (if set to 1, the default) or not (if set to 0) the boundaries as fields into the file (it is useful to not add the boundaries when writing a domain extracted from another domain)

3.62 precisiongeom

Description: Class to change the way floating-point number comparison is done. By default, two numbers are the same if their absolute difference is less than 1e-10. The keyword is useful to change this value. Moreover, nodes coordinates will be written in .geom files with this same precision.

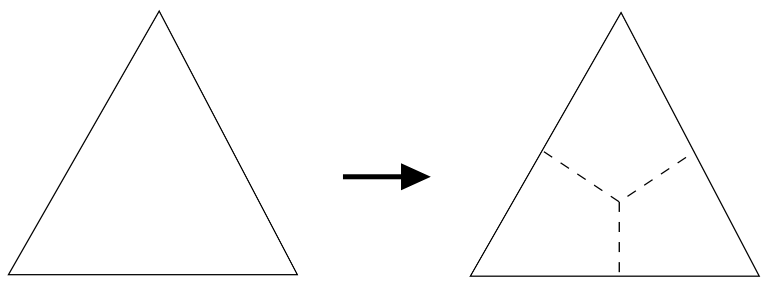
See also: interprete (3)

Usage:
precisiongeom precision
where

- **precision** *float*: New value of precision.

3.63 raffiner_anisotrope

Description: To allows to cut triangle or tetrahedra elements respectively in 3 or 4 new ones by defining a new summit located at the center of the element. Note that such a cut creates flat elements (anisotropic).



initial triangle Raffiner_anisotrope

See also: interprete (3)

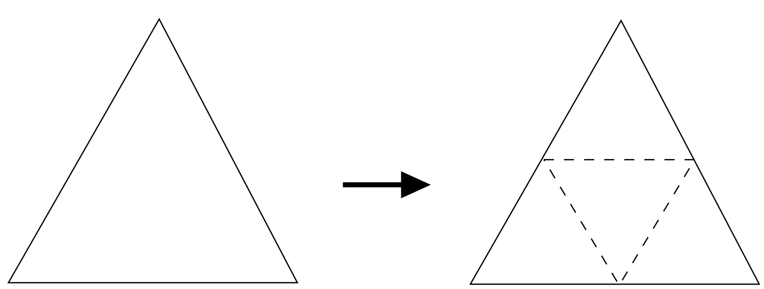
Usage:
raffiner_anisotrope domain_name
where

- **domain_name** *str*: Name of domain.

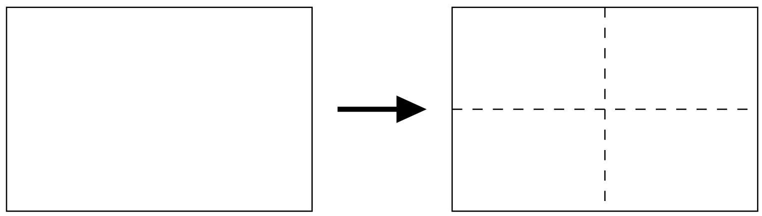
3.64 raffiner_isotrope

Synonymous: **raffiner_simplexes**

Description: To allows to cut triangles/quadrangles or tetrahedral/hexaedras elements respectively in 4 or 8 new ones by defining new summits located at the middle of edges (and center of faces and elements for quadrangles and hexaedra). Such a cut preserves the shape of original elements (ìsotropic̀).



initial triangle Raffiner_isotrope



See also: interprete (3)

Usage:
raffiner_isotrope domain_name
where

- **domain_name** *str*: Name of domain.

3.65 read

Synonymous: **lire**

Description: Interpretor to read the object objet defined between the braces.

See also: interprete (3)

Usage:
read a_object bloc
where

- **a_object** *str*: Object to be read.
- **bloc** *str*: Definition of the object.

3.66 read_file

Synonymous: **lire_fichier**

Description: Keyword to read the object name_obj contained in the file filename.
This is notably used when the calculation domain has already been meshed and the mesh contains the file filename, simply write lire_fichier dom filename (where dom is the name of the meshed domain).
If the filename is ;, is to execute a data set given in the file of name name_obj (a space must be entered between the semi-colon and the file name).

See also: interprete (3) read_unsupported_ascii_file_from_icem (3.69) read_file_binary (3.67)

Usage:
read_file name_obj filename
where

- **name_obj** *str*: Name of the object to be read.
- **filename** *str*: Name of the file.

3.67 read_file_binary

Synonymous: **lire_fichier_bin**

Description: Keyword to read an object name_obj in the unformatted type file filename.

See also: read_file (3.66)

Usage:
read_file_binary name_obj filename
where

- **name_obj** *str*: Name of the object to be read.
- **filename** *str*: Name of the file.

3.68 lire_tgrid

Description: Keyword to reaf Tgrid/Gambit mesh files. 2D (triangles or quadrangles) and 3D (tetra or hexa elements) meshes, may be read by TRUST.

See also: interprete (3)

Usage:
lire_tgrid dom filename
where

- **dom** *str*: Name of domaine.
- **filename** *str*: Name of file containing the mesh.

3.69 read_unsupported_ascii_file_from_icem

Description: not_set

See also: read_file (3.66)

Usage:
read_unsupported_ascii_file_from_icem name_obj filename
where

- **name_obj** *str*: Name of the object to be read.
- **filename** *str*: Name of the file.

3.70 orienter_simplexes

Synonymous: **rectify_mesh**

Description: Keyword to raffine a mesh

See also: interprete (3)

Usage:
orienter_simplexes domain_name
where

- **domain_name** *str*: Name of domain.

3.71 redresser_hexaedres_vdf

Description: Keyword to convert a domain (named domain_name) with quadrilaterals/VEF hexaedras which looks like rectangles/VDF hexaedras into a domain with real rectangles/VDF hexaedras.

See also: interprete (3)

Usage:
redresser_hexaedres_vdf domain_name
where

- **domain_name** *str*: Name of domain to resequence.

3.72 refine_mesh

Description: not_set

See also: interprete (3)

Usage:
refine_mesh domaine
where

- **domaine** *str*

3.73 regroupebord

Description: Keyword to build one boundary new_bord with several boundaries of the domain named domaine.

See also: interprete (3)

Usage:
regroupebord domaine new_bord bords
where

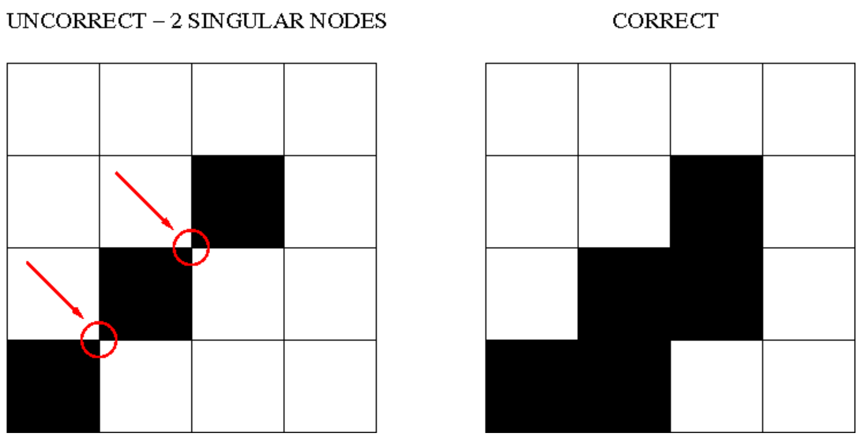
- **domaine** *str*: Name of domain
- **new_bord** *str*: Name of the new boundary
- **bords** *bloc_lecture* (3.39): { Bound1 Bound2 }

3.74 remove_elem

Description: Keyword to remove element from a VDF mesh (named domaine_name), either from an explicit list of elements or from a geometric condition defined by a condition f(x,y)>0 in 2D and f(x,y,z)>0 in 3D. All the new borders generated are gathered in one boundary called : newBord (to rename it, use RegroupeBord keyword. To split it to different boundaries, use DecoupeBord_Pour_Rayonnement keyword). Example of a removed zone of radius 0.2 centered at (x,y)=(0.5,0.5):
Remove_elem dom { fonction $0.2 * 0.2 - (x - 0.5)^2 - (y - 0.5)^2 > 0$ }
Warning : the thickness of removed zone has to be large enough to avoid singular nodes as decribed below :

See also: interprete (3)

Usage:



remove_elem **domaine** **bloc**
where

- **domaine** *str*: Name of domain
- **bloc** *remove_elem_bloc* (3.75)

3.75 remove_elem_bloc

Description: not_set

See also: objet_lecture (32)

Usage:
{

[**liste** *n n1 n2 ... nn*]
[**fonction** *str*]

}
where

- **liste** *n n1 n2 ... nn*
- **fonction** *str*

3.76 remove_invalid_internal_boundaries

Description: Keyword to suppress an internal boundary of the domain_name domain. Indeed, some mesh tools may define internal boundaries (eg: for post processing task after the calculation) but TRUST does not support it yet.

See also: interprete (3)

Usage:
remove_invalid_internal_boundaries **domain_name**
where

- **domain_name** *str*: Name of domain.

3.77 reordonner_faces_periodiques

Description: The Reordonner_faces_periodiques keyword is mandatory to first define the periodic boundaries and also to reorder the faces of theses boundaries.

See also: interprete (3)

Usage:
reordonner_faces_periodiques domaine nom_bord_perio
where

- **domaine** *str*: Name of domain.
- **nom_bord_perio** *str*: boundary_name.

3.78 reorienter_tetraedres

Description: This keyword is mandatory for front-tracking computations with the VEF discretisation. For each tetrahedral element of the domain, it checks if it has a positive volume. If the volume (determinant of the three vectors) is negative, it swaps two nodes to reverse the orientation of this tetrahedron.

See also: interprete (3)

Usage:
reorienter_tetraedres domain_name
where

- **domain_name** *str*: Name of domain.

3.79 reorienter_triangles

Description: not_set

See also: interprete (3)

Usage:
reorienter_triangles domain_name
where

- **domain_name** *str*: Name of domain.

3.80 reordonner

Description: The Reordonner interpretor is required sometimes for a VDF mesh which is not produced by the internal mesher. Example where this is used:
Lire_Fichier dom fichier.geom
Reordonner dom
Observations: This keyword is redundant when the mesh that is read is correctly sequenced in the TRUST sense. This significant mesh operation may take some time... The message returned by TRUST is not explicit when the Reordonner (Resequencing) keyword is required but not included in the data set...

See also: interprete (3)

Usage:

reordonner domain_name
where

- **domain_name** *str*: Name of domain to resequence.

3.81 rotation

Description: Keyword to rotate the geometry of an arbitrary angle around an axis aligned with Ox, Oy or Oz axis.

See also: interprete (3)

Usage:
rotation domain_name dir coord1 coord2 angle
where

- **domain_name** *str*: Name of domain to wich the transformation is applied.
- **dir** *str into ['X', 'Y', 'Z']*: X, Y or Z to indicate the direction of the rotation axis
- **coord1** *float*: coordinates of the center of rotation in the plane orthogonal to the rotation axis. These coordinates must be specified in the direct triad sense.
- **coord2** *float*
- **angle** *float*: angle of rotation (in degrees)

3.82 scatter

Description: Class to read a partionned mesh in the files during a parallel calculation. The files are in binary format.

See also: interprete (3) scatterformatte (3.83) scattermed (3.84)

Usage:
scatter file domaine
where

- **file** *str*: Name of file.
- **domaine** *str*: Name of domain.

3.83 scatterformatte

Description: Class to read a partionned mesh in the files during a parallel calculation. The files are formatted.

See also: scatter (3.82)

Usage:
scatterformatte file domaine
where

- **file** *str*: Name of file.
- **domaine** *str*: Name of domain.

3.84 scattermed

Description: This keyword will read the partition of the domain_name domain into a the MED format files file.med created by Medsplitter.

See also: scatter (3.82)

Usage:
scattermed file domaine
where

- **file** *str*: Name of file.
- **domaine** *str*: Name of domain.

3.85 solve

Synonymous: **resoudre**

Description: Interpretor to start calculation with TRUST.

Keyword Discretiser should have already be used to read the object.
See also: interprete (3)

Usage:
solve pb
where

- **pb** *str*: Name of problem to be solved.

3.86 supprime_bord

Description: Keyword to remove boundaries (named Boundary_name1 Boundary_name2) of the domain named domain_name.

See also: interprete (3)

Usage:
supprime_bord domaine bords
where

- **domaine** *str*: Name of domain
- **bords** *list_nom* (3.87): { Boundary_name1 Boundaray_name2 }

3.87 list_nom

Description: List of name.

See also: listobj (31.3)

Usage:
{ object1 object2 .... }
list of *nom_anonyme* (22.1)

3.88 system

Description: To run Unix commands from the data file. Example: System 'echo The End | mail triou@cea.fr'

See also: interprete (3)

Usage:
system cmd
where

- **cmd** *str*: command to execute.

3.89 test_solveur

Description: To test several solvers

See also: interprete (3)

Usage:
test_solveur {

[**fichier_secmem** *str*]
[**fichier_matrice** *str*]
[**fichier_solution** *str*]
[**nb_test** *int*]
[**impr**]
[**solveur** *solveur_sys_base*]
[**fichier_solveur** *str*]
[**genere_fichier_solveur** *float*]
[**seuil_verification** *float*]
[**pas_de_solution_initiale**]
[**ascii**]

}
where

- **fichier_secmem** *str*: Filename containing the second member B
- **fichier_matrice** *str*: Filename containing the matrix A
- **fichier_solution** *str*: Filename containing the solution x
- **nb_test** *int*: Number of tests to measure the time resolution (one preconditionnement)
- **impr** : To print the convergence solver
- **solveur** *solveur_sys_base* (9.12): To specify a solver
- **fichier_solveur** *str*: To specify a file containing a list of solvers
- **genere_fichier_solveur** *float*: To create a file of the solver with a threshold convergence
- **seuil_verification** *float*: Check if the solution satisfy ||Ax-B||<precision
- **pas_de_solution_initiale** : Resolution isn't initialized with the solution x
- **ascii** : Ascii files

3.90 testeur

Description: not_set

See also: interprete (3)

Usage:
testeur   data
where

- **data** *bloc_lecture* (3.39)

3.91 testeur_medcoupling

Description: not_set

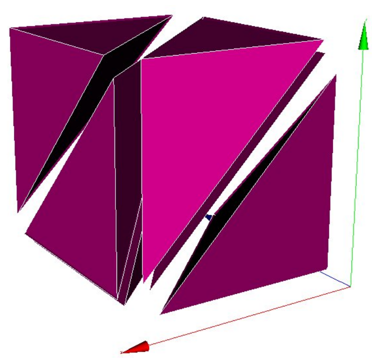
See also: interprete (3)

Usage:
testeur_medcoupling   pb_name   field_name
where

- **pb_name** *str*: Name of domain.
- **field_name** *str*: Name of domain.

3.92 tetraedriser

Description: To achieve a tetrahedral mesh based on a mesh comprising blocks, the Tetraedriser (Tetrahedralise) interpretor is used in VEF discretisation. Initial block is divided in 6 tetrahedra:



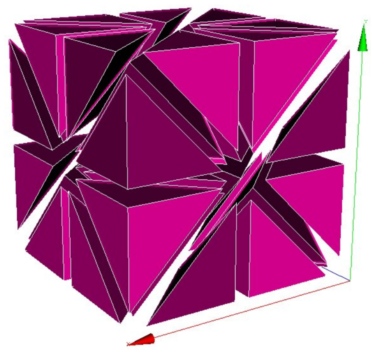
See also: interprete (3) tetraedriser_homogene (3.93) tetraedriser_homogene_fin (3.95) tetraedriser_homogene_compact (3.94) tetraedriser_par_prisme (3.96)

Usage:
tetraedriser   domain_name
where

- **domain_name** *str*: Name of domain.

3.93 tetraedriser_homogene

Description: Use the Tetraedriser_homogene (Homogeneous_Tetrahedralisation) interpretor in VEF discretisation to mesh a block in tetrahedrals. Each block hexahedral is no longer divided into 6 tetrahedrals (keyword Tetraedriser (Tetrahedralise)), it is now broken down into 40 tetrahedrals. Thus a block defined with 11 nodes in each X, Y, Z direction will contain 10*10*10*40=40,000 tetrahedrals. This also allows problems in the mesh corners with the P1NC/P1iso/P1bulle or P1/P1 discretisation items to be avoided. Initial block is divided in 40 tetrahedra:



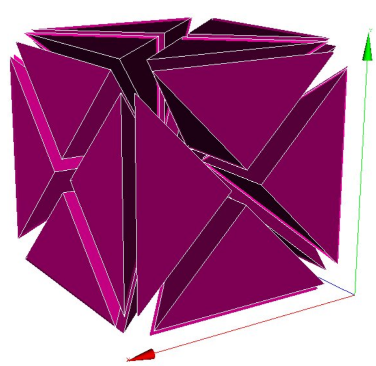
See also: tetraedriser (3.92)

Usage:
tetraedriser_homogene domain_name
where

- **domain_name** *str*: Name of domain.

3.94 tetraedriser_homogene_compact

Description: This new discretisation generates tetrahedral elements from cartesian or non-cartesian hexahedral elements. The process cut each hexahedral in 6 pyramids, each of them being cut then in 4 tetrahedral. So, in comparison with tetra_homogene, less elements (*24 instead of*40) with more homogeneous volumes are generated. Moreover, this process is done in a faster way. Initial block is divided in 24 tetrahedra:



See also: tetraedriser (3.92)

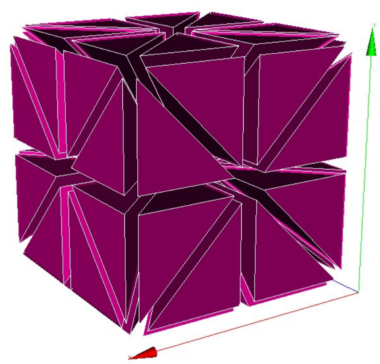
Usage:

tetraedriser_homogene_compact   domain_name
where

- **domain_name** *str*: Name of domain.

3.95 tetraedriser_homogene_fin

Description: Tetraedriser_homogene_fin is the recommended option to tetrahedralise blocks. As an extension (subdivision) of Tetraedriser_homogene_compact, this last one cut each initial block in 48 tetrahedra (against 24, previously). This cutting ensures :
- a correct cutting in the corners (in respect to pressure discretization PreP1B),
- a better isotropy of elements than with Tetraedriser_homogene_compact,
- a better alignment of summits (this could have a benefit effect on calculation near walls since first elements in contact with it are all contained in the same constant thickness and ii/ by the way, a 3D cartesian grid based on summits can be engendered and used to realise spectral analysis in HIT for instance). Initial block is divided in 48 tetrahedra:



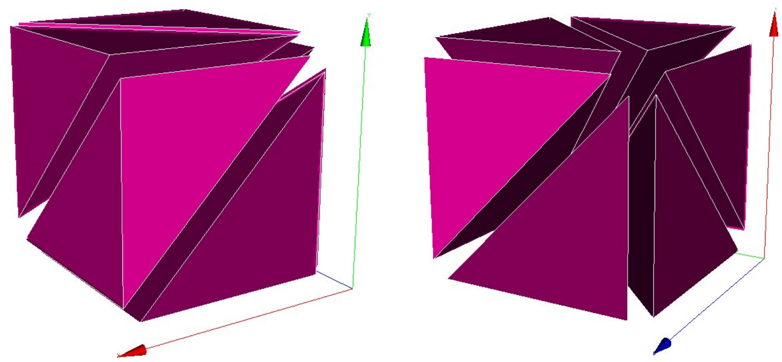
See also: tetraedriser (3.92)

Usage:
tetraedriser_homogene_fin   domain_name
where

- **domain_name** *str*: Name of domain.

3.96 tetraedriser_par_prisme

Description: Tetraedriser_par_prisme generates 6 iso-volume tetrahedral element from primary hexahedral one (contrarily to the 5 elements ordinarily generated by tetraedriser). This element is suitable for calculation of gradients at the summit (coincident with the gravity centre of the jointed elements related with) and spectra (due to a better alignment of the points).



Initial block is divided in 6 prismes.

See also: tetraedriser (3.92)

Usage:
tetraedriser_par_prisme domain_name
where

- **domain_name** *str*: Name of domain.

3.97 transformer

Description: Keyword to transform the coordinates of the geometry.
Exemple to rotate your mesh by a 90o rotation and to scale the z coordinates by a factor 2: Transformer domain_name -y -x 2*z

See also: interprete (3)

Usage:
transformer domain_name formule
where

- **domain_name** *str*: Name of domain.
- **formule** *word1 word2 (word3)*: Function_for_x Function_for_y

$$Function\_forz$$

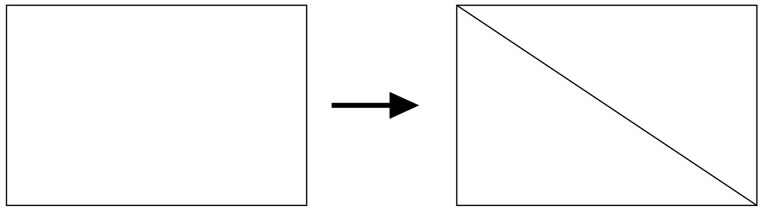
3.98 trianguler

Description: To achieve a triangular mesh from a mesh comprising rectangles (2 triangles per rectangle). Should be used in VEF discretization. Principle:

See also: interprete (3) trianguler_h (3.100) trianguler_fin (3.99)

Usage:
trianguler domain_name
where

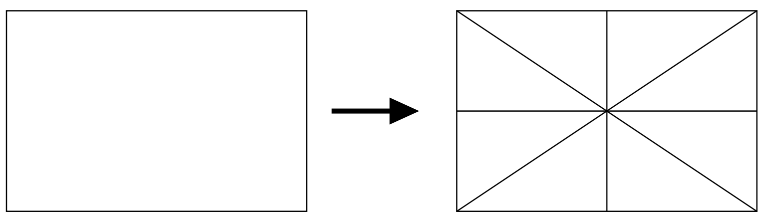
- **domain_name** *str*: Name of domain.



initial rectangle Trianguler

3.99 trianguler_fin

Description: Trianguler_fin is the recommended option to triangulate rectangles.
As an extension (subdivision) of Triangulate_h option, this one cut each initial rectangle in 8 triangles (against 4, previously). This cutting ensures :
- a correct cutting in the corners (in respect to pressure discretisation PreP1B).
- a better isotropy of elements than with Trianguler_h option.
- a better alignment of summits (this could have a benefit effect on calculation near walls since first elements in contact with it are all contained in the same constant thickness, and, by this way, a 2D cartesian grid based on summits can be engendered and used to realise statistical analysis in plan channel configuration for instance). Principle:



initial rectangle Trianguler_fin

See also: trianguler (3.98)

Usage:
trianguler_fin domain_name
where

- **domain_name** *str*: Name of domain.

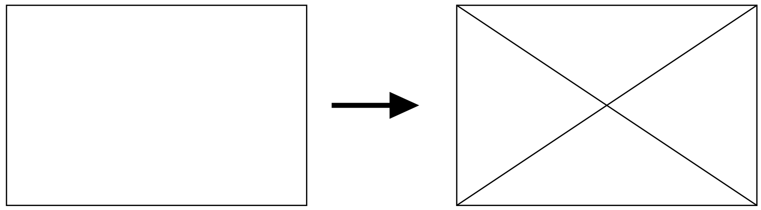
3.100 trianguler_h

Description: To achieve a triangular mesh from a mesh comprising rectangles (4 triangles per rectangle). Should be used in VEF discretization. Principle:

See also: trianguler (3.98)

Usage:
trianguler_h domain_name
where

- **domain_name** *str*: Name of domain.



3.101 verifier_qualite_raffinements

Description: not_set

See also: interprete (3)

Usage:
verifier_qualite_raffinements domain_names
where

- **domain_names** *vect_nom* (3.102)

3.102 vect_nom

Description: Vect of name.

See also: listobj (31.3)

Usage:
n object1 object2 ....
list of *nom_anonyme* (22.1)

3.103 verifier_simplexes

Description: Keyword to raffine a simplexes

See also: interprete (3)

Usage:
verifier_simplexes domain_name
where

- **domain_name** *str*: Name of domain.

3.104 verifiercoin

Description: This keyword subdivides inconsistent 2D/3D cells used with VEFPreP1B discretization. Must be used before the mesh is discretized. NL he lire_fichier option can be used only if the file.decoupage_som was previously created by TRUST. This option, only in 2D, reverses the common face at two cells (at least one is inconsistent), through the nodes opposed. In 3D, the option has no effect.
The expert_only option deactivates, into the VEFPreP1B divergence operator, the test of inconsistent cells.

See also: interprete (3)

Usage:
verifiercoin dom
where

- **dom** *str*: Name of domain.

3.105 ecrire

Description: Keyword to write the object of name name_obj to a standard outlet.

See also: interprete (3)

Usage:
ecrire name_obj
where

- **name_obj** *str*: Name of the object to be written.

3.106 ecrire_fichier_bin

Synonymous: **ecrire_fichier**

Description: Keyword to write the object of name name_obj to a file filename. Since the v1.6.3, the default format is now binary format file.

See also: interprete (3) ecrire_fichier_formatte (3.21)

Usage:
ecrire_fichier_bin name_obj filename
where

- **name_obj** *str*: Name of the object to be written.
- **filename** *str*: Name of the file.

3.107 ecrire_med

Description: Write a domain to MED format into a file.

See also: interprete (3)

Usage:
ecrire_med nom_dom file
where

- **nom_dom** *str*: Name of domain.
- **file** *str*: Name of file.

4 pb_gen_base

Description: Basic class for problems.

See also: objet_u (33) Pb_base (4.1) probleme_couple (4.7) pbc_med (4.31)

Usage:

4.1 Pb_base

Description: Resolution of equations on a domain. A problem is defined by creating an object and assigning the problem type that the user wishes to resolve. To enter values for the problem objects created, the Lire (Read) interpretor is used with a data block.

Keyword Discretiser should have already be used to read the object.
See also: pb_gen_base (4) pb_thermohydraulique (4.19) pb_hydraulique (4.12) pb_hydraulique_turbulent (4.17) pb_thermohydraulique_turbulent (4.27) pb_conduction (4.11) pb_thermohydraulique_qc (4.24) pb-_thermohydraulique_turbulent_qc (4.28) pb_hydraulique_concentration (4.13) pb_hydraulique_concentration-_turbulent (4.15) pb_thermohydraulique_concentration (4.20) pb_thermohydraulique_concentration_turbulent (4.22) pb_avec_passif (4.9) pb_post (4.18) problem_read_generic (4.33)

Usage:
Pb_base obj Lire obj {

> [**Post_processing|postraitement** *corps_postraitement*]
> [**Post_processings|postraitements** *post_processings*]
> [**liste_de_postraitements** *liste_post_ok*]
> [**liste_postraitements** *liste_post*]
> [**sauvegarde** *format_file*]
> [**sauvegarde_simple** *format_file*]
> [**reprise** *format_file*]
> [**resume_last_time** *format_file*]

}
where

- **Post_processing|postraitement** *corps_postraitement* (4.2): One post-processing (without name).
- **Post_processings|postraitements** *post_processings* (4.3): List of Postraitement objects (with name).

- **liste_de_postraitements** *liste_post_ok* (4.4): This
- **liste_postraitements** *liste_post* (4.5): This block defines the output files to be written during the computation. The output format is lata in order to use OpenDX to draw the results. This block can be divided in one or several sub-blocks that can be written at different frequencies and in different directories. Attention. The directory lata used in this example should be created before running the computation or the lata files will be lost.
- **sauvegarde** *format_file* (4.6): Keyword used when calculation results are to be backed up. When a coupling is performed, the backup-recovery file name must be well specified for each problem. In this case, you must save to different files and correctly specify these files when restarting the calculation.
- **sauvegarde_simple** *format_file* (4.6): The same keyword than Sauvegarde except, the last time step only is saved.
- **reprise** *format_file* (4.6): Keyword to restart a calculation based on the name_file file (see the class format_file). If format_reprise is xyz, the name_file file should be the .xyz file created by the previous calculation. With this file, it is possible to restart a parallel calculation on P processors, whereas the previous calculation has been run on N (N<>P) processors. Should the calculation be

restarted, values for the tinit (see schema_temps_base) time fields are taken from the name_file file. If there is no backup corresponding to this time in the name_file, TRUST exits in error.

- **resume_last_time** *format_file* (4.6): Keyword to restart a calculation based on the name_file file, restart the calculation at the last time found in the file (tinit is set to last time of saved files).

4.2 corps_postraitement

Description: not_set

See also: post_processing (4.4.3)

Usage:
{

[**definition_champs** *definition_champs*]
[**Probes|sondes** *sondes*]
[**domaine** *str*]
[**format** *str into ['lml', 'lata', 'lata_v1', 'lata_v2', 'med', 'med_major']*]
[**fields|champs** *champs_posts*]
[**statistiques** *stats_posts*]
[**fichier** *str*]
[**statistiques_en_serie** *stats_serie_posts*]
[**interfaces** *champs_posts*]

}
where

- **definition_champs** *definition_champs* (4.2.1) for inheritance: Keyword to create new or more complex field for advanced postprocessing.
- **Probes|sondes** *sondes* (4.2.3) for inheritance: Probe.
- **domaine** *str* for inheritance: This optional parameter specifies the domain on which the data should be interpolated before it is written in the output file. The default is to write the data on the domain of the current problem (no interpolation).
- **format** *str into ['lml', 'lata', 'lata_v1', 'lata_v2', 'med', 'med_major']* for inheritance: This optional parameter specifies the format of the output file. The basename used for the output file is the basename of the data file. For the fmt parameter, choices are lml or lata. A short description of each format can be found below. The default value is lml.
- **fields|champs** *champs_posts* (4.2.17) for inheritance: Field's write mode.
- **statistiques** *stats_posts* (4.2.20) for inheritance: Statistics between two points fixed : start of integration time and end of integration time.
- **fichier** *str* for inheritance: Name of file.
- **statistiques_en_serie** *stats_serie_posts* (4.2.28) for inheritance: Statistics between two points not fixed : on period of integration.
- **interfaces** *champs_posts* (4.2.17) for inheritance: Keyword to read all the caracteristics of the interfaces. Different kind of interfaces exist as well as different interface intitialisations.

4.2.1 definition_champs

Description: List of definition champ

See also: listobj (31.3)

Usage:
{ object1 object2 .... }
list of *definition_champ* (4.2.2)

4.2.2 definition_champ

Description: Keyword to create new complex field for advanced postprocessing.

See also: objet_lecture (32)

Usage:
name champ_generique
where

- **name** *str*: The name of the new created field.
- **champ_generique** *champ_generique_base* (7)

4.2.3 sondes

Description: List of probes.

See also: listobj (31.3)

Usage:
{ object1 object2 .... }
list of *sonde* (4.2.4)

4.2.4 sonde

Description: Keyword is used to define the probes. Observations: the probe co-ordinates should be given in Cartesian co-ordinates (X, Y, Z), including axisymmetric.

See also: objet_lecture (32)

Usage:
nom_sonde [**special**] **nom_inco mperiode prd type**
where

- **nom_sonde** *str*: Name of the file in which the values taken over time will be saved. The complete file name is nom_sonde.son.
- **special** *str into ['chsom', 'nodes', 'grav', 'som']*: Option to change the positions of the probes. Several options are available:
  grav : each probe is moved to the nearest cell center of the mesh;
  som : each probe is moved to the nearest vertex of the mesh
  nodes : each probe is moved to the nearest face center of the mesh;
  chsom : only available for P1NC sampled field. The values of the probes are calculated according to P1-Conform corresponding field.
- **nom_inco** *str*: Name of the sampled field.
- **mperiode** *str into ['periode']*: Keyword to set the sampled field measurement frequency.
- **prd** *float*: Period value. Every prd seconds, the field value calculated at the previous time step is written to the nom_sonde.son file.
- **type** *sonde_base* (4.2.5): Type of probe.

4.2.5 sonde_base

Description: Basic probe. Probes refer to sensors that allow a value or several points of the domain to be monitored over time. The probes may be a set of points defined one by one (keyword Points) or a set of points evenly distributed over a straight segment (keyword Segment) or arranged according to a layout (keyword Plan) or according to a parallelepiped (keyword Volume). The fields allow all the values of a physical value on the domain to be known at several moments in time.

See also: objet_lecture (32) points (4.2.6) numero_elem_sur_maitre (4.2.10) position_like (4.2.11) segment (4.2.12) plan (4.2.13) volume (4.2.14) circle (4.2.15) circle_3 (4.2.16)

Usage:
sonde_base

4.2.6 points

Description: Keyword to define the number of probe points. The file is arranged in columns.

See also: sonde_base (4.2.5) point (4.2.8) segmentpoints (4.2.9)

Usage:
points points
where

- **points** *listpoints* (4.2.7): Probe points.

4.2.7 listpoints

Description: Points.

See also: listobj (31.3)

Usage:
n object1 object2 ....
list of *un_point* (3.8.3)

4.2.8 point

Description: Point as class-daughter of Points.

See also: points (4.2.6)

Usage:
point points
where

- **points** *listpoints* (4.2.7): Probe points.

4.2.9 segmentpoints

Description: This keyword is used to define a probe segment from specifics points. The nom_champ field is sampled at ns specifics points.

See also: points (4.2.6)

Usage:
segmentpoints points
where

- **points** *listpoints* (4.2.7): Probe points.

4.2.10 numero_elem_sur_maitre

Description: Keyword to define a probe at the special element. Useful for min/max sonde.

See also: sonde_base (4.2.5)

Usage:
numero_elem_sur_maitre numero
where

- **numero** *int*: element number

4.2.11 position_like

Description: Keyword to define a probe at the same position of another probe named autre_sonde.

See also: sonde_base (4.2.5)

Usage:
position_like autre_sonde
where

- **autre_sonde** *str*: Name of the other probe.

4.2.12 segment

Description: Keyword to define the number of probe segment points. The file is arranged in columns.

See also: sonde_base (4.2.5)

Usage:
segment nbr point_deb point_fin
where

- **nbr** *int*: Number of probe points of the segment, evenly distributed.
- **point_deb** *un_point* (3.8.3): First outer probe segment point.
- **point_fin** *un_point* (3.8.3): Second outer probe segment point.

4.2.13 plan

Description: Keyword to set the number of probe layout points. The file format is type .lml

See also: sonde_base (4.2.5)

Usage:
plan nbr nbr2 point_deb point_fin point_fin_2
where

- **nbr** *int*: Number of probes in the first direction.
- **nbr2** *int*: Number of probes in the second direction.
- **point_deb** *un_point* (3.8.3): First point defining the angle. This angle should be positive.
- **point_fin** *un_point* (3.8.3): Second point defining the angle. This angle should be positive.
- **point_fin_2** *un_point* (3.8.3): Third point defining the angle. This angle should be positive.

4.2.14 volume

Description: Keyword to define the probe volume in a parallelepiped passing through 4 points and the number of probes in each direction.

See also: sonde_base (4.2.5)

Usage:
volume nbr nbr2 nbr3 point_deb point_fin point_fin_2 point_fin_3
where

- **nbr** *int*: Number of probes in the first direction.
- **nbr2** *int*: Number of probes in the second direction.
- **nbr3** *int*: Number of probes in the third direction.
- **point_deb** *un_point* (3.8.3): Point of origin.
- **point_fin** *un_point* (3.8.3): Point defining the first direction (from point of origin).
- **point_fin_2** *un_point* (3.8.3): Point defining the second direction (from point of origin).
- **point_fin_3** *un_point* (3.8.3): Point defining the third direction (from point of origin).

4.2.15 circle

Description: Keyword to define several probes located on a circle.

See also: sonde_base (4.2.5)

Usage:
circle nbr point_deb [**direction**] **radius theta1 theta2**
where

- **nbr** *int*: Number of probes between teta1 and teta2 (angles given in degrees).
- **point_deb** *un_point* (3.8.3): Center of the circle.
- **direction** *int into [0, 1, 2]*: Axis normal to the circle plane (0:x axis, 1:y axis, 2:z axis).
- **radius** *float*: Radius of the circle.
- **theta1** *float*: First angle.
- **theta2** *float*: Second angle.

4.2.16 circle_3

Description: Keyword to define several probes located on a circle (in 3-D space).

See also: sonde_base (4.2.5)

Usage:
circle_3 nbr point_deb direction radius theta1 theta2
where

- **nbr** *int*: Number of probes between teta1 and teta2 (angles given in degrees).
- **point_deb** *un_point* (3.8.3): Center of the circle.
- **direction** *int into [0, 1, 2]*: Axis normal to the circle plane (0:x axis, 1:y axis, 2:z axis).
- **radius** *float*: Radius of the circle.
- **theta1** *float*: First angle.
- **theta2** *float*: Second angle.

4.2.17 champs_posts

Description: Field's write mode.

See also: objet_lecture (32)

Usage:
[**format**] **mot** **period** **fields|champs**
where

- **format** *str into ['binaire', 'formatte']*: Type of file.
- **mot** *str into ['dt_post', 'nb_pas_dt_post']*: Keyword to set the kind of the field's write frequency. Either a time period or a time step period.
- **period** *str*: Value of the period.
- **fields|champs** *champs_a_post* (4.2.18): Post-processed fields.

4.2.18 champs_a_post

Description: Fields to be post-processed.

See also: listobj (31.3)

Usage:
{ object1 object2 .... }
list of *champ_a_post* (4.2.19)

4.2.19 champ_a_post

Description: Field to be post-processed.

See also: objet_lecture (32)

Usage:
champ [**localisation**]
where

- **champ** *str*: Name of the post-processed field.
- **localisation** *str into ['elem', 'som', 'faces']*: Localisation of post-processed field values: The two available values are elem, som, or faces (LATA format only) used respectively to select field values at mesh centres (CHAMPMAILLE type field in the lml file) or at mesh nodes (CHAMPPOINT type field in the lml file). If no selection is made, localisation is set to som by default.

4.2.20 stats_posts

Description: Field's write mode.
Dt_post: This keyword is used to set the calculated statistics write period.
dts: frequency value.
t_deb value: Start of integration time
t_fin value: End of integration time

stat: Set to **Moyenne (average)** to calculate the average of the field *nom_champ* (field name) over time or **Ecart_type (std_deviation)** to calculate the standard deviation (statistic rms) of the field *nom_champ (field_name)* or **Correlation** to calculate the correlation between the two fields *nom_champ* and *second_nom_champ.*

nom_champ: name of the field on which statistical analysis will be performed. Possible keywords are **Vitesse (speed)**, **Pression (pressure)**, **Temperature**, **Concentration,...**

localisation: localisation of post-processed field values (**elem** or **som**).

Example:
Statistiques Dt_post dtst {
t_deb 0.1 **t_fin** 0.12
Moyenne Pression
Ecart_type Pression
Correlation Vitesse Vitesse }
It will write every **dt_post** the mean, standard deviation and correlation value:

t<=t_{deb} :
average: $\overline{P(t)} = 0$
std_deviation: $< P(t)$>=0
correlation: $< U(t).V(t)$>=0

$t > t_{\text{deb}}$:
average: $\overline{P(t)} = \frac{1}{t-t_{\text{deb}}} \int\limits_{t_{\text{deb}}}^{t} P(t)\text{dt}$
std_deviation: $< P(t)$>=$\sqrt{\frac{1}{t-t_{\text{deb}}} \int\limits_{t_{\text{deb}}}^{t} \left[P(t) - \overline{P(t)}\right]^2 \text{dt}}$
correlation: $< U(t).V(t)$>=$\frac{1}{t-t_{\text{deb}}} \int\limits_{t_{\text{deb}}}^{t} \left[U(t) - \overline{U(t)}\right] . \left[V(t) - \overline{V(t)}\right] \text{dt}$

See also: objet_lecture (32)

Usage:
mot period fields|champs
where

- **mot** *str into ['dt_post', 'nb_pas_dt_post']*: Keyword to set the kind of the field's write frequency. Either a time period or a time step period.
- **period** *str*: Value of the period.
- **fields|champs** *list_stat_post* (4.2.21): Post-processed fields.

4.2.21 list_stat_post

Description: Post-processing for statistics

See also: listobj (31.3)

Usage:
{ object1 object2 .... }
list of *stat_post_deriv* (4.2.22)

4.2.22 stat_post_deriv

Description: not_set

See also: objet_lecture (32) t_deb (4.2.23) t_fin (4.2.24) moyenne (4.2.25) ecart_type (4.2.26) correlation (4.2.27)

Usage:
stat_post_deriv

4.2.23 t_deb

Description: not_set

See also: stat_post_deriv (4.2.22)

Usage:
t_deb val
where

- **val** *float*

4.2.24 t_fin

Description: not_set

See also: stat_post_deriv (4.2.22)

Usage:
t_fin val
where

- **val** *float*

4.2.25 moyenne

Synonymous: **champ_post_statistiques_moyenne**

Description: not_set

See also: stat_post_deriv (4.2.22)

Usage:
moyenne field [**localisation**]
where

- **field** *str*
- **localisation** *str into ['elem', 'som', 'faces']*: Localisation of post-processed field value

4.2.26 ecart_type

Synonymous: **champ_post_statistiques_ecart_type**

Description: not_set

See also: stat_post_deriv (4.2.22)

Usage:
ecart_type field [**localisation**]
where

- **field** *str*
- **localisation** *str into ['elem', 'som', 'faces']*: Localisation of post-processed field value

4.2.27 correlation

Synonymous: **champ_post_statistiques_correlation**

Description: not_set

See also: stat_post_deriv (4.2.22)

Usage:
correlation first_field second_field [**localisation**]
where

- **first_field** *str*
- **second_field** *str*
- **localisation** *str into ['elem', 'som', 'faces']*: Localisation of post-processed field value

4.2.28 stats_serie_posts

Description: Post-processing for statistics.
Statistiques_en_serie: This keyword is used to set the statistics. Average on **dt_integr** time interval is post-processed every **dt_integr** seconds

dt_integr value : Period of integration and write period.

stat: Set to **Moyenne (average)** to calculate the average of the field *nom_champ* (field name) over time or **Ecart_type (std_deviation)** to calculate the standard deviation (statistic rms) of the field *nom_champ (field_name)*.

nom_champ: name of the field on which statistical analysis will be performed. Possible keywords are **Vitesse (speed)**, **Pression (pressure)**, **Temperature**, **Concentration,...**

localisation: localisation of post-processed field values (**elem** or **som**).

Example:

Statistiques_en_serie Dt_integr dtst {
Moyenne Pression
}
Will calculate and write every dtst seconds the mean value:

$$(n+1)\text{dt\_integr} > t > n * \text{dt\_integr}, \overline{P(t)} = \frac{1}{t - n * \text{dt\_integr}} \int_{t_n * \text{dt\_integr}}^{t} P(t)\text{dt}$$

See also: objet_lecture (32)

Usage:
mot dt_integr stat
where

- **mot** *str into ['dt_integr']*: Keyword is used to set the statistics period of integration and write period.
- **dt_integr** *float*: Average on dt_integr time interval is post-processed every dt_integr seconds.
- **stat** *list_stat_post* (4.2.21)

4.3 post_processings

Synonymous: **postraitements**

Description: Keyword to use several results files. List of objects of post-processing (with name).

See also: listobj (31.3)

Usage:
{ object1 object2 .... }
list of *un_postraitement* (4.3.1)

4.3.1 un_postraitement

Description: An object of post-processing (with name).

See also: objet_lecture (32)

Usage:
nom post
where

- **nom** *str*: Name of the post-processing.
- **post** *corps_postraitement* (4.2): Definition of the post-processing.

4.4 liste_post_ok

Description: Keyword to use several results files. List of objects of post-processing (with name)

See also: listobj (31.3)

Usage:
{ object1 object2 .... }
list of *nom_postraitement* (4.4.1)

4.4.1 nom_postraitement

Description:

See also: objet_lecture (32)

Usage:
nom post
where

- **nom** *str*: Name of the post-processing.
- **post** *postraitement_base* (4.4.2): the post

4.4.2 postraitement_base

Description: not_set

See also: objet_lecture (32) post_processing (4.4.3)

Usage:

4.4.3 post_processing

Synonymous: **postraitement**

Description: An object of post-processing (without name).

See also: postraitement_base (4.4.2) corps_postraitement (4.2)

Usage:
post_processing {

[**definition_champs** *definition_champs*]
[**Probes|sondes** *sondes*]
[**domaine** *str*]
[**format** *str into ['lml', 'lata', 'lata_v1', 'lata_v2', 'med', 'med_major']*]
[**fields|champs** *champs_posts*]
[**statistiques** *stats_posts*]
[**fichier** *str*]
[**statistiques_en_serie** *stats_serie_posts*]
[**interfaces** *champs_posts*]

}
where

- **definition_champs** *definition_champs* (4.2.1): Keyword to create new or more complex field for advanced postprocessing.
- **Probes|sondes** *sondes* (4.2.3): Probe.
- **domaine** *str*: This optional parameter specifies the domain on which the data should be interpolated before it is written in the output file. The default is to write the data on the domain of the current problem (no interpolation).
- **format** *str into ['lml', 'lata', 'lata_v1', 'lata_v2', 'med', 'med_major']*: This optional parameter specifies the format of the output file. The basename used for the output file is the basename of the data file. For the fmt parameter, choices are lml or lata. A short description of each format can be found below. The default value is lml.
- **fields|champs** *champs_posts* (4.2.17): Field's write mode.
- **statistiques** *stats_posts* (4.2.20): Statistics between two points fixed : start of integration time and end of integration time.
- **fichier** *str*: Name of file.
- **statistiques_en_serie** *stats_serie_posts* (4.2.28): Statistics between two points not fixed : on period of integration.
- **interfaces** *champs_posts* (4.2.17): Keyword to read all the caracteristics of the interfaces. Different kind of interfaces exist as well as different interface intitialisations.

4.5 liste_post

Description: Keyword to use several results files. List of objects of post-processing (with name)

See also: listobj (31.3)

Usage:
{ object1 object2 .... }
list of *un_postraitement_spec* (4.5.1)

4.5.1 un_postraitement_spec

Description: An object of post-processing (with type +name).

See also: objet_lecture (32)

Usage:
[**type_un_post**] [**type_postraitement_ft_lata**]
where

- **type_un_post** *type_un_post* (4.5.2)
- **type_postraitement_ft_lata** *type_postraitement_ft_lata* (4.5.3)

4.5.2 type_un_post

Description: not_set

See also: objet_lecture (32)

Usage:
type post
where

- **type** *str into ['postraitement', 'post_processing']*
- **post** *un_postraitement* (4.3.1)

4.5.3 type_postraitement_ft_lata

Description: not_set

See also: objet_lecture (32)

Usage:
type nom bloc
where

- **type** *str into ['postraitement_ft_lata', 'postraitement_lata']*
- **nom** *str*: Name of the post-processing.
- **bloc** *str*

4.6 format_file

Description: File formatted.

See also: objet_lecture (32)

Usage:
[**format**] **name_file**
where

- **format** *str into ['binaire', 'formatte', 'xyz']*: Type of file (the file format).
- **name_file** *str*: Name of file.

4.7 probleme_couple

Description: This instruction causes a probleme_couple type object to be created. This type of object has an associated problem list, that is, the coupling of n problems among them may be processed. Coupling between these problems is carried out explicitly via conditions at particular contact limits. Each problem may be associated either with the Associer keyword or with the Lire/groupes keywords. The difference is that in the first case, the four problems exchange values then calculate their timestep, rather in the second case, the same strategy is used for all the problems listed inside one group, but the second group of problem exchange values with the first group of problems after the first group did its timestep. So, the first case may then also be written like this:
Probleme_Couple pbc
Lire pbc { groupes { { pb1 , pb2 , pb3 , pb4 } } }
There is a physical environment per problem (however, the same physical environment could be common to several problems).
Each problem is resolved in a domain.
Warning : Presently, coupling requires coincident meshes. In case of non-coincident meshes, boundary condition 'paroi_contact' in VEF returns error message (see paroi_contact for correcting procedure).

See also: pb_gen_base (4)

Usage:
probleme_couple obj Lire obj {

[**groupes** *list_list_nom*]

}
where

- **groupes** *list_list_nom* (4.8): { groupes { { pb1 , pb2 } , { pb3 , pb4 } } }

4.8 list_list_nom

Description: pour les groupes

See also: listobj (31.3)

Usage:
{ object1 , object2 .... }
list of *list_un_pb* (31.1) separeted with ,

4.9 pb_avec_passif

Description: Class to create a classical problem with a scalar transport equation (e.g: temperature or concentration) and an additional set of passive scalars (e.g: temperature or concentration) equations.

Keyword Discretiser should have already be used to read the object.
See also: Pb_base (4.1) pb_thermohydraulique_concentration_turbulent_scalaires_passifs (4.23) pb_thermohydraulique_concentration_scalaires_passifs (4.21) pb_thermohydraulique_turbulent_scalaires_passifs (4.30) pb_thermohydraulique_scalaires_passifs (4.26) pb_hydraulique_concentration_turbulent_scalaires_passifs (4.16) pb_hydraulique_concentration_scalaires_passifs (4.14) pb_thermohydraulique_qc_fraction_massique (4.25) pb_thermohydraulique_turbulent_qc_fraction_massique (4.29)

Usage:
pb_avec_passif obj Lire obj {

equations_scalaires_passifs *listeqn*

[**Post_processing|postraitement** *corps_postraitement*]
[**Post_processings|postraitements** *post_processings*]
[**liste_de_postraitements** *liste_post_ok*]
[**liste_postraitements** *liste_post*]
[**sauvegarde** *format_file*]
[**sauvegarde_simple** *format_file*]
[**reprise** *format_file*]
[**resume_last_time** *format_file*]

}
where

- **equations_scalaires_passifs** *listeqn* (4.10): Passive scalar equations. The unknowns of the passive scalar equation number N are named temperatureN or concentrationN or fraction_massiqueN. This keyword is used to define initial conditions and the post processing fields. This kind of problem is very useful to test in only one data file (and then only one calculation) different schemes or different boundary conditions for the scalar transport equation.
- **Post_processing|postraitement** *corps_postraitement* (4.2) for inheritance: One post-processing (without name).
- **Post_processings|postraitements** *post_processings* (4.3) for inheritance: List of Postraitement objects (with name).
- **liste_de_postraitements** *liste_post_ok* (4.4) for inheritance: This
- **liste_postraitements** *liste_post* (4.5) for inheritance: This block defines the output files to be written during the computation. The output format is lata in order to use OpenDX to draw the results. This block can be divided in one or several sub-blocks that can be written at different frequencies and in different directories. Attention. The directory lata used in this example should be created before running the computation or the lata files will be lost.
- **sauvegarde** *format_file* (4.6) for inheritance: Keyword used when calculation results are to be backed up. When a coupling is performed, the backup-recovery file name must be well specified for each problem. In this case, you must save to different files and correctly specify these files when restarting the calculation.
- **sauvegarde_simple** *format_file* (4.6) for inheritance: The same keyword than Sauvegarde except, the last time step only is saved.
- **reprise** *format_file* (4.6) for inheritance: Keyword to restart a calculation based on the name_file file (see the class format_file). If format_reprise is xyz, the name_file file should be the .xyz file created by the previous calculation. With this file, it is possible to restart a parallel calculation on P processors, whereas the previous calculation has been run on N (N<>P) processors. Should the calculation be restarted, values for the tinit (see schema_temps_base) time fields are taken from the name_file file. If there is no backup corresponding to this time in the name_file, TRUST exits in error.
- **resume_last_time** *format_file* (4.6) for inheritance: Keyword to restart a calculation based on the name_file file, restart the calculation at the last time found in the file (tinit is set to last time of saved files).

4.10 listeqn

Description: List of equations.

See also: listobj (31.3)

Usage:
{ object1 object2 .... }
list of *eqn_base* (5.18)

4.11 pb_conduction

Description: Resolution of the heat equation.

Keyword Discretiser should have already be used to read the object.
See also: Pb_base (4.1)

Usage:
pb_conduction obj Lire obj {

[**conduction** *conduction*]
[**Post_processing|postraitement** *corps_postraitement*]
[**Post_processings|postraitements** *post_processings*]
[**liste_de_postraitements** *liste_post_ok*]
[**liste_postraitements** *liste_post*]
[**sauvegarde** *format_file*]
[**sauvegarde_simple** *format_file*]
[**reprise** *format_file*]
[**resume_last_time** *format_file*]

}
where

- **conduction** *conduction* (5.1): Heat equation.
- **Post_processing|postraitement** *corps_postraitement* (4.2) for inheritance: One post-processing (without name).
- **Post_processings|postraitements** *post_processings* (4.3) for inheritance: List of Postraitement objects (with name).
- **liste_de_postraitements** *liste_post_ok* (4.4) for inheritance: This
- **liste_postraitements** *liste_post* (4.5) for inheritance: This block defines the output files to be written during the computation. The output format is lata in order to use OpenDX to draw the results. This block can be divided in one or several sub-blocks that can be written at different frequencies and in different directories. Attention. The directory lata used in this example should be created before running the computation or the lata files will be lost.
- **sauvegarde** *format_file* (4.6) for inheritance: Keyword used when calculation results are to be backed up. When a coupling is performed, the backup-recovery file name must be well specified for each problem. In this case, you must save to different files and correctly specify these files when restarting the calculation.
- **sauvegarde_simple** *format_file* (4.6) for inheritance: The same keyword than Sauvegarde except, the last time step only is saved.
- **reprise** *format_file* (4.6) for inheritance: Keyword to restart a calculation based on the name_file file (see the class format_file). If format_reprise is xyz, the name_file file should be the .xyz file created by the previous calculation. With this file, it is possible to restart a parallel calculation on P processors, whereas the previous calculation has been run on N (N<>P) processors. Should the calculation be restarted, values for the tinit (see schema_temps_base) time fields are taken from the name_file file. If there is no backup corresponding to this time in the name_file, TRUST exits in error.
- **resume_last_time** *format_file* (4.6) for inheritance: Keyword to restart a calculation based on the name_file file, restart the calculation at the last time found in the file (tinit is set to last time of saved files).

4.12 pb_hydraulique

Description: Resolution of the NAVIER STOKES equations.

Keyword Discretiser should have already be used to read the object.

See also: Pb_base (4.1)

Usage:
pb_hydraulique obj Lire obj {

> **navier_stokes_standard** *navier_stokes_standard*
> [**Post_processing|postraitement** *corps_postraitement*]
> [**Post_processings|postraitements** *post_processings*]
> [**liste_de_postraitements** *liste_post_ok*]
> [**liste_postraitements** *liste_post*]
> [**sauvegarde** *format_file*]
> [**sauvegarde_simple** *format_file*]
> [**reprise** *format_file*]
> [**resume_last_time** *format_file*]

}
where

- **navier_stokes_standard** *navier_stokes_standard* (5.23): NAVIER STOKES equations.
- **Post_processing|postraitement** *corps_postraitement* (4.2) for inheritance: One post-processing (without name).
- **Post_processings|postraitements** *post_processings* (4.3) for inheritance: List of Postraitement objects (with name).
- **liste_de_postraitements** *liste_post_ok* (4.4) for inheritance: This
- **liste_postraitements** *liste_post* (4.5) for inheritance: This block defines the output files to be written during the computation. The output format is lata in order to use OpenDX to draw the results. This block can be divided in one or several sub-blocks that can be written at different frequencies and in different directories. Attention. The directory lata used in this example should be created before running the computation or the lata files will be lost.
- **sauvegarde** *format_file* (4.6) for inheritance: Keyword used when calculation results are to be backed up. When a coupling is performed, the backup-recovery file name must be well specified for each problem. In this case, you must save to different files and correctly specify these files when restarting the calculation.
- **sauvegarde_simple** *format_file* (4.6) for inheritance: The same keyword than Sauvegarde except, the last time step only is saved.
- **reprise** *format_file* (4.6) for inheritance: Keyword to restart a calculation based on the name_file file (see the class format_file). If format_reprise is xyz, the name_file file should be the .xyz file created by the previous calculation. With this file, it is possible to restart a parallel calculation on P processors, whereas the previous calculation has been run on N (N<>P) processors. Should the calculation be restarted, values for the tinit (see schema_temps_base) time fields are taken from the name_file file. If there is no backup corresponding to this time in the name_file, TRUST exits in error.
- **resume_last_time** *format_file* (4.6) for inheritance: Keyword to restart a calculation based on the name_file file, restart the calculation at the last time found in the file (tinit is set to last time of saved files).

4.13 pb_hydraulique_concentration

Description: Resolution of NAVIER STOKES/multiple constituent transportation equations.

Keyword Discretiser should have already be used to read the object.
See also: Pb_base (4.1)

Usage:
pb_hydraulique_concentration obj Lire obj {

[**navier_stokes_standard** *navier_stokes_standard*]
[**convection_diffusion_concentration** *convection_diffusion_concentration*]
[**Post_processing|postraitement** *corps_postraitement*]
[**Post_processings|postraitements** *post_processings*]
[**liste_de_postraitements** *liste_post_ok*]
[**liste_postraitements** *liste_post*]
[**sauvegarde** *format_file*]
[**sauvegarde_simple** *format_file*]
[**reprise** *format_file*]
[**resume_last_time** *format_file*]

}
where

- **navier_stokes_standard** *navier_stokes_standard* (5.23): NAVIER STOKES equations.
- **convection_diffusion_concentration** *convection_diffusion_concentration* (5.11): Constituent transportation vectorial equation (concentration diffusion convection).
- **Post_processing|postraitement** *corps_postraitement* (4.2) for inheritance: One post-processing (without name).
- **Post_processings|postraitements** *post_processings* (4.3) for inheritance: List of Postraitement objects (with name).
- **liste_de_postraitements** *liste_post_ok* (4.4) for inheritance: This
- **liste_postraitements** *liste_post* (4.5) for inheritance: This block defines the output files to be written during the computation. The output format is lata in order to use OpenDX to draw the results. This block can be divided in one or several sub-blocks that can be written at different frequencies and in different directories. Attention. The directory lata used in this example should be created before running the computation or the lata files will be lost.
- **sauvegarde** *format_file* (4.6) for inheritance: Keyword used when calculation results are to be backed up. When a coupling is performed, the backup-recovery file name must be well specified for each problem. In this case, you must save to different files and correctly specify these files when restarting the calculation.
- **sauvegarde_simple** *format_file* (4.6) for inheritance: The same keyword than Sauvegarde except, the last time step only is saved.
- **reprise** *format_file* (4.6) for inheritance: Keyword to restart a calculation based on the name_file file (see the class format_file). If format_reprise is xyz, the name_file file should be the .xyz file created by the previous calculation. With this file, it is possible to restart a parallel calculation on P processors, whereas the previous calculation has been run on N (N<>P) processors. Should the calculation be restarted, values for the tinit (see schema_temps_base) time fields are taken from the name_file file. If there is no backup corresponding to this time in the name_file, TRUST exits in error.
- **resume_last_time** *format_file* (4.6) for inheritance: Keyword to restart a calculation based on the name_file file, restart the calculation at the last time found in the file (tinit is set to last time of saved files).

4.14 pb_hydraulique_concentration_scalaires_passifs

Description: Resolution of NAVIER STOKES/multiple constituent transportation equations with the additional passive scalar equations.

Keyword Discretiser should have already be used to read the object.
See also: pb_avec_passif (4.9)

Usage:
pb_hydraulique_concentration_scalaires_passifs obj Lire obj {

[**navier_stokes_standard** *navier_stokes_standard*]
[**convection_diffusion_concentration** *convection_diffusion_concentration*]
equations_scalaires_passifs *listeqn*
[**Post_processing|postraitement** *corps_postraitement*]
[**Post_processings|postraitements** *post_processings*]
[**liste_de_postraitements** *liste_post_ok*]
[**liste_postraitements** *liste_post*]
[**sauvegarde** *format_file*]
[**sauvegarde_simple** *format_file*]
[**reprise** *format_file*]
[**resume_last_time** *format_file*]

}
where

- **navier_stokes_standard** *navier_stokes_standard* (5.23): NAVIER STOKES equations.
- **convection_diffusion_concentration** *convection_diffusion_concentration* (5.11): Constituent transportation equations (concentration diffusion convection).
- **equations_scalaires_passifs** *listeqn* (4.10) for inheritance: Passive scalar equations. The unknowns of the passive scalar equation number N are named temperatureN or concentrationN or fraction_massiqueN. This keyword is used to define initial conditions and the post processing fields. This kind of problem is very useful to test in only one data file (and then only one calculation) different schemes or different boundary conditions for the scalar transport equation.
- **Post_processing|postraitement** *corps_postraitement* (4.2) for inheritance: One post-processing (without name).
- **Post_processings|postraitements** *post_processings* (4.3) for inheritance: List of Postraitement objects (with name).
- **liste_de_postraitements** *liste_post_ok* (4.4) for inheritance: This
- **liste_postraitements** *liste_post* (4.5) for inheritance: This block defines the output files to be written during the computation. The output format is lata in order to use OpenDX to draw the results. This block can be divided in one or several sub-blocks that can be written at different frequencies and in different directories. Attention. The directory lata used in this example should be created before running the computation or the lata files will be lost.
- **sauvegarde** *format_file* (4.6) for inheritance: Keyword used when calculation results are to be backed up. When a coupling is performed, the backup-recovery file name must be well specified for each problem. In this case, you must save to different files and correctly specify these files when restarting the calculation.
- **sauvegarde_simple** *format_file* (4.6) for inheritance: The same keyword than Sauvegarde except, the last time step only is saved.
- **reprise** *format_file* (4.6) for inheritance: Keyword to restart a calculation based on the name_file file (see the class format_file). If format_reprise is xyz, the name_file file should be the .xyz file created by the previous calculation. With this file, it is possible to restart a parallel calculation on P processors, whereas the previous calculation has been run on N (N<>P) processors. Should the calculation be restarted, values for the tinit (see schema_temps_base) time fields are taken from the name_file file. If there is no backup corresponding to this time in the name_file, TRUST exits in error.
- **resume_last_time** *format_file* (4.6) for inheritance: Keyword to restart a calculation based on the name_file file, restart the calculation at the last time found in the file (tinit is set to last time of saved files).

4.15 pb_hydraulique_concentration_turbulent

Description: Resolution of NAVIER STOKES/multiple constituent transportation equations, with turbulence modelling.

Keyword Discretiser should have already be used to read the object.
See also: Pb_base (4.1)

Usage:
pb_hydraulique_concentration_turbulent obj Lire obj {

> [**navier_stokes_turbulent** *navier_stokes_turbulent*]
> [**convection_diffusion_concentration_turbulent** *convection_diffusion_concentration_turbulent*]
> [**Post_processing|postraitement** *corps_postraitement*]
> [**Post_processings|postraitements** *post_processings*]
> [**liste_de_postraitements** *liste_post_ok*]
> [**liste_postraitements** *liste_post*]
> [**sauvegarde** *format_file*]
> [**sauvegarde_simple** *format_file*]
> [**reprise** *format_file*]
> [**resume_last_time** *format_file*]

}
where

- **navier_stokes_turbulent** *navier_stokes_turbulent* (5.24): NAVIER STOKES equations as well as the associated turbulence model equations.
- **convection_diffusion_concentration_turbulent** *convection_diffusion_concentration_turbulent* (5.12): Constituent transportation equations (concentration diffusion convection) as well as the associated turbulence model equations.
- **Post_processing|postraitement** *corps_postraitement* (4.2) for inheritance: One post-processing (without name).
- **Post_processings|postraitements** *post_processings* (4.3) for inheritance: List of Postraitement objects (with name).
- **liste_de_postraitements** *liste_post_ok* (4.4) for inheritance: This
- **liste_postraitements** *liste_post* (4.5) for inheritance: This block defines the output files to be written during the computation. The output format is lata in order to use OpenDX to draw the results. This block can be divided in one or several sub-blocks that can be written at different frequencies and in different directories. Attention. The directory lata used in this example should be created before running the computation or the lata files will be lost.
- **sauvegarde** *format_file* (4.6) for inheritance: Keyword used when calculation results are to be backed up. When a coupling is performed, the backup-recovery file name must be well specified for each problem. In this case, you must save to different files and correctly specify these files when restarting the calculation.
- **sauvegarde_simple** *format_file* (4.6) for inheritance: The same keyword than Sauvegarde except, the last time step only is saved.
- **reprise** *format_file* (4.6) for inheritance: Keyword to restart a calculation based on the name_file file (see the class format_file). If format_reprise is xyz, the name_file file should be the .xyz file created by the previous calculation. With this file, it is possible to restart a parallel calculation on P processors, whereas the previous calculation has been run on N (N<>P) processors. Should the calculation be restarted, values for the tinit (see schema_temps_base) time fields are taken from the name_file file. If there is no backup corresponding to this time in the name_file, TRUST exits in error.
- **resume_last_time** *format_file* (4.6) for inheritance: Keyword to restart a calculation based on the name_file file, restart the calculation at the last time found in the file (tinit is set to last time of saved files).

4.16 pb_hydraulique_concentration_turbulent_scalaires_passifs

Description: Resolution of NAVIER STOKES/multiple constituent transportation equations, with turbulence modelling and with the additional passive scalar equations.

Keyword Discretiser should have already be used to read the object.
See also: pb_avec_passif (4.9)

Usage:
pb_hydraulique_concentration_turbulent_scalaires_passifs obj Lire obj {

[**navier_stokes_turbulent** *navier_stokes_turbulent*]
[**convection_diffusion_concentration_turbulent** *convection_diffusion_concentration_turbulent*]
equations_scalaires_passifs *listeqn*
[**Post_processing|postraitement** *corps_postraitement*]
[**Post_processings|postraitements** *post_processings*]
[**liste_de_postraitements** *liste_post_ok*]
[**liste_postraitements** *liste_post*]
[**sauvegarde** *format_file*]
[**sauvegarde_simple** *format_file*]
[**reprise** *format_file*]
[**resume_last_time** *format_file*]

}
where

- **navier_stokes_turbulent** *navier_stokes_turbulent* (5.24): NAVIER STOKES equations as well as the associated turbulence model equations.
- **convection_diffusion_concentration_turbulent** *convection_diffusion_concentration_turbulent* (5.12): Constituent transportation equations (concentration diffusion convection) as well as the associated turbulence model equations.
- **equations_scalaires_passifs** *listeqn* (4.10) for inheritance: Passive scalar equations. The unknowns of the passive scalar equation number N are named temperatureN or concentrationN or fraction_massiqueN. This keyword is used to define initial conditions and the post processing fields. This kind of problem is very useful to test in only one data file (and then only one calculation) different schemes or different boundary conditions for the scalar transport equation.
- **Post_processing|postraitement** *corps_postraitement* (4.2) for inheritance: One post-processing (without name).
- **Post_processings|postraitements** *post_processings* (4.3) for inheritance: List of Postraitement objects (with name).
- **liste_de_postraitements** *liste_post_ok* (4.4) for inheritance: This
- **liste_postraitements** *liste_post* (4.5) for inheritance: This block defines the output files to be written during the computation. The output format is lata in order to use OpenDX to draw the results. This block can be divided in one or several sub-blocks that can be written at different frequencies and in different directories. Attention. The directory lata used in this example should be created before running the computation or the lata files will be lost.
- **sauvegarde** *format_file* (4.6) for inheritance: Keyword used when calculation results are to be backed up. When a coupling is performed, the backup-recovery file name must be well specified for each problem. In this case, you must save to different files and correctly specify these files when restarting the calculation.
- **sauvegarde_simple** *format_file* (4.6) for inheritance: The same keyword than Sauvegarde except, the last time step only is saved.
- **reprise** *format_file* (4.6) for inheritance: Keyword to restart a calculation based on the name_file file (see the class format_file). If format_reprise is xyz, the name_file file should be the .xyz file created by the previous calculation. With this file, it is possible to restart a parallel calculation on

P processors, whereas the previous calculation has been run on N (N<>P) processors. Should the calculation be restarted, values for the tinit (see schema_temps_base) time fields are taken from the name_file file. If there is no backup corresponding to this time in the name_file, TRUST exits in error.

- **resume_last_time** *format_file* (4.6) for inheritance: Keyword to restart a calculation based on the name_file file, restart the calculation at the last time found in the file (tinit is set to last time of saved files).

4.17 pb_hydraulique_turbulent

Description: Resolution of NAVIER STOKES equations with turbulence modelling.

Keyword Discretiser should have already be used to read the object.
See also: Pb_base (4.1)

Usage:
pb_hydraulique_turbulent obj Lire obj {

navier_stokes_turbulent *navier_stokes_turbulent*
[**Post_processing|postraitement** *corps_postraitement*]
[**Post_processings|postraitements** *post_processings*]
[**liste_de_postraitements** *liste_post_ok*]
[**liste_postraitements** *liste_post*]
[**sauvegarde** *format_file*]
[**sauvegarde_simple** *format_file*]
[**reprise** *format_file*]
[**resume_last_time** *format_file*]

}
where

- **navier_stokes_turbulent** *navier_stokes_turbulent* (5.24): NAVIER STOKES equations as well as the associated turbulence model equations.
- **Post_processing|postraitement** *corps_postraitement* (4.2) for inheritance: One post-processing (without name).
- **Post_processings|postraitements** *post_processings* (4.3) for inheritance: List of Postraitement objects (with name).
- **liste_de_postraitements** *liste_post_ok* (4.4) for inheritance: This
- **liste_postraitements** *liste_post* (4.5) for inheritance: This block defines the output files to be written during the computation. The output format is lata in order to use OpenDX to draw the results. This block can be divided in one or several sub-blocks that can be written at different frequencies and in different directories. Attention. The directory lata used in this example should be created before running the computation or the lata files will be lost.
- **sauvegarde** *format_file* (4.6) for inheritance: Keyword used when calculation results are to be backed up. When a coupling is performed, the backup-recovery file name must be well specified for each problem. In this case, you must save to different files and correctly specify these files when restarting the calculation.
- **sauvegarde_simple** *format_file* (4.6) for inheritance: The same keyword than Sauvegarde except, the last time step only is saved.
- **reprise** *format_file* (4.6) for inheritance: Keyword to restart a calculation based on the name_file file (see the class format_file). If format_reprise is xyz, the name_file file should be the .xyz file created by the previous calculation. With this file, it is possible to restart a parallel calculation on P processors, whereas the previous calculation has been run on N (N<>P) processors. Should the calculation be restarted, values for the tinit (see schema_temps_base) time fields are taken from the

name_file file. If there is no backup corresponding to this time in the name_file, TRUST exits in error.

- **resume_last_time** *format_file* (4.6) for inheritance: Keyword to restart a calculation based on the name_file file, restart the calculation at the last time found in the file (tinit is set to last time of saved files).

4.18 pb_post

Description: not_set

Keyword Discretiser should have already be used to read the object.
See also: Pb_base (4.1)

Usage:
pb_post obj Lire obj {

[**Post_processing|postraitement** *corps_postraitement*]
[**Post_processings|postraitements** *post_processings*]
[**liste_de_postraitements** *liste_post_ok*]
[**liste_postraitements** *liste_post*]
[**sauvegarde** *format_file*]
[**sauvegarde_simple** *format_file*]
[**reprise** *format_file*]
[**resume_last_time** *format_file*]

}
where

- **Post_processing|postraitement** *corps_postraitement* (4.2) for inheritance: One post-processing (without name).
- **Post_processings|postraitements** *post_processings* (4.3) for inheritance: List of Postraitement objects (with name).
- **liste_de_postraitements** *liste_post_ok* (4.4) for inheritance: This
- **liste_postraitements** *liste_post* (4.5) for inheritance: This block defines the output files to be written during the computation. The output format is lata in order to use OpenDX to draw the results. This block can be divided in one or several sub-blocks that can be written at different frequencies and in different directories. Attention. The directory lata used in this example should be created before running the computation or the lata files will be lost.
- **sauvegarde** *format_file* (4.6) for inheritance: Keyword used when calculation results are to be backed up. When a coupling is performed, the backup-recovery file name must be well specified for each problem. In this case, you must save to different files and correctly specify these files when restarting the calculation.
- **sauvegarde_simple** *format_file* (4.6) for inheritance: The same keyword than Sauvegarde except, the last time step only is saved.
- **reprise** *format_file* (4.6) for inheritance: Keyword to restart a calculation based on the name_file file (see the class format_file). If format_reprise is xyz, the name_file file should be the .xyz file created by the previous calculation. With this file, it is possible to restart a parallel calculation on P processors, whereas the previous calculation has been run on N (N<>P) processors. Should the calculation be restarted, values for the tinit (see schema_temps_base) time fields are taken from the name_file file. If there is no backup corresponding to this time in the name_file, TRUST exits in error.
- **resume_last_time** *format_file* (4.6) for inheritance: Keyword to restart a calculation based on the name_file file, restart the calculation at the last time found in the file (tinit is set to last time of saved files).

4.19 pb_thermohydraulique

Description: Resolution of thermohydraulic problem.

Keyword Discretiser should have already be used to read the object.
See also: Pb_base (4.1)

Usage:
pb_thermohydraulique obj Lire obj {

[**navier_stokes_standard** *navier_stokes_standard*]
[**convection_diffusion_temperature** *convection_diffusion_temperature*]
[**Post_processing|postraitement** *corps_postraitement*]
[**Post_processings|postraitements** *post_processings*]
[**liste_de_postraitements** *liste_post_ok*]
[**liste_postraitements** *liste_post*]
[**sauvegarde** *format_file*]
[**sauvegarde_simple** *format_file*]
[**reprise** *format_file*]
[**resume_last_time** *format_file*]

}
where

- **navier_stokes_standard** *navier_stokes_standard* (5.23): NAVIER STOKES equations.
- **convection_diffusion_temperature** *convection_diffusion_temperature* (5.15): Energy equation (temperature diffusion convection).
- **Post_processing|postraitement** *corps_postraitement* (4.2) for inheritance: One post-processing (without name).
- **Post_processings|postraitements** *post_processings* (4.3) for inheritance: List of Postraitement objects (with name).
- **liste_de_postraitements** *liste_post_ok* (4.4) for inheritance: This
- **liste_postraitements** *liste_post* (4.5) for inheritance: This block defines the output files to be written during the computation. The output format is lata in order to use OpenDX to draw the results. This block can be divided in one or several sub-blocks that can be written at different frequencies and in different directories. Attention. The directory lata used in this example should be created before running the computation or the lata files will be lost.
- **sauvegarde** *format_file* (4.6) for inheritance: Keyword used when calculation results are to be backed up. When a coupling is performed, the backup-recovery file name must be well specified for each problem. In this case, you must save to different files and correctly specify these files when restarting the calculation.
- **sauvegarde_simple** *format_file* (4.6) for inheritance: The same keyword than Sauvegarde except, the last time step only is saved.
- **reprise** *format_file* (4.6) for inheritance: Keyword to restart a calculation based on the name_file file (see the class format_file). If format_reprise is xyz, the name_file file should be the .xyz file created by the previous calculation. With this file, it is possible to restart a parallel calculation on P processors, whereas the previous calculation has been run on N (N<>P) processors. Should the calculation be restarted, values for the tinit (see schema_temps_base) time fields are taken from the name_file file. If there is no backup corresponding to this time in the name_file, TRUST exits in error.
- **resume_last_time** *format_file* (4.6) for inheritance: Keyword to restart a calculation based on the name_file file, restart the calculation at the last time found in the file (tinit is set to last time of saved files).

4.20 pb_thermohydraulique_concentration

Description: Resolution of NAVIER STOKES/energy/multiple constituent transportation equations.

Keyword Discretiser should have already be used to read the object.
See also: Pb_base (4.1)

Usage:
pb_thermohydraulique_concentration obj Lire obj {

[**navier_stokes_standard** *navier_stokes_standard*]
[**convection_diffusion_concentration** *convection_diffusion_concentration*]
[**convection_diffusion_temperature** *convection_diffusion_temperature*]
[**Post_processing|postraitement** *corps_postraitement*]
[**Post_processings|postraitements** *post_processings*]
[**liste_de_postraitements** *liste_post_ok*]
[**liste_postraitements** *liste_post*]
[**sauvegarde** *format_file*]
[**sauvegarde_simple** *format_file*]
[**reprise** *format_file*]
[**resume_last_time** *format_file*]

}
where

- **navier_stokes_standard** *navier_stokes_standard* (5.23): NAVIER STOKES equations.
- **convection_diffusion_concentration** *convection_diffusion_concentration* (5.11): Constituent transportation equations (concentration diffusion convection).
- **convection_diffusion_temperature** *convection_diffusion_temperature* (5.15): Energy equation (temperature diffusion convection).
- **Post_processing|postraitement** *corps_postraitement* (4.2) for inheritance: One post-processing (without name).
- **Post_processings|postraitements** *post_processings* (4.3) for inheritance: List of Postraitement objects (with name).
- **liste_de_postraitements** *liste_post_ok* (4.4) for inheritance: This
- **liste_postraitements** *liste_post* (4.5) for inheritance: This block defines the output files to be written during the computation. The output format is lata in order to use OpenDX to draw the results. This block can be divided in one or several sub-blocks that can be written at different frequencies and in different directories. Attention. The directory lata used in this example should be created before running the computation or the lata files will be lost.
- **sauvegarde** *format_file* (4.6) for inheritance: Keyword used when calculation results are to be backed up. When a coupling is performed, the backup-recovery file name must be well specified for each problem. In this case, you must save to different files and correctly specify these files when restarting the calculation.
- **sauvegarde_simple** *format_file* (4.6) for inheritance: The same keyword than Sauvegarde except, the last time step only is saved.
- **reprise** *format_file* (4.6) for inheritance: Keyword to restart a calculation based on the name_file file (see the class format_file). If format_reprise is xyz, the name_file file should be the .xyz file created by the previous calculation. With this file, it is possible to restart a parallel calculation on P processors, whereas the previous calculation has been run on N (N<>P) processors. Should the calculation be restarted, values for the tinit (see schema_temps_base) time fields are taken from the name_file file. If there is no backup corresponding to this time in the name_file, TRUST exits in error.
- **resume_last_time** *format_file* (4.6) for inheritance: Keyword to restart a calculation based on the name_file file, restart the calculation at the last time found in the file (tinit is set to last time of saved files).

4.21 pb_thermohydraulique_concentration_scalaires_passifs

Description: Resolution of NAVIER STOKES/energy/multiple constituent transportation equations, with the additional passive scalar equations.

Keyword Discretiser should have already be used to read the object.
See also: pb_avec_passif (4.9)

Usage:
pb_thermohydraulique_concentration_scalaires_passifs obj Lire obj {

> [**navier_stokes_standard** *navier_stokes_standard*]
> [**convection_diffusion_concentration** *convection_diffusion_concentration*]
> [**convection_diffusion_temperature** *convection_diffusion_temperature*]
> **equations_scalaires_passifs** *listeqn*
> [**Post_processing|postraitement** *corps_postraitement*]
> [**Post_processings|postraitements** *post_processings*]
> [**liste_de_postraitements** *liste_post_ok*]
> [**liste_postraitements** *liste_post*]
> [**sauvegarde** *format_file*]
> [**sauvegarde_simple** *format_file*]
> [**reprise** *format_file*]
> [**resume_last_time** *format_file*]

}
where

- **navier_stokes_standard** *navier_stokes_standard* (5.23): NAVIER STOKES equations.
- **convection_diffusion_concentration** *convection_diffusion_concentration* (5.11): Constituent transportation equations (concentration diffusion convection).
- **convection_diffusion_temperature** *convection_diffusion_temperature* (5.15): Energy equations (temperature diffusion convection).
- **equations_scalaires_passifs** *listeqn* (4.10) for inheritance: Passive scalar equations. The unknowns of the passive scalar equation number N are named temperatureN or concentrationN or fraction_massiqueN. This keyword is used to define initial conditions and the post processing fields. This kind of problem is very useful to test in only one data file (and then only one calculation) different schemes or different boundary conditions for the scalar transport equation.
- **Post_processing|postraitement** *corps_postraitement* (4.2) for inheritance: One post-processing (without name).
- **Post_processings|postraitements** *post_processings* (4.3) for inheritance: List of Postraitement objects (with name).
- **liste_de_postraitements** *liste_post_ok* (4.4) for inheritance: This
- **liste_postraitements** *liste_post* (4.5) for inheritance: This block defines the output files to be written during the computation. The output format is lata in order to use OpenDX to draw the results. This block can be divided in one or several sub-blocks that can be written at different frequencies and in different directories. Attention. The directory lata used in this example should be created before running the computation or the lata files will be lost.
- **sauvegarde** *format_file* (4.6) for inheritance: Keyword used when calculation results are to be backed up. When a coupling is performed, the backup-recovery file name must be well specified for each problem. In this case, you must save to different files and correctly specify these files when restarting the calculation.
- **sauvegarde_simple** *format_file* (4.6) for inheritance: The same keyword than Sauvegarde except, the last time step only is saved.
- **reprise** *format_file* (4.6) for inheritance: Keyword to restart a calculation based on the name_file file (see the class format_file). If format_reprise is xyz, the name_file file should be the .xyz file

created by the previous calculation. With this file, it is possible to restart a parallel calculation on P processors, whereas the previous calculation has been run on N (N<>P) processors. Should the calculation be restarted, values for the tinit (see schema_temps_base) time fields are taken from the name_file file. If there is no backup corresponding to this time in the name_file, TRUST exits in error.

- **resume_last_time** *format_file* (4.6) for inheritance: Keyword to restart a calculation based on the name_file file, restart the calculation at the last time found in the file (tinit is set to last time of saved files).

4.22 pb_thermohydraulique_concentration_turbulent

Description: Resolution of NAVIER STOKES/energy/multiple constituent transportation equations, with turbulence modelling.

Keyword Discretiser should have already be used to read the object.
See also: Pb_base (4.1)

Usage:
pb_thermohydraulique_concentration_turbulent obj Lire obj {

[**navier_stokes_turbulent** *navier_stokes_turbulent*]
[**convection_diffusion_concentration_turbulent** *convection_diffusion_concentration_turbulent*]
[**convection_diffusion_temperature_turbulent** *convection_diffusion_temperature_turbulent*]
[**Post_processing|postraitement** *corps_postraitement*]
[**Post_processings|postraitements** *post_processings*]
[**liste_de_postraitements** *liste_post_ok*]
[**liste_postraitements** *liste_post*]
[**sauvegarde** *format_file*]
[**sauvegarde_simple** *format_file*]
[**reprise** *format_file*]
[**resume_last_time** *format_file*]

}
where

- **navier_stokes_turbulent** *navier_stokes_turbulent* (5.24): NAVIER STOKES equations as well as the associated turbulence model equations.
- **convection_diffusion_concentration_turbulent** *convection_diffusion_concentration_turbulent* (5.12): Constituent transportation equations (concentration diffusion convection) as well as the associated turbulence model equations.
- **convection_diffusion_temperature_turbulent** *convection_diffusion_temperature_turbulent* (5.17): Energy equation (temperature diffusion convection) as well as the associated turbulence model equations.
- **Post_processing|postraitement** *corps_postraitement* (4.2) for inheritance: One post-processing (without name).
- **Post_processings|postraitements** *post_processings* (4.3) for inheritance: List of Postraitement objects (with name).
- **liste_de_postraitements** *liste_post_ok* (4.4) for inheritance: This
- **liste_postraitements** *liste_post* (4.5) for inheritance: This block defines the output files to be written during the computation. The output format is lata in order to use OpenDX to draw the results. This block can be divided in one or several sub-blocks that can be written at different frequencies and in different directories. Attention. The directory lata used in this example should be created before running the computation or the lata files will be lost.

- **sauvegarde** *format_file* (4.6) for inheritance: Keyword used when calculation results are to be backed up. When a coupling is performed, the backup-recovery file name must be well specified for each problem. In this case, you must save to different files and correctly specify these files when restarting the calculation.
- **sauvegarde_simple** *format_file* (4.6) for inheritance: The same keyword than Sauvegarde except, the last time step only is saved.
- **reprise** *format_file* (4.6) for inheritance: Keyword to restart a calculation based on the name_file file (see the class format_file). If format_reprise is xyz, the name_file file should be the .xyz file created by the previous calculation. With this file, it is possible to restart a parallel calculation on P processors, whereas the previous calculation has been run on N (N<>P) processors. Should the calculation be restarted, values for the tinit (see schema_temps_base) time fields are taken from the name_file file. If there is no backup corresponding to this time in the name_file, TRUST exits in error.
- **resume_last_time** *format_file* (4.6) for inheritance: Keyword to restart a calculation based on the name_file file, restart the calculation at the last time found in the file (tinit is set to last time of saved files).

4.23 pb_thermohydraulique_concentration_turbulent_scalaires_passifs

Description: Resolution of NAVIER STOKES/energy/multiple constituent transportation equations, with turbulence modelling and with the additional passive scalar equations.

Keyword Discretiser should have already be used to read the object.
See also: pb_avec_passif (4.9)

Usage:
pb_thermohydraulique_concentration_turbulent_scalaires_passifs obj Lire obj {

[**navier_stokes_turbulent** *navier_stokes_turbulent*]
[**convection_diffusion_concentration_turbulent** *convection_diffusion_concentration_turbulent*]
[**convection_diffusion_temperature_turbulent** *convection_diffusion_temperature_turbulent*]
equations_scalaires_passifs *listeqn*
[**Post_processing|postraitement** *corps_postraitement*]
[**Post_processings|postraitements** *post_processings*]
[**liste_de_postraitements** *liste_post_ok*]
[**liste_postraitements** *liste_post*]
[**sauvegarde** *format_file*]
[**sauvegarde_simple** *format_file*]
[**reprise** *format_file*]
[**resume_last_time** *format_file*]

}
where

- **navier_stokes_turbulent** *navier_stokes_turbulent* (5.24): NAVIER STOKES equations as well as the associated turbulence model equations.
- **convection_diffusion_concentration_turbulent** *convection_diffusion_concentration_turbulent* (5.12): Constituent transportation equations (concentration diffusion convection) as well as the associated turbulence model equations.
- **convection_diffusion_temperature_turbulent** *convection_diffusion_temperature_turbulent* (5.17): Energy equations (temperature diffusion convection) as well as the associated turbulence model equations.
- **equations_scalaires_passifs** *listeqn* (4.10) for inheritance: Passive scalar equations. The unknowns of the passive scalar equation number N are named temperatureN or concentrationN or fraction-_massiqueN. This keyword is used to define initial conditions and the post processing fields. This

kind of problem is very useful to test in only one data file (and then only one calculation) different schemes or different boundary conditions for the scalar transport equation.

- **Post_processing|postraitement** *corps_postraitement* (4.2) for inheritance: One post-processing (without name).
- **Post_processings|postraitements** *post_processings* (4.3) for inheritance: List of Postraitement objects (with name).
- **liste_de_postraitements** *liste_post_ok* (4.4) for inheritance: This
- **liste_postraitements** *liste_post* (4.5) for inheritance: This block defines the output files to be written during the computation. The output format is lata in order to use OpenDX to draw the results. This block can be divided in one or several sub-blocks that can be written at different frequencies and in different directories. Attention. The directory lata used in this example should be created before running the computation or the lata files will be lost.
- **sauvegarde** *format_file* (4.6) for inheritance: Keyword used when calculation results are to be backed up. When a coupling is performed, the backup-recovery file name must be well specified for each problem. In this case, you must save to different files and correctly specify these files when restarting the calculation.
- **sauvegarde_simple** *format_file* (4.6) for inheritance: The same keyword than Sauvegarde except, the last time step only is saved.
- **reprise** *format_file* (4.6) for inheritance: Keyword to restart a calculation based on the name_file file (see the class format_file). If format_reprise is xyz, the name_file file should be the .xyz file created by the previous calculation. With this file, it is possible to restart a parallel calculation on P processors, whereas the previous calculation has been run on N (N<>P) processors. Should the calculation be restarted, values for the tinit (see schema_temps_base) time fields are taken from the name_file file. If there is no backup corresponding to this time in the name_file, TRUST exits in error.
- **resume_last_time** *format_file* (4.6) for inheritance: Keyword to restart a calculation based on the name_file file, restart the calculation at the last time found in the file (tinit is set to last time of saved files).

4.24 pb_thermohydraulique_qc

Description: Resolution of thermohydraulic problem under smal Mach number.
Keywords for the unknowns other than pressure, velocity, temperature are :
masse_volumique : density
enthalpie : enthalpy
pression : reduced pressure
pression_tot : total pressure.

Keyword Discretiser should have already be used to read the object.
See also: Pb_base (4.1)

Usage:
pb_thermohydraulique_qc obj Lire obj {

navier_stokes_qc *navier_stokes_qc*
convection_diffusion_chaleur_qc *convection_diffusion_chaleur_qc*
[**Post_processing|postraitement** *corps_postraitement*]
[**Post_processings|postraitements** *post_processings*]
[**liste_de_postraitements** *liste_post_ok*]
[**liste_postraitements** *liste_post*]
[**sauvegarde** *format_file*]
[**sauvegarde_simple** *format_file*]
[**reprise** *format_file*]

[**resume_last_time** *format_file*]

}
where

- **navier_stokes_qc** *navier_stokes_qc* (5.19): NAVIER STOKES equations under smal Mach number.

- **convection_diffusion_chaleur_qc** *convection_diffusion_chaleur_qc* (5.8): Energy equation under smal Mach number.
- **Post_processing|postraitement** *corps_postraitement* (4.2) for inheritance: One post-processing (without name).
- **Post_processings|postraitements** *post_processings* (4.3) for inheritance: List of Postraitement objects (with name).
- **liste_de_postraitements** *liste_post_ok* (4.4) for inheritance: This
- **liste_postraitements** *liste_post* (4.5) for inheritance: This block defines the output files to be written during the computation. The output format is lata in order to use OpenDX to draw the results. This block can be divided in one or several sub-blocks that can be written at different frequencies and in different directories. Attention. The directory lata used in this example should be created before running the computation or the lata files will be lost.
- **sauvegarde** *format_file* (4.6) for inheritance: Keyword used when calculation results are to be backed up. When a coupling is performed, the backup-recovery file name must be well specified for each problem. In this case, you must save to different files and correctly specify these files when restarting the calculation.
- **sauvegarde_simple** *format_file* (4.6) for inheritance: The same keyword than Sauvegarde except, the last time step only is saved.
- **reprise** *format_file* (4.6) for inheritance: Keyword to restart a calculation based on the name_file file (see the class format_file). If format_reprise is xyz, the name_file file should be the .xyz file created by the previous calculation. With this file, it is possible to restart a parallel calculation on P processors, whereas the previous calculation has been run on N (N<>P) processors. Should the calculation be restarted, values for the tinit (see schema_temps_base) time fields are taken from the name_file file. If there is no backup corresponding to this time in the name_file, TRUST exits in error.
- **resume_last_time** *format_file* (4.6) for inheritance: Keyword to restart a calculation based on the name_file file, restart the calculation at the last time found in the file (tinit is set to last time of saved files).

4.25 pb_thermohydraulique_qc_fraction_massique

Description: Resolution of thermohydraulic problem under smal Mach number with passive scalar equations.

Keyword Discretiser should have already be used to read the object.
See also: pb_avec_passif (4.9)

Usage:
pb_thermohydraulique_qc_fraction_massique obj Lire obj {

navier_stokes_qc *navier_stokes_qc*
convection_diffusion_chaleur_qc *convection_diffusion_chaleur_qc*
equations_scalaires_passifs *listeqn*
[**Post_processing|postraitement** *corps_postraitement*]
[**Post_processings|postraitements** *post_processings*]
[**liste_de_postraitements** *liste_post_ok*]
[**liste_postraitements** *liste_post*]

[**sauvegarde** *format_file*]
[**sauvegarde_simple** *format_file*]
[**reprise** *format_file*]
[**resume_last_time** *format_file*]

}
where

- **navier_stokes_qc** *navier_stokes_qc* (5.19): NAVIER STOKES equations under smal Mach number.

- **convection_diffusion_chaleur_qc** *convection_diffusion_chaleur_qc* (5.8): Energy equation under smal Mach number.
- **equations_scalaires_passifs** *listeqn* (4.10) for inheritance: Passive scalar equations. The unknowns of the passive scalar equation number N are named temperatureN or concentrationN or fraction-_massiqueN. This keyword is used to define initial conditions and the post processing fields. This kind of problem is very useful to test in only one data file (and then only one calculation) different schemes or different boundary conditions for the scalar transport equation.
- **Post_processing|postraitement** *corps_postraitement* (4.2) for inheritance: One post-processing (without name).
- **Post_processings|postraitements** *post_processings* (4.3) for inheritance: List of Postraitement objects (with name).
- **liste_de_postraitements** *liste_post_ok* (4.4) for inheritance: This
- **liste_postraitements** *liste_post* (4.5) for inheritance: This block defines the output files to be written during the computation. The output format is lata in order to use OpenDX to draw the results. This block can be divided in one or several sub-blocks that can be written at different frequencies and in different directories. Attention. The directory lata used in this example should be created before running the computation or the lata files will be lost.
- **sauvegarde** *format_file* (4.6) for inheritance: Keyword used when calculation results are to be backed up. When a coupling is performed, the backup-recovery file name must be well specified for each problem. In this case, you must save to different files and correctly specify these files when restarting the calculation.
- **sauvegarde_simple** *format_file* (4.6) for inheritance: The same keyword than Sauvegarde except, the last time step only is saved.
- **reprise** *format_file* (4.6) for inheritance: Keyword to restart a calculation based on the name_file file (see the class format_file). If format_reprise is xyz, the name_file file should be the .xyz file created by the previous calculation. With this file, it is possible to restart a parallel calculation on P processors, whereas the previous calculation has been run on N (N<>P) processors. Should the calculation be restarted, values for the tinit (see schema_temps_base) time fields are taken from the name_file file. If there is no backup corresponding to this time in the name_file, TRUST exits in error.
- **resume_last_time** *format_file* (4.6) for inheritance: Keyword to restart a calculation based on the name_file file, restart the calculation at the last time found in the file (tinit is set to last time of saved files).

4.26 pb_thermohydraulique_scalaires_passifs

Description: Resolution of thermohydraulic problem, with the additional passive scalar equations.

Keyword Discretiser should have already be used to read the object.
See also: pb_avec_passif (4.9)

Usage:
pb_thermohydraulique_scalaires_passifs obj Lire obj {

[**navier_stokes_standard** *navier_stokes_standard*]
[**convection_diffusion_temperature** *convection_diffusion_temperature*]
equations_scalaires_passifs *listeqn*
[**Post_processing|postraitement** *corps_postraitement*]
[**Post_processings|postraitements** *post_processings*]
[**liste_de_postraitements** *liste_post_ok*]
[**liste_postraitements** *liste_post*]
[**sauvegarde** *format_file*]
[**sauvegarde_simple** *format_file*]
[**reprise** *format_file*]
[**resume_last_time** *format_file*]

}
where

- **navier_stokes_standard** *navier_stokes_standard* (5.23): NAVIER STOKES equations.
- **convection_diffusion_temperature** *convection_diffusion_temperature* (5.15): Energy equations (temperature diffusion convection).
- **equations_scalaires_passifs** *listeqn* (4.10) for inheritance: Passive scalar equations. The unknowns of the passive scalar equation number N are named temperatureN or concentrationN or fraction_massiqueN. This keyword is used to define initial conditions and the post processing fields. This kind of problem is very useful to test in only one data file (and then only one calculation) different schemes or different boundary conditions for the scalar transport equation.
- **Post_processing|postraitement** *corps_postraitement* (4.2) for inheritance: One post-processing (without name).
- **Post_processings|postraitements** *post_processings* (4.3) for inheritance: List of Postraitement objects (with name).
- **liste_de_postraitements** *liste_post_ok* (4.4) for inheritance: This
- **liste_postraitements** *liste_post* (4.5) for inheritance: This block defines the output files to be written during the computation. The output format is lata in order to use OpenDX to draw the results. This block can be divided in one or several sub-blocks that can be written at different frequencies and in different directories. Attention. The directory lata used in this example should be created before running the computation or the lata files will be lost.
- **sauvegarde** *format_file* (4.6) for inheritance: Keyword used when calculation results are to be backed up. When a coupling is performed, the backup-recovery file name must be well specified for each problem. In this case, you must save to different files and correctly specify these files when restarting the calculation.
- **sauvegarde_simple** *format_file* (4.6) for inheritance: The same keyword than Sauvegarde except, the last time step only is saved.
- **reprise** *format_file* (4.6) for inheritance: Keyword to restart a calculation based on the name_file file (see the class format_file). If format_reprise is xyz, the name_file file should be the .xyz file created by the previous calculation. With this file, it is possible to restart a parallel calculation on P processors, whereas the previous calculation has been run on N (N<>P) processors. Should the calculation be restarted, values for the tinit (see schema_temps_base) time fields are taken from the name_file file. If there is no backup corresponding to this time in the name_file, TRUST exits in error.
- **resume_last_time** *format_file* (4.6) for inheritance: Keyword to restart a calculation based on the name_file file, restart the calculation at the last time found in the file (tinit is set to last time of saved files).

4.27 pb_thermohydraulique_turbulent

Description: Resolution of thermohydraulic problem, with turbulence modelling.

Keyword Discretiser should have already be used to read the object.
See also: Pb_base (4.1)

Usage:
pb_thermohydraulique_turbulent obj Lire obj {

navier_stokes_turbulent *navier_stokes_turbulent*
convection_diffusion_temperature_turbulent *convection_diffusion_temperature_turbulent*
[**Post_processing|postraitement** *corps_postraitement*]
[**Post_processings|postraitements** *post_processings*]
[**liste_de_postraitements** *liste_post_ok*]
[**liste_postraitements** *liste_post*]
[**sauvegarde** *format_file*]
[**sauvegarde_simple** *format_file*]
[**reprise** *format_file*]
[**resume_last_time** *format_file*]

}
where

- **navier_stokes_turbulent** *navier_stokes_turbulent* (5.24): NAVIER STOKES equations as well as the associated turbulence model equations.
- **convection_diffusion_temperature_turbulent** *convection_diffusion_temperature_turbulent* (5.17): Energy equation (temperature diffusion convection) as well as the associated turbulence model equations.
- **Post_processing|postraitement** *corps_postraitement* (4.2) for inheritance: One post-processing (without name).
- **Post_processings|postraitements** *post_processings* (4.3) for inheritance: List of Postraitement objects (with name).
- **liste_de_postraitements** *liste_post_ok* (4.4) for inheritance: This
- **liste_postraitements** *liste_post* (4.5) for inheritance: This block defines the output files to be written during the computation. The output format is lata in order to use OpenDX to draw the results. This block can be divided in one or several sub-blocks that can be written at different frequencies and in different directories. Attention. The directory lata used in this example should be created before running the computation or the lata files will be lost.
- **sauvegarde** *format_file* (4.6) for inheritance: Keyword used when calculation results are to be backed up. When a coupling is performed, the backup-recovery file name must be well specified for each problem. In this case, you must save to different files and correctly specify these files when restarting the calculation.
- **sauvegarde_simple** *format_file* (4.6) for inheritance: The same keyword than Sauvegarde except, the last time step only is saved.
- **reprise** *format_file* (4.6) for inheritance: Keyword to restart a calculation based on the name_file file (see the class format_file). If format_reprise is xyz, the name_file file should be the .xyz file created by the previous calculation. With this file, it is possible to restart a parallel calculation on P processors, whereas the previous calculation has been run on N (N<>P) processors. Should the calculation be restarted, values for the tinit (see schema_temps_base) time fields are taken from the name_file file. If there is no backup corresponding to this time in the name_file, TRUST exits in error.
- **resume_last_time** *format_file* (4.6) for inheritance: Keyword to restart a calculation based on the name_file file, restart the calculation at the last time found in the file (tinit is set to last time of saved files).

4.28 pb_thermohydraulique_turbulent_qc

Description: Resolution of turbulent thermohydraulic problem under smal Mach number.
Warning : Available for VDF and VEF P0/P1NC discretization only.

Keyword Discretiser should have already be used to read the object.
See also: Pb_base (4.1)

Usage:
pb_thermohydraulique_turbulent_qc obj Lire obj {

> **navier_stokes_turbulent_qc** *navier_stokes_turbulent_qc*
> **convection_diffusion_chaleur_turbulent_qc** *convection_diffusion_chaleur_turbulent_qc*
> [**Post_processing|postraitement** *corps_postraitement*]
> [**Post_processings|postraitements** *post_processings*]
> [**liste_de_postraitements** *liste_post_ok*]
> [**liste_postraitements** *liste_post*]
> [**sauvegarde** *format_file*]
> [**sauvegarde_simple** *format_file*]
> [**reprise** *format_file*]
> [**resume_last_time** *format_file*]

}
where

- **navier_stokes_turbulent_qc** *navier_stokes_turbulent_qc* (5.26): NAVIER STOKES equations under smal Mach number as well as the associated turbulence model equations.
- **convection_diffusion_chaleur_turbulent_qc** *convection_diffusion_chaleur_turbulent_qc* (5.10): Energy equation under smal Mach number as well as the associated turbulence model equations.
- **Post_processing|postraitement** *corps_postraitement* (4.2) for inheritance: One post-processing (without name).
- **Post_processings|postraitements** *post_processings* (4.3) for inheritance: List of Postraitement objects (with name).
- **liste_de_postraitements** *liste_post_ok* (4.4) for inheritance: This
- **liste_postraitements** *liste_post* (4.5) for inheritance: This block defines the output files to be written during the computation. The output format is lata in order to use OpenDX to draw the results. This block can be divided in one or several sub-blocks that can be written at different frequencies and in different directories. Attention. The directory lata used in this example should be created before running the computation or the lata files will be lost.
- **sauvegarde** *format_file* (4.6) for inheritance: Keyword used when calculation results are to be backed up. When a coupling is performed, the backup-recovery file name must be well specified for each problem. In this case, you must save to different files and correctly specify these files when restarting the calculation.
- **sauvegarde_simple** *format_file* (4.6) for inheritance: The same keyword than Sauvegarde except, the last time step only is saved.
- **reprise** *format_file* (4.6) for inheritance: Keyword to restart a calculation based on the name_file file (see the class format_file). If format_reprise is xyz, the name_file file should be the .xyz file created by the previous calculation. With this file, it is possible to restart a parallel calculation on P processors, whereas the previous calculation has been run on N (N<>P) processors. Should the calculation be restarted, values for the tinit (see schema_temps_base) time fields are taken from the name_file file. If there is no backup corresponding to this time in the name_file, TRUST exits in error.
- **resume_last_time** *format_file* (4.6) for inheritance: Keyword to restart a calculation based on the name_file file, restart the calculation at the last time found in the file (tinit is set to last time of saved files).

4.29 pb_thermohydraulique_turbulent_qc_fraction_massique

Description: Resolution of turbulent thermohydraulic problem under smal Mach number with passive scalar equations.

Keyword Discretiser should have already be used to read the object.
See also: pb_avec_passif (4.9)

Usage:
pb_thermohydraulique_turbulent_qc_fraction_massique obj Lire obj {

> **navier_stokes_turbulent_qc** *navier_stokes_turbulent_qc*
> **convection_diffusion_chaleur_turbulent_qc** *convection_diffusion_chaleur_turbulent_qc*
> **equations_scalaires_passifs** *listeqn*
> [**Post_processing|postraitement** *corps_postraitement*]
> [**Post_processings|postraitements** *post_processings*]
> [**liste_de_postraitements** *liste_post_ok*]
> [**liste_postraitements** *liste_post*]
> [**sauvegarde** *format_file*]
> [**sauvegarde_simple** *format_file*]
> [**reprise** *format_file*]
> [**resume_last_time** *format_file*]

}
where

- **navier_stokes_turbulent_qc** *navier_stokes_turbulent_qc* (5.26): NAVIER STOKES equations under smal Mach number as well as the associated turbulence model equations.
- **convection_diffusion_chaleur_turbulent_qc** *convection_diffusion_chaleur_turbulent_qc* (5.10): Energy equation under smal Mach number as well as the associated turbulence model equations.
- **equations_scalaires_passifs** *listeqn* (4.10) for inheritance: Passive scalar equations. The unknowns of the passive scalar equation number N are named temperatureN or concentrationN or fraction_massiqueN. This keyword is used to define initial conditions and the post processing fields. This kind of problem is very useful to test in only one data file (and then only one calculation) different schemes or different boundary conditions for the scalar transport equation.
- **Post_processing|postraitement** *corps_postraitement* (4.2) for inheritance: One post-processing (without name).
- **Post_processings|postraitements** *post_processings* (4.3) for inheritance: List of Postraitement objects (with name).
- **liste_de_postraitements** *liste_post_ok* (4.4) for inheritance: This
- **liste_postraitements** *liste_post* (4.5) for inheritance: This block defines the output files to be written during the computation. The output format is lata in order to use OpenDX to draw the results. This block can be divided in one or several sub-blocks that can be written at different frequencies and in different directories. Attention. The directory lata used in this example should be created before running the computation or the lata files will be lost.
- **sauvegarde** *format_file* (4.6) for inheritance: Keyword used when calculation results are to be backed up. When a coupling is performed, the backup-recovery file name must be well specified for each problem. In this case, you must save to different files and correctly specify these files when restarting the calculation.
- **sauvegarde_simple** *format_file* (4.6) for inheritance: The same keyword than Sauvegarde except, the last time step only is saved.
- **reprise** *format_file* (4.6) for inheritance: Keyword to restart a calculation based on the name_file file (see the class format_file). If format_reprise is xyz, the name_file file should be the .xyz file created by the previous calculation. With this file, it is possible to restart a parallel calculation on

P processors, whereas the previous calculation has been run on N (N<>P) processors. Should the calculation be restarted, values for the tinit (see schema_temps_base) time fields are taken from the name_file file. If there is no backup corresponding to this time in the name_file, TRUST exits in error.

- **resume_last_time** *format_file* (4.6) for inheritance: Keyword to restart a calculation based on the name_file file, restart the calculation at the last time found in the file (tinit is set to last time of saved files).

4.30 pb_thermohydraulique_turbulent_scalaires_passifs

Description: Resolution of thermohydraulic problem, with turbulence modelling and with the additional passive scalar equations.

Keyword Discretiser should have already be used to read the object.
See also: pb_avec_passif (4.9)

Usage:
pb_thermohydraulique_turbulent_scalaires_passifs obj Lire obj {

[**navier_stokes_turbulent** *navier_stokes_turbulent*]
[**convection_diffusion_temperature_turbulent** *convection_diffusion_temperature_turbulent*]
equations_scalaires_passifs *listeqn*
[**Post_processing|postraitement** *corps_postraitement*]
[**Post_processings|postraitements** *post_processings*]
[**liste_de_postraitements** *liste_post_ok*]
[**liste_postraitements** *liste_post*]
[**sauvegarde** *format_file*]
[**sauvegarde_simple** *format_file*]
[**reprise** *format_file*]
[**resume_last_time** *format_file*]

}
where

- **navier_stokes_turbulent** *navier_stokes_turbulent* (5.24): NAVIER STOKES equations as well as the associated turbulence model equations.
- **convection_diffusion_temperature_turbulent** *convection_diffusion_temperature_turbulent* (5.17): Energy equations (temperature diffusion convection) as well as the associated turbulence model equations.
- **equations_scalaires_passifs** *listeqn* (4.10) for inheritance: Passive scalar equations. The unknowns of the passive scalar equation number N are named temperatureN or concentrationN or fraction_massiqueN. This keyword is used to define initial conditions and the post processing fields. This kind of problem is very useful to test in only one data file (and then only one calculation) different schemes or different boundary conditions for the scalar transport equation.
- **Post_processing|postraitement** *corps_postraitement* (4.2) for inheritance: One post-processing (without name).
- **Post_processings|postraitements** *post_processings* (4.3) for inheritance: List of Postraitement objects (with name).
- **liste_de_postraitements** *liste_post_ok* (4.4) for inheritance: This
- **liste_postraitements** *liste_post* (4.5) for inheritance: This block defines the output files to be written during the computation. The output format is lata in order to use OpenDX to draw the results. This block can be divided in one or several sub-blocks that can be written at different frequencies and in different directories. Attention. The directory lata used in this example should be created before running the computation or the lata files will be lost.

- **sauvegarde** *format_file* (4.6) for inheritance: Keyword used when calculation results are to be backed up. When a coupling is performed, the backup-recovery file name must be well specified for each problem. In this case, you must save to different files and correctly specify these files when restarting the calculation.
- **sauvegarde_simple** *format_file* (4.6) for inheritance: The same keyword than Sauvegarde except, the last time step only is saved.
- **reprise** *format_file* (4.6) for inheritance: Keyword to restart a calculation based on the name_file file (see the class format_file). If format_reprise is xyz, the name_file file should be the .xyz file created by the previous calculation. With this file, it is possible to restart a parallel calculation on P processors, whereas the previous calculation has been run on N (N<>P) processors. Should the calculation be restarted, values for the tinit (see schema_temps_base) time fields are taken from the name_file file. If there is no backup corresponding to this time in the name_file, TRUST exits in error.
- **resume_last_time** *format_file* (4.6) for inheritance: Keyword to restart a calculation based on the name_file file, restart the calculation at the last time found in the file (tinit is set to last time of saved files).

4.31 pbc_med

Description: Permet de relire des fichiers meds et de les postraiter.

See also: pb_gen_base (4)

Usage:
pbc_med list_info_med
where

- **list_info_med** *list_info_med* (4.32)

4.32 list_info_med

Description: not_set

See also: listobj (31.3)

Usage:
{ object1 , object2 .... }
list of *info_med* (4.32.1) separeted with ,

4.32.1 info_med

Description: not_set

See also: objet_lecture (32)

Usage:
file_med domaine pb_post
where

- **file_med** *str*: Name of file med.
- **domaine** *str*: Name of domain.
- **pb_post** *pb_post* (4.18)

4.33 problem_read_generic

Description: The probleme_read_generic differs rom the rest of the TRUST code : The problem does not state the number of equations that are enclosed in the problem. As the list of equations to be solved in the generic read problem is declared in the data file and not pre-defined in the structure of the problem, each equation has to be distinctively associated with the problem with the Associer keyword.

Keyword Discretiser should have already be used to read the object.
See also: Pb_base (4.1)

Usage:
problem_read_generic obj Lire obj {

[**Post_processing|postraitement** *corps_postraitement*]
[**Post_processings|postraitements** *post_processings*]
[**liste_de_postraitements** *liste_post_ok*]
[**liste_postraitements** *liste_post*]
[**sauvegarde** *format_file*]
[**sauvegarde_simple** *format_file*]
[**reprise** *format_file*]
[**resume_last_time** *format_file*]

}
where

- **Post_processing|postraitement** *corps_postraitement* (4.2) for inheritance: One post-processing (without name).
- **Post_processings|postraitements** *post_processings* (4.3) for inheritance: List of Postraitement objects (with name).
- **liste_de_postraitements** *liste_post_ok* (4.4) for inheritance: This
- **liste_postraitements** *liste_post* (4.5) for inheritance: This block defines the output files to be written during the computation. The output format is lata in order to use OpenDX to draw the results. This block can be divided in one or several sub-blocks that can be written at different frequencies and in different directories. Attention. The directory lata used in this example should be created before running the computation or the lata files will be lost.
- **sauvegarde** *format_file* (4.6) for inheritance: Keyword used when calculation results are to be backed up. When a coupling is performed, the backup-recovery file name must be well specified for each problem. In this case, you must save to different files and correctly specify these files when restarting the calculation.
- **sauvegarde_simple** *format_file* (4.6) for inheritance: The same keyword than Sauvegarde except, the last time step only is saved.
- **reprise** *format_file* (4.6) for inheritance: Keyword to restart a calculation based on the name_file file (see the class format_file). If format_reprise is xyz, the name_file file should be the .xyz file created by the previous calculation. With this file, it is possible to restart a parallel calculation on P processors, whereas the previous calculation has been run on N (N<>P) processors. Should the calculation be restarted, values for the tinit (see schema_temps_base) time fields are taken from the name_file file. If there is no backup corresponding to this time in the name_file, TRUST exits in error.
- **resume_last_time** *format_file* (4.6) for inheritance: Keyword to restart a calculation based on the name_file file, restart the calculation at the last time found in the file (tinit is set to last time of saved files).

5 mor_eqn

Description: Class of equation pieces (morceaux d'equation).

See also: objet_u (33) eqn_base (5.18)

Usage:

5.1 conduction

Description: Heat equation.

Keyword Discretiser should have already be used to read the object.
See also: eqn_base (5.18)

Usage:
conduction obj Lire obj {

> [**diffusion** *bloc_diffusion*]
> [**initial_conditions|conditions_initiales** *condinits*]
> [**boundary_conditions|conditions_limites** *condlims*]
> [**sources** *sources*]
> [**ecrire_fichier_xyz_valeur** *ecrire_fichier_xyz_valeur_param*]
> [**ecrire_fichier_xyz_valeur_bin** *ecrire_fichier_xyz_valeur_param*]
> [**parametre_equation** *parametre_equation_base*]
> [**equation_non_resolue** *str*]

}
where

- **diffusion** *bloc_diffusion* (5.2) for inheritance: Keyword to specify the diffusion operator.
- **initial_conditions|conditions_initiales** *condinits* (5.3) for inheritance: Initial conditions.
- **boundary_conditions|conditions_limites** *condlims* (5.4) for inheritance: Boundary conditions.
- **sources** *sources* (5.5) for inheritance: To introduce a source term into an equation (in case of several source terms into the same equation, the blocks corresponding to the various terms need to be separated by a comma)
- **ecrire_fichier_xyz_valeur** *ecrire_fichier_xyz_valeur_param* (5.6) for inheritance: This keyword is used to write the values of a field for the whole domain or only for some boundaries in a text file with the following format: n_valeur
  x_1 y_1 [z_1] val_1
  ...
  x_n y_n [z_n] val_n
  The created files are named : pbname_fieldname_[boundaryname]_time.dat
- **ecrire_fichier_xyz_valeur_bin** *ecrire_fichier_xyz_valeur_param* (5.6) for inheritance: This keyword is used to write the values of a field for the whole domain or only for some boundaries in a binary file with the following format: n_valeur
  x_1 y_1 [z_1] val_1
  ...
  x_n y_n [z_n] val_n
  The created files are named : pbname_fieldname_[boundaryname]_time.dat
- **parametre_equation** *parametre_equation_base* (5.7) for inheritance: Keyword used to specify additional parameters for the equation
- **equation_non_resolue** *str* for inheritance: The equation will not be solved while condition(t) is verified if equation_non_resolue keyword is used. Exemple: The Navier Stokes is not solved between time t0 and t1.

Navier_Sokes_Standard
{ equation_non_resolue (t>t0)*(t<t1) }

5.2 bloc_diffusion

Description: not_set

See also: objet_lecture (32)

Usage:
aco [**operateur**] [**op_implicite**] **acof**
where

- **aco** *str into ['{']: Open accodance sign.*
- **operateur** *diffusion_deriv (5.2.1): if none is specified, the diffusive scheme used is an order 2 scheme.*
- **op_implicite** *op_implicite (5.2.9): To have diffusive implicitation, it use Uzawa algorithm. Very useful when viscosity has large variations.*
- **acof** *str into ['}']* : Closed accodance sign.

5.2.1 diffusion_deriv

Description: not_set

See also: objet_lecture (32) negligeable (5.2.2) p1b (5.2.3) p1ncp1b (5.2.4) stab (5.2.5) standard (5.2.6) option (5.2.8)

Usage:
diffusion_deriv

5.2.2 negligeable

Description: the diffusivity will not taken in count

See also: diffusion_deriv (5.2.1)

Usage:
negligeable

5.2.3 p1b

Description: not_set

See also: diffusion_deriv (5.2.1)

Usage:
p1b

5.2.4 p1ncp1b

Description: not_set

See also: diffusion_deriv (5.2.1)

Usage:

5.2.5 stab

Description: keyword allowing consistent and stable calculations even in case of obtuse angle meshes.

See also: diffusion_deriv (5.2.1)

Usage:
stab {

[**standard** *int*]
[**info** *int*]
[**new_jacobian** *int*]
[**nu** *int*]
[**nut** *int*]
[**nu_transp** *int*]
[**nut_transp** *int*]

}
where

- **standard** *int*: to recover the same results as calculations made by standard laminar diffusion operator. However, no stabilization technique is used and calculations may be unstable when working with obtuse angle meshes (by default 0)
- **info** *int*: developer option to get the stabilizing ratio (by default 0)
- **new_jacobian** *int*: when implicit time schemes are used, this option defines a new jacobian that may be more suitable to get stationary solutions (by default 0)
- **nu** *int*: (respectively nut 1) takes the molecular viscosity (resp. eddy viscosity) into account in the velocity gradient part of the diffusion expression (by default nu=1 and nut=1)
- **nut** *int*
- **nu_transp** *int*: (respectively nut_transp 1) takes the molecular viscosity (resp. eddy viscosity) into account in the transposed velocity gradient part of the diffusion expression (by default nu_transp=0 and nut_transp=1)
- **nut_transp** *int*

5.2.6 standard

Description: A new keyword, intended for LES calculations, has been developed to optimise and parameterise each term of the diffusion operator. Remark:

1. This class requires to define a filtering operator : see solveur_bar
2. The former (original) version: diffusion { } -which omitted some of the term of the diffusion operator- can be recovered by using the following parameters in the new class :
diffusion { standard grad_Ubar 0 nu 1 nut 1 nu_transp 0 nut_transp 1 filtrer_resu 0}.

See also: diffusion_deriv (5.2.1)

Usage:
standard [**mot1**] [**bloc_diffusion_standard**]
where

- **mot1** *str into ['defaut_bar']*: equivalent to grad_Ubar 1 nu 1 nut 1 nu_transp 1 nut_transp 1 filtrer_resu 1
- **bloc_diffusion_standard** *bloc_diffusion_standard* (5.2.7)

5.2.7 bloc_diffusion_standard

Description: grad_Ubar 1 makes the gradient calculated through the filtered values of velocity (P1-conform).
nu 1 (respectively nut 1) takes the molecular viscosity (eddy viscosity) into account in the velocity gradient part of the diffusion expression.
nu_transp 1 (respectively nut_transp 1) takes the molecular viscosity (eddy viscosity) into account according in the TRANSPOSED velocity gradient part of the diffusion expression.
filtrer_resu 1 allows to filter the resulting diffusive fluxes contribution.

See also: objet_lecture (32)

Usage:
mot1 val1 mot2 val2 mot3 val3 mot4 val4 mot5 val5 mot6 val6
where

- **mot1** *str into ['grad_Ubar', 'nu', 'nut', 'nu_transp', 'nut_transp', 'filtrer_resu']*
- **val1** *int into [0, 1]*
- **mot2** *str into ['grad_Ubar', 'nu', 'nut', 'nu_transp', 'nut_transp', 'filtrer_resu']*
- **val2** *int into [0, 1]*
- **mot3** *str into ['grad_Ubar', 'nu', 'nut', 'nu_transp', 'nut_transp', 'filtrer_resu']*
- **val3** *int into [0, 1]*
- **mot4** *str into ['grad_Ubar', 'nu', 'nut', 'nu_transp', 'nut_transp', 'filtrer_resu']*
- **val4** *int into [0, 1]*
- **mot5** *str into ['grad_Ubar', 'nu', 'nut', 'nu_transp', 'nut_transp', 'filtrer_resu']*
- **val5** *int into [0, 1]*
- **mot6** *str into ['grad_Ubar', 'nu', 'nut', 'nu_transp', 'nut_transp', 'filtrer_resu']*
- **val6** *int into [0, 1]*

5.2.8 option

Description: not_set

See also: diffusion_deriv (5.2.1)

Usage:
option bloc_lecture
where

- **bloc_lecture** *bloc_lecture* (3.39)

5.2.9 op_implicite

Description: not_set

See also: objet_lecture (32)

Usage:
implicite mot solveur
where

- **implicite** *str into ['implicite']*
- **mot** *str into ['solveur']*
- **solveur** *solveur_sys_base* (9.12)

5.3 condinits

Description: Initial conditions.

See also: objet_lecture (32)

Usage:
aco condinit acof
where

- **aco** *str into ['{']: Open accodance sign.*
- **condinit** *condinit (5.3.1): CI*
- **acof** *str into ['}']* : Closed accodance sign.

5.3.1 condinit

Description: Initial condition.

See also: objet_lecture (32)

Usage:
nom ch
where

- **nom** *str*: Name of initial condition field.
- **ch** *champ_base* (15.1): Type field and the initial values.

5.4 condlims

Description: Boundary conditions.

See also: listobj (31.3)

Usage:
{ object1 object2 .... }
list of *condlimlu* (5.4.1)

5.4.1 condlimlu

Description: Boundary condition specified.

See also: objet_lecture (32)

Usage:
bord cl
where

- **bord** *str*: Name of the edge where the boundary condition applies.
- **cl** *condlim_base* (11): Boundary condition at the boundary called bord (edge).

5.5 sources

Description: The sources.

See also: listobj (31.3)

Usage:
{ object1 , object2 .... }
list of *source_base* (27) separeted with ,

5.6 ecrire_fichier_xyz_valeur_param

Description: not_set

Keyword Discretiser should have already be used to read the object.
See also: listobj (31.3)

Usage:
n object1 , object2 ....
list of *ecrire_fichier_xyz_valeur_item* (5.6.1) separeted with ,

5.6.1 ecrire_fichier_xyz_valeur_item

Description: To write the values of a field for some boundaries in a text file.
The name of the files is pb_name_field_name_time.dat
Several Ecrire_fichier_xyz_valeur keywords may be written into an equation to write several fields. This kind of files may be read by Champ_don_lu or Champ_front_lu for example.

See also: objet_lecture (32)

Usage:
name dt_ecrire_fic [**bords**]
where

- **name** *str*: Name of the field to write (Champ_Inc, Champ_Fonc or a post_processed field).
- **dt_ecrire_fic** *float*: Time period for printing in the file.
- **bords** *bords_ecrire* (5.6.2): to post-process only on some boundaries

5.6.2 bords_ecrire

Description: not_set

See also: objet_lecture (32)

Usage:
chaine bords
where

- **chaine** *str into ['bords']*
- **bords** *n word1 word2 ... wordn*: Keyword to post-process only on some boundaries :
  bords nb_bords boundary1 ... boundaryn
  where
  nb_bords : number of boundaries
  boundary1 ... boundaryn : name of the boundaries.

5.7 parametre_equation_base

Description: Basic class for parametre_equation

See also: objet_lecture (32) parametre_diffusion_implicite (5.7.1) parametre_implicite (5.7.2)

Usage:

5.7.1 parametre_diffusion_implicite

Description: To specify additional parameters for the equation when using impliciting diffusion

See also: parametre_equation_base (5.7)

Usage:
parametre_diffusion_implicite {

> [**crank** *int into [0, 1]*]
> [**preconditionnement_diag** *int into [0, 1]*]
> [**niter_max_diffusion_implicite** *int*]
> [**seuil_diffusion_implicite** *float*]

}
where

- **crank** *int into [0, 1]*: Use (1) or not (0, default) a Crank Nicholson method for the diffusion implicitation algorithm. Setting crank to 1 increases the order of the algorithm from 1 to 2.
- **preconditionnement_diag** *int into [0, 1]*: The CG used to solve the implicitation of the equation diffusion operator is not preconditioned by default. If this option is set to 1, a diagonal preconditionning is used. Warning: this option is not necessarily more efficient, depending on the treated case.
- **niter_max_diffusion_implicite** *int*: Change the maximum number of iterations for the CG (Conjugate Gradient) algorithm when solving the diffusion implicitation of the equation.
- **seuil_diffusion_implicite** *float*: Change the threshold convergence value used by default for the CG resolution for the diffusion implicitation of this equation.

5.7.2 parametre_implicite

Description: Keyword to change for this equation only the parameter of the implicit scheme used to solve the problem.

See also: parametre_equation_base (5.7)

Usage:
parametre_implicite {

> [**seuil_convergence_implicite** *float*]
> [**seuil_convergence_solveur** *float*]
> [**solveur** *solveur_sys_base*]
> [**resolution_explicite**]
> [**equation_non_resolue**]
> [**equation_frequence_resolue** *str*]

}
where

- **seuil_convergence_implicite** *float*: Keyword to change for this equation only the value of seuil_convergence_implicite used in the implicit scheme.
- **seuil_convergence_solveur** *float*: Keyword to change for this equation only the value of seuil_convergence_solveur used in the implicit scheme
- **solveur** *solveur_sys_base* (9.12): Keyword to change for this equation only the solver used in the implicit scheme
- **resolution_explicite** : To solve explicitly the equation whereas the scheme is an implicit scheme.
- **equation_non_resolue** : Keyword to specify that the equation is not solved.
- **equation_frequence_resolue** *str*: Keyword to specify that the equation is solved only every n time steps (n is an integer or given by a time-dependent function f(t)).

5.8 convection_diffusion_chaleur_qc

Description: Energy equation under smal Mach number.

Keyword Discretiser should have already be used to read the object.
See also: eqn_base (5.18) convection_diffusion_chaleur_turbulent_qc (5.10)

Usage:
convection_diffusion_chaleur_qc obj Lire obj {

[**mode_calcul_convection** *str into ['ancien', 'divuT_moins_Tdivu', 'divrhouT_moins_Tdivrhou']*]
[**convection** *bloc_convection*]
[**diffusion** *bloc_diffusion*]
[**initial_conditions|conditions_initiales** *condinits*]
[**boundary_conditions|conditions_limites** *condlims*]
[**sources** *sources*]
[**ecrire_fichier_xyz_valeur** *ecrire_fichier_xyz_valeur_param*]
[**ecrire_fichier_xyz_valeur_bin** *ecrire_fichier_xyz_valeur_param*]
[**parametre_equation** *parametre_equation_base*]
[**equation_non_resolue** *str*]

}
where

- **mode_calcul_convection** *str into ['ancien', 'divuT_moins_Tdivu', 'divrhouT_moins_Tdivrhou']*: Option to set the form of the convective operator
divrhouT_moins_Tdivrhou (the default since 1.6.8): rho.u.gradT = div(rho.u.T)- Tdiv(rho.u.1)
ancien: u.gradT = div(u.T) - T.div(u)
divuT_moins_Tdivu : u.gradT = div(u.T) - Tdiv(u.1)
- **convection** *bloc_convection* (5.9) for inheritance: Keyword to alter the convection scheme.
- **diffusion** *bloc_diffusion* (5.2) for inheritance: Keyword to specify the diffusion operator.
- **initial_conditions|conditions_initiales** *condinits* (5.3) for inheritance: Initial conditions.
- **boundary_conditions|conditions_limites** *condlims* (5.4) for inheritance: Boundary conditions.
- **sources** *sources* (5.5) for inheritance: To introduce a source term into an equation (in case of several source terms into the same equation, the blocks corresponding to the various terms need to be separated by a comma)
- **ecrire_fichier_xyz_valeur** *ecrire_fichier_xyz_valeur_param* (5.6) for inheritance: This keyword is used to write the values of a field for the whole domain or only for some boundaries in a text file with the following format: n_valeur
x_1 y_1 [z_1] val_1
...
x_n y_n [z_n] val_n
The created files are named : pbname_fieldname_[boundaryname]_time.dat

- **ecrire_fichier_xyz_valeur_bin** *ecrire_fichier_xyz_valeur_param* (5.6) for inheritance: This keyword is used to write the values of a field for the whole domain or only for some boundaries in a binary file with the following format: n_valeur
x_1 y_1 [z_1] val_1
...
x_n y_n [z_n] val_n
The created files are named : pbname_fieldname_[boundaryname]_time.dat
- **parametre_equation** *parametre_equation_base* (5.7) for inheritance: Keyword used to specify additional parameters for the equation
- **equation_non_resolue** *str* for inheritance: The equation will not be solved while condition(t) is verified if equation_non_resolue keyword is used. Exemple: The Navier Stokes is not solved between time t0 and t1.
Navier_Sokes_Standard
{ equation_non_resolue (t>t0)*(t<t1) }

5.9 bloc_convection

Description: not_set

See also: objet_lecture (32)

Usage:
aco operateur acof
where

- **aco** *str into ['{']: Open accodance sign.*
- **operateur** *convection_deriv (5.9.1)*
- **acof** *str into ['}']* : Closed accodance sign.

5.9.1 convection_deriv

Description: not_set

See also: objet_lecture (32) amont (5.9.2) amont_old (5.9.3) centre (5.9.4) centre4 (5.9.5) centre_old (5.9.6) di_l2 (5.9.7) ef (5.9.8) muscl3 (5.9.10) ef_stab (5.9.11) generic (5.9.14) kquick (5.9.15) muscl (5.9.16) muscl_old (5.9.17) muscl_new (5.9.18) negligeable (5.9.19) quick (5.9.20) btd (5.9.21) supg (5.9.22)

Usage:
convection_deriv

5.9.2 amont

Description: Keyword for upwind scheme in VEF discretization equivalent to generic amont for TRUST version 1.5 or later. The previous upwind scheme can be used with the obsolete in future amont_old keyword.

See also: convection_deriv (5.9.1)

Usage:
amont

5.9.3 amont_old

Description: not_set

See also: convection_deriv (5.9.1)

Usage:
amont_old

5.9.4 centre

Description: not_set

See also: convection_deriv (5.9.1)

Usage:
centre

5.9.5 centre4

Description: not_set

See also: convection_deriv (5.9.1)

Usage:
centre4

5.9.6 centre_old

Description: not_set

See also: convection_deriv (5.9.1)

Usage:
centre_old

5.9.7 di_l2

Description: not_set

See also: convection_deriv (5.9.1)

Usage:
di_l2

5.9.8 ef

Description: For VEF calculations, a centred convective scheme based on Finite Elements formulation can be called through the following data:

Convection { EF transportant_bar val transporte_bar val antisym val filtrer_resu val }

This scheme is 2nd order accuracy (and get better the property of kinetic energy conservation). Due to possible problems of instabilities phenomena, this scheme has to be coupled with stabilisation process (see Source_Qdm_lambdaup).These two last data are equivalent from a theoretical point of view in variationnal writing to : div((u. grad ub , vb) - (u. grad vb, ub)), where vb corresponds to the filtered reference test functions.

Remark:
This class requires to define a filtering operator : see solveur_bar

See also: convection_deriv (5.9.1)

Usage:
ef [**mot1**] [**bloc_ef**]
where

- **mot1** *str into ['defaut_bar']*: equivalent to transportant_bar 0 transporte_bar 1 filtrer_resu 1 antisym 1
- **bloc_ef** *bloc_ef* (5.9.9)

5.9.9 bloc_ef

Description: not_set

See also: objet_lecture (32)

Usage:
mot1 val1 mot2 val2 mot3 val3 mot4 val4
where

- **mot1** *str into ['transportant_bar', 'transporte_bar', 'filtrer_resu', 'antisym']*
- **val1** *int into [0, 1]*
- **mot2** *str into ['transportant_bar', 'transporte_bar', 'filtrer_resu', 'antisym']*
- **val2** *int into [0, 1]*
- **mot3** *str into ['transportant_bar', 'transporte_bar', 'filtrer_resu', 'antisym']*
- **val3** *int into [0, 1]*
- **mot4** *str into ['transportant_bar', 'transporte_bar', 'filtrer_resu', 'antisym']*
- **val4** *int into [0, 1]*

5.9.10 muscl3

Description: Keyword for a scheme using a ponderation between muscl and center schemes in VEF.

See also: convection_deriv (5.9.1)

Usage:
muscl3 {

[**alpha** *float*]

}
where

- **alpha** *float*: To weight the scheme centering with the factor double (between 0 (full centered) and 1 (muscl), by default 1).

5.9.11 ef_stab

Description: Keyword for a VEF convective scheme.

See also: convection_deriv (5.9.1)

Usage:
ef_stab {

[**alpha** *float*]
[**test** *int*]
[**tdivu**]
[**old**]
[**volumes_etendus**]
[**volumes_non_etendus**]
[**amont_sous_zone** *str*]
[**alpha_sous_zone** *listsous_zone_valeur*]

}
where

- **alpha** *float*: To weight the scheme centering with the factor double (between 0 (full centered) and 1 (mix between upwind and centered), by default 1). For scalar equation, it is adviced to use alpha=1 and for the momentum equation, alpha=0.2 is adviced.
- **test** *int*: Developer option to compare old and new version of EF_stab
- **tdivu** : To have the convective operator calculated as div(TU)-TdivU(=UgradT).
- **old** : To use old version of EF_stab scheme (default no).
- **volumes_etendus** : Option for the scheme to use the extended volumes (default, yes).
- **volumes_non_etendus** : Option for the scheme to not use the extended volumes (default, no).
- **amont_sous_zone** *str*: Option to degenerate EF_stab scheme into Amont (upwind) scheme in the sub zone of name sz_name. The sub zone may be located arbitrarily in the domain but the more often this option will be activated in a zone where EF_stab scheme generates instabilities as for free outlet for example.
- **alpha_sous_zone** *listsous_zone_valeur* (5.9.12): Option to change locally the alpha value on N sub-zones named sub_zone_name_I. Generally, it is used to prevent from a local divergence by increasing locally the alpha parameter.

5.9.12 listsous_zone_valeur

Description: List of groups of two words.

See also: listobj (31.3)

Usage:
n object1 object2 ....
list of *sous_zone_valeur* (5.9.13)

5.9.13 sous_zone_valeur

Description: Two words.

See also: objet_lecture (32)

Usage:
sous_zone valeur
where

- **sous_zone** *str*: sous zone
- **valeur** *float*: value

5.9.14 generic

Description: Keyword for generic calling of upwind and muscl convective scheme in VEF discretization. For muscl scheme, limiters and order for fluxes calculations have to be specified. The available limiters are : minmod - vanleer -vanalbada - chakravarthy - superbee, and the order of accuracy is 1 or 2. Note that chakravarthy is a non-symmetric limiter and superbee may engender results out of physical limits. By consequence, these two limiters are not recommended.
Examples:
convection { generic amont }
convection { generic muscl minmod 1 }
convection { generic muscl vanleer 2 }

In case of results out of physical limits with muscl scheme (due for instance to strong non-conformal velocity flow field), user can redefine in data file a lower order and a smoother limiter, as : convection { generic muscl minmod 1 }

See also: convection_deriv (5.9.1)

Usage:
generic type [**limiteur**] [**ordre**] [**alpha**]
where

- **type** *str into ['amont', 'muscl', 'centre']*: type of scheme
- **limiteur** *str into ['minmod', 'vanleer', 'vanalbada', 'chakravarthy', 'superbee']*: type of limiter
- **ordre** *int into [1, 2, 3]*: order of accuracy
- **alpha** *float*: alpha

5.9.15 kquick

Description: not_set

See also: convection_deriv (5.9.1)

Usage:
kquick

5.9.16 muscl

Description: Keyword for muscl scheme in VEF discretization equivalent to generic muscl vanleer 2 for the 1.5 version or later. The previous muscl scheme can be used with the obsolete in future muscl_old keyword.

See also: convection_deriv (5.9.1)

Usage:
muscl

5.9.17 muscl_old

Description: not_set

See also: convection_deriv (5.9.1)

Usage:
muscl_old

5.9.18 muscl_new

Description: not_set

See also: convection_deriv (5.9.1)

Usage:
muscl_new

5.9.19 negligeable

Description: suppresses the convection operator.

See also: convection_deriv (5.9.1)

Usage:
negligeable

5.9.20 quick

Description: not_set

See also: convection_deriv (5.9.1)

Usage:
quick

5.9.21 btd

Description: not_set

See also: convection_deriv (5.9.1)

Usage:
btd {

btd *float*
facteur *float*

}
where

- **btd** *float*
- **facteur** *float*

5.9.22 supg

Description: not_set

See also: convection_deriv (5.9.1)

Usage:
supg {

facteur *float*

}
where

- **facteur** *float*

5.10 convection_diffusion_chaleur_turbulent_qc

Description: Energy equation under smal Mach number as well as the associated turbulence model equations.

Keyword Discretiser should have already be used to read the object.
See also: convection_diffusion_chaleur_qc (5.8)

Usage:
convection_diffusion_chaleur_turbulent_qc obj Lire obj {

[**modele_turbulence** *modele_turbulence_scal_base*]
[**mode_calcul_convection** *str into ['ancien', 'divuT_moins_Tdivu', 'divrhouT_moins_Tdivrhou']*]
[**convection** *bloc_convection*]
[**diffusion** *bloc_diffusion*]
[**initial_conditions|conditions_initiales** *condinits*]
[**boundary_conditions|conditions_limites** *condlims*]
[**sources** *sources*]
[**ecrire_fichier_xyz_valeur** *ecrire_fichier_xyz_valeur_param*]
[**ecrire_fichier_xyz_valeur_bin** *ecrire_fichier_xyz_valeur_param*]
[**parametre_equation** *parametre_equation_base*]
[**equation_non_resolue** *str*]

}
where

- **modele_turbulence** *modele_turbulence_scal_base* (21): Turbulence model for the energy equation.

- **mode_calcul_convection** *str into ['ancien', 'divuT_moins_Tdivu', 'divrhouT_moins_Tdivrhou']* for inheritance: Option to set the form of the convective operator
divrhouT_moins_Tdivrhou (the default since 1.6.8): rho.u.gradT = div(rho.u.T)- Tdiv(rho.u.1)
ancien: u.gradT = div(u.T) - T.div(u)
divuT_moins_Tdivu : u.gradT = div(u.T) - Tdiv(u.1)
- **convection** *bloc_convection* (5.9) for inheritance: Keyword to alter the convection scheme.
- **diffusion** *bloc_diffusion* (5.2) for inheritance: Keyword to specify the diffusion operator.
- **initial_conditions|conditions_initiales** *condinits* (5.3) for inheritance: Initial conditions.
- **boundary_conditions|conditions_limites** *condlims* (5.4) for inheritance: Boundary conditions.
- **sources** *sources* (5.5) for inheritance: To introduce a source term into an equation (in case of several source terms into the same equation, the blocks corresponding to the various terms need to be separated by a comma)

- **ecrire_fichier_xyz_valeur** *ecrire_fichier_xyz_valeur_param* (5.6) for inheritance: This keyword is used to write the values of a field for the whole domain or only for some boundaries in a text file with the following format: n_valeur
x_1 y_1 [z_1] val_1
...
x_n y_n [z_n] val_n
The created files are named : pbname_fieldname_[boundaryname]_time.dat
- **ecrire_fichier_xyz_valeur_bin** *ecrire_fichier_xyz_valeur_param* (5.6) for inheritance: This keyword is used to write the values of a field for the whole domain or only for some boundaries in a binary file with the following format: n_valeur
x_1 y_1 [z_1] val_1
...
x_n y_n [z_n] val_n
The created files are named : pbname_fieldname_[boundaryname]_time.dat
- **parametre_equation** *parametre_equation_base* (5.7) for inheritance: Keyword used to specify additional parameters for the equation
- **equation_non_resolue** *str* for inheritance: The equation will not be solved while condition(t) is verified if equation_non_resolue keyword is used. Exemple: The Navier Stokes is not solved between time t0 and t1.
Navier_Sokes_Standard
{ equation_non_resolue (t>t0)*(t<t1) }

5.11 convection_diffusion_concentration

Description: Constituent transportation vectorial equation (concentration diffusion convection).

Keyword Discretiser should have already be used to read the object.
See also: eqn_base (5.18) convection_diffusion_concentration_turbulent (5.12)

Usage:
convection_diffusion_concentration obj Lire obj {

[**nom_inconnue** *str*]
[**masse_molaire** *float*]
[**alias** *str*]
[**convection** *bloc_convection*]
[**diffusion** *bloc_diffusion*]
[**initial_conditions|conditions_initiales** *condinits*]
[**boundary_conditions|conditions_limites** *condlims*]
[**sources** *sources*]
[**ecrire_fichier_xyz_valeur** *ecrire_fichier_xyz_valeur_param*]
[**ecrire_fichier_xyz_valeur_bin** *ecrire_fichier_xyz_valeur_param*]
[**parametre_equation** *parametre_equation_base*]
[**equation_non_resolue** *str*]

}
where

- **nom_inconnue** *str*: Keyword Nom_inconnue will rename the unknown of this equation with the given name. In the postprocessing part, the concentration field will be accessible with this name. This is usefull if you want to track more than one concentration (otherwise, only the concentration field in the first concentration equation can be accessed).
- **masse_molaire** *float*
- **alias** *str*

- **convection** *bloc_convection* (5.9) for inheritance: Keyword to alter the convection scheme.
- **diffusion** *bloc_diffusion* (5.2) for inheritance: Keyword to specify the diffusion operator.
- **initial_conditions|conditions_initiales** *condinits* (5.3) for inheritance: Initial conditions.
- **boundary_conditions|conditions_limites** *condlims* (5.4) for inheritance: Boundary conditions.
- **sources** *sources* (5.5) for inheritance: To introduce a source term into an equation (in case of several source terms into the same equation, the blocks corresponding to the various terms need to be separated by a comma)
- **ecrire_fichier_xyz_valeur** *ecrire_fichier_xyz_valeur_param* (5.6) for inheritance: This keyword is used to write the values of a field for the whole domain or only for some boundaries in a text file with the following format: n_valeur
  x_1 y_1 [z_1] val_1
  ...
  x_n y_n [z_n] val_n
  The created files are named : pbname_fieldname_[boundaryname]_time.dat
- **ecrire_fichier_xyz_valeur_bin** *ecrire_fichier_xyz_valeur_param* (5.6) for inheritance: This keyword is used to write the values of a field for the whole domain or only for some boundaries in a binary file with the following format: n_valeur
  x_1 y_1 [z_1] val_1
  ...
  x_n y_n [z_n] val_n
  The created files are named : pbname_fieldname_[boundaryname]_time.dat
- **parametre_equation** *parametre_equation_base* (5.7) for inheritance: Keyword used to specify additional parameters for the equation
- **equation_non_resolue** *str* for inheritance: The equation will not be solved while condition(t) is verified if equation_non_resolue keyword is used. Exemple: The Navier Stokes is not solved between time t0 and t1.
  Navier_Sokes_Standard
  { equation_non_resolue (t>t0)*(t<t1) }

5.12 convection_diffusion_concentration_turbulent

Description: Constituent transportation equations (concentration diffusion convection) as well as the associated turbulence model equations.

Keyword Discretiser should have already be used to read the object.
See also: convection_diffusion_concentration (5.11)

Usage:
convection_diffusion_concentration_turbulent obj Lire obj {

[**modele_turbulence** *modele_turbulence_scal_base*]
[**nom_inconnue** *str*]
[**masse_molaire** *float*]
[**alias** *str*]
[**convection** *bloc_convection*]
[**diffusion** *bloc_diffusion*]
[**initial_conditions|conditions_initiales** *condinits*]
[**boundary_conditions|conditions_limites** *condlims*]
[**sources** *sources*]
[**ecrire_fichier_xyz_valeur** *ecrire_fichier_xyz_valeur_param*]
[**ecrire_fichier_xyz_valeur_bin** *ecrire_fichier_xyz_valeur_param*]
[**parametre_equation** *parametre_equation_base*]
[**equation_non_resolue** *str*]

}
where

- **modele_turbulence** *modele_turbulence_scal_base* (21): Turbulence model to be used in the constituent transportation equations. The only model currently available is Schmidt.
- **nom_inconnue** *str* for inheritance: Keyword Nom_inconnue will rename the unknown of this equation with the given name. In the postprocessing part, the concentration field will be accessible with this name. This is usefull if you want to track more than one concentration (otherwise, only the concentration field in the first concentration equation can be accessed).
- **masse_molaire** *float* for inheritance
- **alias** *str* for inheritance
- **convection** *bloc_convection* (5.9) for inheritance: Keyword to alter the convection scheme.
- **diffusion** *bloc_diffusion* (5.2) for inheritance: Keyword to specify the diffusion operator.
- **initial_conditions|conditions_initiales** *condinits* (5.3) for inheritance: Initial conditions.
- **boundary_conditions|conditions_limites** *condlims* (5.4) for inheritance: Boundary conditions.
- **sources** *sources* (5.5) for inheritance: To introduce a source term into an equation (in case of several source terms into the same equation, the blocks corresponding to the various terms need to be separated by a comma)
- **ecrire_fichier_xyz_valeur** *ecrire_fichier_xyz_valeur_param* (5.6) for inheritance: This keyword is used to write the values of a field for the whole domain or only for some boundaries in a text file with the following format: n_valeur
  x_1 y_1 [z_1] val_1
  ...
  x_n y_n [z_n] val_n
  The created files are named : pbname_fieldname_[boundaryname]_time.dat
- **ecrire_fichier_xyz_valeur_bin** *ecrire_fichier_xyz_valeur_param* (5.6) for inheritance: This keyword is used to write the values of a field for the whole domain or only for some boundaries in a binary file with the following format: n_valeur
  x_1 y_1 [z_1] val_1
  ...
  x_n y_n [z_n] val_n
  The created files are named : pbname_fieldname_[boundaryname]_time.dat
- **parametre_equation** *parametre_equation_base* (5.7) for inheritance: Keyword used to specify additional parameters for the equation
- **equation_non_resolue** *str* for inheritance: The equation will not be solved while condition(t) is verified if equation_non_resolue keyword is used. Exemple: The Navier Stokes is not solved between time t0 and t1.
  Navier_Sokes_Standard
  { equation_non_resolue (t>t0)*(t<t1) }

5.13 convection_diffusion_fraction_massique_qc

Description: not_set

Keyword Discretiser should have already be used to read the object.
See also: eqn_base (5.18)

Usage:
convection_diffusion_fraction_massique_qc obj Lire obj {

> **espece** *espece*
> [**convection** *bloc_convection*]
> [**diffusion** *bloc_diffusion*]
> [**initial_conditions|conditions_initiales** *condinits*]

[**boundary_conditions|conditions_limites** *condlims*]
[**sources** *sources*]
[**ecrire_fichier_xyz_valeur** *ecrire_fichier_xyz_valeur_param*]
[**ecrire_fichier_xyz_valeur_bin** *ecrire_fichier_xyz_valeur_param*]
[**parametre_equation** *parametre_equation_base*]
[**equation_non_resolue** *str*]

}
where

- **espece** *espece* (14)
- **convection** *bloc_convection* (5.9) for inheritance: Keyword to alter the convection scheme.
- **diffusion** *bloc_diffusion* (5.2) for inheritance: Keyword to specify the diffusion operator.
- **initial_conditions|conditions_initiales** *condinits* (5.3) for inheritance: Initial conditions.
- **boundary_conditions|conditions_limites** *condlims* (5.4) for inheritance: Boundary conditions.
- **sources** *sources* (5.5) for inheritance: To introduce a source term into an equation (in case of several source terms into the same equation, the blocks corresponding to the various terms need to be separated by a comma)
- **ecrire_fichier_xyz_valeur** *ecrire_fichier_xyz_valeur_param* (5.6) for inheritance: This keyword is used to write the values of a field for the whole domain or only for some boundaries in a text file with the following format: n_valeur
  x_1 y_1 [z_1] val_1
  ...
  x_n y_n [z_n] val_n
  The created files are named : pbname_fieldname_[boundaryname]_time.dat
- **ecrire_fichier_xyz_valeur_bin** *ecrire_fichier_xyz_valeur_param* (5.6) for inheritance: This keyword is used to write the values of a field for the whole domain or only for some boundaries in a binary file with the following format: n_valeur
  x_1 y_1 [z_1] val_1
  ...
  x_n y_n [z_n] val_n
  The created files are named : pbname_fieldname_[boundaryname]_time.dat
- **parametre_equation** *parametre_equation_base* (5.7) for inheritance: Keyword used to specify additional parameters for the equation
- **equation_non_resolue** *str* for inheritance: The equation will not be solved while condition(t) is verified if equation_non_resolue keyword is used. Exemple: The Navier Stokes is not solved between time t0 and t1.
  Navier_Sokes_Standard
  { equation_non_resolue (t>t0)*(t<t1) }

5.14 convection_diffusion_fraction_massique_turbulent_qc

Description: not_set

Keyword Discretiser should have already be used to read the object.
See also: eqn_base (5.18)

Usage:
convection_diffusion_fraction_massique_turbulent_qc obj Lire obj {

[**modele_turbulence** *modele_turbulence_scal_base*]
espece *espece*
[**convection** *bloc_convection*]
[**diffusion** *bloc_diffusion*]

[**initial_conditions|conditions_initiales** *condinits*]
[**boundary_conditions|conditions_limites** *condlims*]
[**sources** *sources*]
[**ecrire_fichier_xyz_valeur** *ecrire_fichier_xyz_valeur_param*]
[**ecrire_fichier_xyz_valeur_bin** *ecrire_fichier_xyz_valeur_param*]
[**parametre_equation** *parametre_equation_base*]
[**equation_non_resolue** *str*]

}
where

- **modele_turbulence** *modele_turbulence_scal_base* (21): Turbulence model to be used.
- **espece** *espece* (14)
- **convection** *bloc_convection* (5.9) for inheritance: Keyword to alter the convection scheme.
- **diffusion** *bloc_diffusion* (5.2) for inheritance: Keyword to specify the diffusion operator.
- **initial_conditions|conditions_initiales** *condinits* (5.3) for inheritance: Initial conditions.
- **boundary_conditions|conditions_limites** *condlims* (5.4) for inheritance: Boundary conditions.
- **sources** *sources* (5.5) for inheritance: To introduce a source term into an equation (in case of several source terms into the same equation, the blocks corresponding to the various terms need to be separated by a comma)
- **ecrire_fichier_xyz_valeur** *ecrire_fichier_xyz_valeur_param* (5.6) for inheritance: This keyword is used to write the values of a field for the whole domain or only for some boundaries in a text file with the following format: n_valeur
  x_1 y_1 [z_1] val_1
  ...
  x_n y_n [z_n] val_n
  The created files are named : pbname_fieldname_[boundaryname]_time.dat
- **ecrire_fichier_xyz_valeur_bin** *ecrire_fichier_xyz_valeur_param* (5.6) for inheritance: This keyword is used to write the values of a field for the whole domain or only for some boundaries in a binary file with the following format: n_valeur
  x_1 y_1 [z_1] val_1
  ...
  x_n y_n [z_n] val_n
  The created files are named : pbname_fieldname_[boundaryname]_time.dat
- **parametre_equation** *parametre_equation_base* (5.7) for inheritance: Keyword used to specify additional parameters for the equation
- **equation_non_resolue** *str* for inheritance: The equation will not be solved while condition(t) is verified if equation_non_resolue keyword is used. Exemple: The Navier Stokes is not solved between time t0 and t1.
  Navier_Sokes_Standard
  { equation_non_resolue (t>t0)*(t<t1) }

5.15 convection_diffusion_temperature

Description: Energy equation (temperature diffusion convection).

Keyword Discretiser should have already be used to read the object.
See also: eqn_base (5.18)

Usage:
convection_diffusion_temperature obj Lire obj {

[**penalisation_l2_ftd** *pp*]
[**convection** *bloc_convection*]

[**diffusion** *bloc_diffusion*]
[**initial_conditions|conditions_initiales** *condinits*]
[**boundary_conditions|conditions_limites** *condlims*]
[**sources** *sources*]
[**ecrire_fichier_xyz_valeur** *ecrire_fichier_xyz_valeur_param*]
[**ecrire_fichier_xyz_valeur_bin** *ecrire_fichier_xyz_valeur_param*]
[**parametre_equation** *parametre_equation_base*]
[**equation_non_resolue** *str*]

}
where

- **penalisation_l2_ftd** *pp* (5.16): to activate or not (the default is Direct Forcing method) the Penalized Direct Forcing method to impose the specified temperature on the solid-fluid interface.
- **convection** *bloc_convection* (5.9) for inheritance: Keyword to alter the convection scheme.
- **diffusion** *bloc_diffusion* (5.2) for inheritance: Keyword to specify the diffusion operator.
- **initial_conditions|conditions_initiales** *condinits* (5.3) for inheritance: Initial conditions.
- **boundary_conditions|conditions_limites** *condlims* (5.4) for inheritance: Boundary conditions.
- **sources** *sources* (5.5) for inheritance: To introduce a source term into an equation (in case of several source terms into the same equation, the blocks corresponding to the various terms need to be separated by a comma)
- **ecrire_fichier_xyz_valeur** *ecrire_fichier_xyz_valeur_param* (5.6) for inheritance: This keyword is used to write the values of a field for the whole domain or only for some boundaries in a text file with the following format: n_valeur
  x_1 y_1 [z_1] val_1
  ...
  x_n y_n [z_n] val_n
  The created files are named : pbname_fieldname_[boundaryname]_time.dat
- **ecrire_fichier_xyz_valeur_bin** *ecrire_fichier_xyz_valeur_param* (5.6) for inheritance: This keyword is used to write the values of a field for the whole domain or only for some boundaries in a binary file with the following format: n_valeur
  x_1 y_1 [z_1] val_1
  ...
  x_n y_n [z_n] val_n
  The created files are named : pbname_fieldname_[boundaryname]_time.dat
- **parametre_equation** *parametre_equation_base* (5.7) for inheritance: Keyword used to specify additional parameters for the equation
- **equation_non_resolue** *str* for inheritance: The equation will not be solved while condition(t) is verified if equation_non_resolue keyword is used. Exemple: The Navier Stokes is not solved between time t0 and t1.
  Navier_Sokes_Standard
  { equation_non_resolue (t>t0)*(t<t1) }

5.16 pp

Description: not_set

See also: listobj (31.3)

Usage:
{ object1 object2 .... }
list of *penalisation_l2_ftd_lec* (5.16.1)

5.16.1 penalisation_l2_ftd_lec

Description: not_set

See also: objet_lecture (32)

Usage:
bord val
where

- **bord** *str*
- **val** *n x1 x2 ... xn*

5.17 convection_diffusion_temperature_turbulent

Description: Energy equation (temperature diffusion convection) as well as the associated turbulence model equations.

Keyword Discretiser should have already be used to read the object.
See also: eqn_base (5.18)

Usage:
convection_diffusion_temperature_turbulent obj Lire obj {

[**modele_turbulence** *modele_turbulence_scal_base*]
[**convection** *bloc_convection*]
[**diffusion** *bloc_diffusion*]
[**initial_conditions|conditions_initiales** *condinits*]
[**boundary_conditions|conditions_limites** *condlims*]
[**sources** *sources*]
[**ecrire_fichier_xyz_valeur** *ecrire_fichier_xyz_valeur_param*]
[**ecrire_fichier_xyz_valeur_bin** *ecrire_fichier_xyz_valeur_param*]
[**parametre_equation** *parametre_equation_base*]
[**equation_non_resolue** *str*]

}
where

- **modele_turbulence** *modele_turbulence_scal_base* (21): Turbulence model for the energy equation.

- **convection** *bloc_convection* (5.9) for inheritance: Keyword to alter the convection scheme.
- **diffusion** *bloc_diffusion* (5.2) for inheritance: Keyword to specify the diffusion operator.
- **initial_conditions|conditions_initiales** *condinits* (5.3) for inheritance: Initial conditions.
- **boundary_conditions|conditions_limites** *condlims* (5.4) for inheritance: Boundary conditions.
- **sources** *sources* (5.5) for inheritance: To introduce a source term into an equation (in case of several source terms into the same equation, the blocks corresponding to the various terms need to be separated by a comma)
- **ecrire_fichier_xyz_valeur** *ecrire_fichier_xyz_valeur_param* (5.6) for inheritance: This keyword is used to write the values of a field for the whole domain or only for some boundaries in a text file with the following format: n_valeur
  x_1 y_1 [z_1] val_1
  ...
  x_n y_n [z_n] val_n
  The created files are named : pbname_fieldname_[boundaryname]_time.dat

- **ecrire_fichier_xyz_valeur_bin** *ecrire_fichier_xyz_valeur_param* (5.6) for inheritance: This keyword is used to write the values of a field for the whole domain or only for some boundaries in a binary file with the following format: n_valeur
x_1 y_1 [z_1] val_1
...
x_n y_n [z_n] val_n
The created files are named : pbname_fieldname_[boundaryname]_time.dat
- **parametre_equation** *parametre_equation_base* (5.7) for inheritance: Keyword used to specify additional parameters for the equation
- **equation_non_resolue** *str* for inheritance: The equation will not be solved while condition(t) is verified if equation_non_resolue keyword is used. Exemple: The Navier Stokes is not solved between time t0 and t1.
Navier_Sokes_Standard
{ equation_non_resolue (t>t0)*(t<t1) }

5.18 eqn_base

Description: Basic class for equations.

Keyword Discretiser should have already be used to read the object.
See also: mor_eqn (5) navier_stokes_standard (5.23) convection_diffusion_temperature (5.15) convection_diffusion_temperature_turbulent (5.17) conduction (5.1) convection_diffusion_chaleur_qc (5.8) transport_k_epsilon (5.27) convection_diffusion_concentration (5.11) convection_diffusion_fraction_massique_qc (5.13) convection_diffusion_fraction_massique_turbulent_qc (5.14)

Usage:
eqn_base obj Lire obj {

[**convection** *bloc_convection*]
[**diffusion** *bloc_diffusion*]
[**initial_conditions|conditions_initiales** *condinits*]
[**boundary_conditions|conditions_limites** *condlims*]
[**sources** *sources*]
[**ecrire_fichier_xyz_valeur** *ecrire_fichier_xyz_valeur_param*]
[**ecrire_fichier_xyz_valeur_bin** *ecrire_fichier_xyz_valeur_param*]
[**parametre_equation** *parametre_equation_base*]
[**equation_non_resolue** *str*]

}
where

- **convection** *bloc_convection* (5.9): Keyword to alter the convection scheme.
- **diffusion** *bloc_diffusion* (5.2): Keyword to specify the diffusion operator.
- **initial_conditions|conditions_initiales** *condinits* (5.3): Initial conditions.
- **boundary_conditions|conditions_limites** *condlims* (5.4): Boundary conditions.
- **sources** *sources* (5.5): To introduce a source term into an equation (in case of several source terms into the same equation, the blocks corresponding to the various terms need to be separated by a comma)
- **ecrire_fichier_xyz_valeur** *ecrire_fichier_xyz_valeur_param* (5.6): This keyword is used to write the values of a field for the whole domain or only for some boundaries in a text file with the following format: n_valeur
x_1 y_1 [z_1] val_1
...
x_n y_n [z_n] val_n
The created files are named : pbname_fieldname_[boundaryname]_time.dat

- **ecrire_fichier_xyz_valeur_bin** *ecrire_fichier_xyz_valeur_param* (5.6): This keyword is used to write the values of a field for the whole domain or only for some boundaries in a binary file with the following format: n_valeur
x_1 y_1 [z_1] val_1
...
x_n y_n [z_n] val_n
The created files are named : pbname_fieldname_[boundaryname]_time.dat
- **parametre_equation** *parametre_equation_base* (5.7): Keyword used to specify additional parameters for the equation
- **equation_non_resolue** *str*: The equation will not be solved while condition(t) is verified if equation_non_resolue keyword is used. Exemple: The Navier Stokes is not solved between time t0 and t1.
Navier_Sokes_Standard
{ equation_non_resolue (t>t0)*(t<t1) }

5.19 navier_stokes_qc

Description: NAVIER STOKES equations under smal Mach number.

Keyword Discretiser should have already be used to read the object.
See also: navier_stokes_standard (5.23)

Usage:
navier_stokes_qc obj Lire obj {

[**methode_calcul_pression_initiale** *str into ['avec_les_cl', 'avec_sources', 'avec_sources_et_operateurs', 'sans_rien']*]
[**projection_initiale** *int*]
[**solveur_pression** *solveur_sys_base*]
[**solveur_bar** *solveur_sys_base*]
[**dt_projection** *deuxmots*]
[**seuil_divU** *floatfloat*]
[**traitement_particulier** *traitement_particulier*]
[**convection** *bloc_convection*]
[**diffusion** *bloc_diffusion*]
[**initial_conditions|conditions_initiales** *condinits*]
[**boundary_conditions|conditions_limites** *condlims*]
[**sources** *sources*]
[**ecrire_fichier_xyz_valeur** *ecrire_fichier_xyz_valeur_param*]
[**ecrire_fichier_xyz_valeur_bin** *ecrire_fichier_xyz_valeur_param*]
[**parametre_equation** *parametre_equation_base*]
[**equation_non_resolue** *str*]

}
where

- **methode_calcul_pression_initiale** *str into ['avec_les_cl', 'avec_sources', 'avec_sources_et_operateurs', 'sans_rien']* for inheritance: Keyword to select an option for the pressure calculation before the fist time step. Options are : avec_les_cl (default option lapP=0 is solved with Neuman boundary conditions on pressure if any), avec_sources (lapP=f is solved with Neuman boundaries conditions and f integrating the source terms of the Navier Stokes equation) and avec_sources_et_operateurs (lapP=f is solved as with the previous option avec_sources but f integrating also some operators of the Navier Stokes equation). The two last options are useful and sometime necessary when source terms are implicited when using an implicit time scheme to solve the Navier Stokes equation.

- **projection_initiale** *int* for inheritance: Keyword to suppress, if boolean equals 0, the initial projection which checks DivU=0. By default, boolean equals 1.
- **solveur_pression** *solveur_sys_base* (9.12) for inheritance: Linear pressure system resolution method.

- **solveur_bar** *solveur_sys_base* (9.12) for inheritance: This keyword is used to define when filtering operation is called (typically for EF convective scheme, standard diffusion operator and Source_Qdm_lambdaup). A file (solveur.bar) is then created and used for inversion procedure. Syntax is the same then for pressure solver (GCP is required for multi-processor calculations and, in a general way, for big meshes).
- **dt_projection** *deuxmots* (5.20) for inheritance: nb value : This keyword checks every nb time-steps the equality of velocity divergence to zero. value is the criteria convergency for the solver used.
- **seuil_divU** *floatfloat* (5.21) for inheritance: value factor : this keyword is intended to minimise the number of iterations during the pressure system resolution. The convergence criteria during this step ('seuil' in solveur_pression) is dynamically adapted according to the mass conservation. At tn , the linear system Ax=B is considered as solved if the residual ||Ax-B||<seuil(tn). For tn+1, the threshold value seuil(tn+1) will be evualated as:
  If (|max(DivU)*dt|<value)
  Seuil(tn+1)= Seuil(tn)*factor
  Else
  Seuil(tn+1)= Seuil(tn)*factor
  Endif
  The first parameter (value) is the mass evolution the user is ready to accept per timestep, and the second one (factor) is the factor of evolution for 'seuil' (for example 1.1, so 10
- **traitement_particulier** *traitement_particulier* (5.22) for inheritance: Keyword to post-process particular values.
- **convection** *bloc_convection* (5.9) for inheritance: Keyword to alter the convection scheme.
- **diffusion** *bloc_diffusion* (5.2) for inheritance: Keyword to specify the diffusion operator.
- **initial_conditions|conditions_initiales** *condinits* (5.3) for inheritance: Initial conditions.
- **boundary_conditions|conditions_limites** *condlims* (5.4) for inheritance: Boundary conditions.
- **sources** *sources* (5.5) for inheritance: To introduce a source term into an equation (in case of several source terms into the same equation, the blocks corresponding to the various terms need to be separated by a comma)
- **ecrire_fichier_xyz_valeur** *ecrire_fichier_xyz_valeur_param* (5.6) for inheritance: This keyword is used to write the values of a field for the whole domain or only for some boundaries in a text file with the following format: n_valeur
  x_1 y_1 [z_1] val_1
  ...
  x_n y_n [z_n] val_n
  The created files are named : pbname_fieldname_[boundaryname]_time.dat
- **ecrire_fichier_xyz_valeur_bin** *ecrire_fichier_xyz_valeur_param* (5.6) for inheritance: This keyword is used to write the values of a field for the whole domain or only for some boundaries in a binary file with the following format: n_valeur
  x_1 y_1 [z_1] val_1
  ...
  x_n y_n [z_n] val_n
  The created files are named : pbname_fieldname_[boundaryname]_time.dat
- **parametre_equation** *parametre_equation_base* (5.7) for inheritance: Keyword used to specify additional parameters for the equation
- **equation_non_resolue** *str* for inheritance: The equation will not be solved while condition(t) is verified if equation_non_resolue keyword is used. Exemple: The Navier Stokes is not solved between time t0 and t1.
  Navier_Sokes_Standard
  { equation_non_resolue (t>t0)*(t<t1) }

5.20 deuxmots

Description: Two words.

See also: objet_lecture (32)

Usage:
mot_1 mot_2
where

- **mot_1** *str*: First word.
- **mot_2** *str*: Second word.

5.21 floatfloat

Description: Two reals.

See also: objet_lecture (32)

Usage:
a b
where

- **a** *float*: First real.
- **b** *float*: Second real.

5.22 traitement_particulier

Description: Auxiliary class to post-process particular values.

See also: objet_lecture (32)

Usage:
aco trait_part acof
where

- **aco** *str into ['{']: Open accodance sign.*
- **trait_part** *traitement_particulier_base (5.22.1): Type of traitement_particulier.*
- **acof** *str into ['}']* : Closed accodance sign.

5.22.1 traitement_particulier_base

Description: Basic class to post-process particular values.

See also: objet_lecture (32) temperature (5.22.2) canal (5.22.3) ec (5.22.4) thi (5.22.5) chmoy_faceperio (5.22.6)

Usage:

5.22.2 temperature

Description: not_set

See also: traitement_particulier_base (5.22.1)

Usage:
temperature {

bord *str*
direction *int*

}
where

- **bord** *str*
- **direction** *int*

5.22.3 canal

Description: Keyword for statistics on a periodic plane channel.

See also: traitement_particulier_base (5.22.1)

Usage:
canal {

[**dt_impr_moy_spat** *float*]
[**dt_impr_moy_temp** *float*]
[**debut_stat** *float*]
[**fin_stat** *float*]
[**pulsation_w** *float*]
[**nb_points_par_phase** *int*]
[**reprise** *str*]

}
where

- **dt_impr_moy_spat** *float*: Period to print the spatial average (default value is 1e6).
- **dt_impr_moy_temp** *float*: Period to print the temporal average (default value is 1e6).
- **debut_stat** *float*: Time to start the temporal averaging (default value is 1e6).
- **fin_stat** *float*: Time to end the temporal averaging (default value is 1e6).
- **pulsation_w** *float*: Pulsation for phase averaging (in case of pulsating forcing term) (no default value).
- **nb_points_par_phase** *int*: Number of samples to represent phase average all along a period (no default value).
- **reprise** *str*: val_moy_temp_xxxxxx.sauv : Keyword to restart a calculation with previous average quantities.
  Note that for thermal and turbulent problems, averages on temperature and turbulent viscosity are automatically calculated. To restart a calculation with phase averaging, val_moy_temp_xxxxxx.sauv_phase file is required on the directory where the job is submitted (this last file will be then automatically loaded by TRUST).

5.22.4 ec

Description: Keyword to print total kinetic energy into the referential linked to the domain (keyword Ec). In the case where the domain is moving into a Galilean referential, the keyword Ec_dans_repere_fixe will print total kinetic energy in the Galilean referential whereas Ec will print the value calculated into the moving referential linked to the domain

See also: traitement_particulier_base (5.22.1)

Usage:
ec {

[**Ec**]
[**Ec_dans_repere_fixe**]
[**periode** *float*]

}
where

- **Ec**
- **Ec_dans_repere_fixe**
- **periode** *float*: periode is the keyword to set the period of printing into the file datafile_Ec.son or datafile_Ec_dans_repere_fixe.son.

5.22.5 thi

Description: Keyword for a THI (Homogeneous Isotropic Turbulence) calculation.

See also: traitement_particulier_base (5.22.1)

Usage:
thi {

init_Ec *int*
[**val_Ec** *float*]
[**facon_init** *int into [0, 1]*]
[**calc_spectre** *int into [0, 1]*]
[**periode_calc_spectre** *float*]
[**3D** *int into [0, 1]*]
[**1D** *int into [0, 1]*]
[**conservation_Ec**]
[**longueur_boite** *float*]

}
where

- **init_Ec** *int*: Keyword to renormalize initial velocity so as kinetic energy equals to the value given by keyword val_Ec.
- **val_Ec** *float*: Keyword to impose a value for kinetic energy by velocity renormalizated if init_Ec value is 1.
- **facon_init** *int into [0, 1]*: Keyword to specify how kinetic energy is computed (0 or 1).
- **calc_spectre** *int into [0, 1]*: Calculate or not the spectrum of kinetic energy.
  Files called Sorties_THI are written with inside four columns :
  time:t global_kinetic_energy:Ec enstrophy:D skewness:S
  If calc_spectre is set to 1, a file Sorties_THI2_2 is written with three columns :
  time:t kinetic_energy_at_kc=32 enstrophy_at_kc=32
  If calc_spectre is set to 1, a file spectre_xxxxx is written with two columns at each time xxxxx :
  frequency:k energy:E(k).
- **periode_calc_spectre** *float*: Period for calculating spectrum of kinetic energy
- **3D** *int into [0, 1]*: Calculate or not the 3D spectrum
- **1D** *int into [0, 1]*: Calculate or not the 1D spectrum

- **conservation_Ec** : If set to 1, velocity field will be changed as to have a constant kinetic energy (default 0)
- **longueur_boite** *float*: Length of the calculation domain

5.22.6 chmoy_faceperio

Description: non documente

See also: traitement_particulier_base (5.22.1)

Usage:
chmoy_faceperio bloc
where

- **bloc** *bloc_lecture* (3.39)

5.23 navier_stokes_standard

Description: NAVIER STOKES equations.

Keyword Discretiser should have already be used to read the object.
See also: eqn_base (5.18) navier_stokes_turbulent (5.24) navier_stokes_qc (5.19)

Usage:
navier_stokes_standard obj Lire obj {

[**methode_calcul_pression_initiale** *str into ['avec_les_cl', 'avec_sources', 'avec_sources_et_operateurs', 'sans_rien']*]
[**projection_initiale** *int*]
[**solveur_pression** *solveur_sys_base*]
[**solveur_bar** *solveur_sys_base*]
[**dt_projection** *deuxmots*]
[**seuil_divU** *floatfloat*]
[**traitement_particulier** *traitement_particulier*]
[**convection** *bloc_convection*]
[**diffusion** *bloc_diffusion*]
[**initial_conditions|conditions_initiales** *condinits*]
[**boundary_conditions|conditions_limites** *condlims*]
[**sources** *sources*]
[**ecrire_fichier_xyz_valeur** *ecrire_fichier_xyz_valeur_param*]
[**ecrire_fichier_xyz_valeur_bin** *ecrire_fichier_xyz_valeur_param*]
[**parametre_equation** *parametre_equation_base*]
[**equation_non_resolue** *str*]

}
where

- **methode_calcul_pression_initiale** *str into ['avec_les_cl', 'avec_sources', 'avec_sources_et_operateurs', 'sans_rien']*: Keyword to select an option for the pressure calculation before the fist time step. Options are : avec_les_cl (default option lapP=0 is solved with Neuman boundary conditions on pressure if any), avec_sources (lapP=f is solved with Neuman boundaries conditions and f integrating the source terms of the Navier Stokes equation) and avec_sources_et_operateurs (lapP=f is solved as with the previous option avec_sources but f integrating also some operators of the Navier Stokes equation). The two last options are useful and sometime necessary when source terms are implicited when using an implicit time scheme to solve the Navier Stokes equation.

- **projection_initiale** *int*: Keyword to suppress, if boolean equals 0, the initial projection which checks DivU=0. By default, boolean equals 1.
- **solveur_pression** *solveur_sys_base* (9.12): Linear pressure system resolution method.
- **solveur_bar** *solveur_sys_base* (9.12): This keyword is used to define when filtering operation is called (typically for EF convective scheme, standard diffusion operator and Source_Qdm_lambdaup). A file (solveur.bar) is then created and used for inversion procedure. Syntax is the same then for pressure solver (GCP is required for multi-processor calculations and, in a general way, for big meshes).
- **dt_projection** *deuxmots* (5.20): nb value : This keyword checks every nb time-steps the equality of velocity divergence to zero. value is the criteria convergency for the solver used.
- **seuil_divU** *floatfloat* (5.21): value factor : this keyword is intended to minimise the number of iterations during the pressure system resolution. The convergence criteria during this step ('seuil' in solveur_pression) is dynamically adapted according to the mass conservation. At tn , the linear system Ax=B is considered as solved if the residual ||Ax-B||<seuil(tn). For tn+1, the threshold value seuil(tn+1) will be evualated as:
  If (|max(DivU)*dt|<value)
  Seuil(tn+1)= Seuil(tn)*factor
  Else
  Seuil(tn+1)= Seuil(tn)*factor
  Endif
  The first parameter (value) is the mass evolution the user is ready to accept per timestep, and the second one (factor) is the factor of evolution for 'seuil' (for example 1.1, so 10
- **traitement_particulier** *traitement_particulier* (5.22): Keyword to post-process particular values.
- **convection** *bloc_convection* (5.9) for inheritance: Keyword to alter the convection scheme.
- **diffusion** *bloc_diffusion* (5.2) for inheritance: Keyword to specify the diffusion operator.
- **initial_conditions|conditions_initiales** *condinits* (5.3) for inheritance: Initial conditions.
- **boundary_conditions|conditions_limites** *condlims* (5.4) for inheritance: Boundary conditions.
- **sources** *sources* (5.5) for inheritance: To introduce a source term into an equation (in case of several source terms into the same equation, the blocks corresponding to the various terms need to be separated by a comma)
- **ecrire_fichier_xyz_valeur** *ecrire_fichier_xyz_valeur_param* (5.6) for inheritance: This keyword is used to write the values of a field for the whole domain or only for some boundaries in a text file with the following format: n_valeur
  x_1 y_1 [z_1] val_1
  ...
  x_n y_n [z_n] val_n
  The created files are named : pbname_fieldname_[boundaryname]_time.dat
- **ecrire_fichier_xyz_valeur_bin** *ecrire_fichier_xyz_valeur_param* (5.6) for inheritance: This keyword is used to write the values of a field for the whole domain or only for some boundaries in a binary file with the following format: n_valeur
  x_1 y_1 [z_1] val_1
  ...
  x_n y_n [z_n] val_n
  The created files are named : pbname_fieldname_[boundaryname]_time.dat
- **parametre_equation** *parametre_equation_base* (5.7) for inheritance: Keyword used to specify additional parameters for the equation
- **equation_non_resolue** *str* for inheritance: The equation will not be solved while condition(t) is verified if equation_non_resolue keyword is used. Exemple: The Navier Stokes is not solved between time t0 and t1.
  Navier_Sokes_Standard
  { equation_non_resolue (t>t0)*(t<t1) }

5.24 navier_stokes_turbulent

Description: NAVIER STOKES equations as well as the associated turbulence model equations.

Keyword Discretiser should have already be used to read the object.
See also: navier_stokes_standard (5.23) navier_stokes_turbulent_qc (5.26)

Usage:
navier_stokes_turbulent obj Lire obj {

[**modele_turbulence** *modele_turbulence_hyd_deriv*]
[**methode_calcul_pression_initiale** *str into ['avec_les_cl', 'avec_sources', 'avec_sources_et_operateurs', 'sans_rien']*]
[**projection_initiale** *int*]
[**solveur_pression** *solveur_sys_base*]
[**solveur_bar** *solveur_sys_base*]
[**dt_projection** *deuxmots*]
[**seuil_divU** *floatfloat*]
[**traitement_particulier** *traitement_particulier*]
[**convection** *bloc_convection*]
[**diffusion** *bloc_diffusion*]
[**initial_conditions|conditions_initiales** *condinits*]
[**boundary_conditions|conditions_limites** *condlims*]
[**sources** *sources*]
[**ecrire_fichier_xyz_valeur** *ecrire_fichier_xyz_valeur_param*]
[**ecrire_fichier_xyz_valeur_bin** *ecrire_fichier_xyz_valeur_param*]
[**parametre_equation** *parametre_equation_base*]
[**equation_non_resolue** *str*]

}
where

- **modele_turbulence** *modele_turbulence_hyd_deriv* (5.25): Turbulence model for NAVIER STOKES equations.
- **methode_calcul_pression_initiale** *str into ['avec_les_cl', 'avec_sources', 'avec_sources_et_operateurs', 'sans_rien']* for inheritance: Keyword to select an option for the pressure calculation before the fist time step. Options are : avec_les_cl (default option lapP=0 is solved with Neuman boundary conditions on pressure if any), avec_sources (lapP=f is solved with Neuman boundaries conditions and f integrating the source terms of the Navier Stokes equation) and avec_sources_et_operateurs (lapP=f is solved as with the previous option avec_sources but f integrating also some operators of the Navier Stokes equation). The two last options are useful and sometime necessary when source terms are implicited when using an implicit time scheme to solve the Navier Stokes equation.
- **projection_initiale** *int* for inheritance: Keyword to suppress, if boolean equals 0, the initial projection which checks DivU=0. By default, boolean equals 1.
- **solveur_pression** *solveur_sys_base* (9.12) for inheritance: Linear pressure system resolution method.
- **solveur_bar** *solveur_sys_base* (9.12) for inheritance: This keyword is used to define when filtering operation is called (typically for EF convective scheme, standard diffusion operator and Source_Qdm_lambdaup). A file (solveur.bar) is then created and used for inversion procedure. Syntax is the same then for pressure solver (GCP is required for multi-processor calculations and, in a general way, for big meshes).
- **dt_projection** *deuxmots* (5.20) for inheritance: nb value : This keyword checks every nb time-steps the equality of velocity divergence to zero. value is the criteria convergency for the solver used.
- **seuil_divU** *floatfloat* (5.21) for inheritance: value factor : this keyword is intended to minimise the number of iterations during the pressure system resolution. The convergence criteria during this step

('seuil' in solveur_pression) is dynamically adapted according to the mass conservation. At tn , the linear system Ax=B is considered as solved if the residual ||Ax-B||<seuil(tn). For tn+1, the threshold value seuil(tn+1) will be evualated as:
If (|max(DivU)*dt|<value)
Seuil(tn+1)= Seuil(tn)*factor
Else
Seuil(tn+1)= Seuil(tn)*factor
Endif
The first parameter (value) is the mass evolution the user is ready to accept per timestep, and the second one (factor) is the factor of evolution for 'seuil' (for example 1.1, so 10

- **traitement_particulier** *traitement_particulier* (5.22) for inheritance: Keyword to post-process particular values.
- **convection** *bloc_convection* (5.9) for inheritance: Keyword to alter the convection scheme.
- **diffusion** *bloc_diffusion* (5.2) for inheritance: Keyword to specify the diffusion operator.
- **initial_conditions|conditions_initiales** *condinits* (5.3) for inheritance: Initial conditions.
- **boundary_conditions|conditions_limites** *condlims* (5.4) for inheritance: Boundary conditions.
- **sources** *sources* (5.5) for inheritance: To introduce a source term into an equation (in case of several source terms into the same equation, the blocks corresponding to the various terms need to be separated by a comma)
- **ecrire_fichier_xyz_valeur** *ecrire_fichier_xyz_valeur_param* (5.6) for inheritance: This keyword is used to write the values of a field for the whole domain or only for some boundaries in a text file with the following format: n_valeur
  x_1 y_1 [z_1] val_1
  ...
  x_n y_n [z_n] val_n
  The created files are named : pbname_fieldname_[boundaryname]_time.dat
- **ecrire_fichier_xyz_valeur_bin** *ecrire_fichier_xyz_valeur_param* (5.6) for inheritance: This keyword is used to write the values of a field for the whole domain or only for some boundaries in a binary file with the following format: n_valeur
  x_1 y_1 [z_1] val_1
  ...
  x_n y_n [z_n] val_n
  The created files are named : pbname_fieldname_[boundaryname]_time.dat
- **parametre_equation** *parametre_equation_base* (5.7) for inheritance: Keyword used to specify additional parameters for the equation
- **equation_non_resolue** *str* for inheritance: The equation will not be solved while condition(t) is verified if equation_non_resolue keyword is used. Exemple: The Navier Stokes is not solved between time t0 and t1.
  Navier_Sokes_Standard
  { equation_non_resolue (t>t0)*(t<t1) }

5.25 modele_turbulence_hyd_deriv

Description: Basic class for turbulence model for NAVIER STOKES equations.

See also: objet_lecture (32) NUL (5.25.2) mod_turb_hyd_ss_maille (5.25.3) mod_turb_hyd_rans (5.25.10)

Usage:
modele_turbulence_hyd_deriv {

[**correction_visco_turb_pour_controle_pas_de_temps**]
[**correction_visco_turb_pour_controle_pas_de_temps_parametre** *float*]
[**turbulence_paroi** *turbulence_paroi_base*]

[**dt_impr_ustar** *float*]
[**dt_impr_ustar_mean_only** *dt_impr_ustar_mean_only*]
[**nut_max** *float*]
[**prandtl_k** *float*]
[**prandtl_eps** *float*]

}
where

- **correction_visco_turb_pour_controle_pas_de_temps** : Keyword to set a limitation to low time steps due to high values of turbulent viscosity. The limit for turbulent viscosity is calculated so that diffusive time-step is equal or higher than convective time-step. For a stationary flow, the correction for turbulent viscosity should apply only during the first time steps and not when permanent state is reached. To check that, we could post process the corr_visco_turb field which is the correction of turbulent viscosity: it should be 1. on the whole domain.
- **correction_visco_turb_pour_controle_pas_de_temps_parametre** *float*: Keyword to set a limitation to low time steps due to high values of turbulent viscosity. The limit for turbulent viscosity is the ratio between diffusive time-step and convective time-step is higher or equal to the given value [0-1]
- **turbulence_paroi** *turbulence_paroi_base* (29): Keyword to set the wall law.
- **dt_impr_ustar** *float*: This keyword is used to print the values (U +, d+, u⋆) obtained with the wall laws into a file named datafile_ProblemName_Ustar.face and periode refers to the printing period, this value is expressed in seconds.
- **dt_impr_ustar_mean_only** *dt_impr_ustar_mean_only* (5.25.1): This keyword is used to print the mean values of u* (obtained with the wall laws) on each boundary, into a file named datafile-_ProblemName_Ustar_mean_only.out. periode refers to the printing period, this value is expressed in seconds. If you don't use the optional keyword boundaries, all the boundaries will be considered. If you use it, you must specify nb_boundaries which is the number of boundaries on which you want to calculate the mean values of u*, then you have to specify their names.
- **nut_max** *float*: Upper limitation of turbulent viscosity (default value 1.e8).
- **prandtl_k** *float*: Keyword to change the Prk value (default 1.0).
- **prandtl_eps** *float*: Keyword to change the Pre value (default 1.3).

5.25.1 dt_impr_ustar_mean_only

Description: not_set

See also: objet_lecture (32)

Usage:
{

dt_impr *float*
[**boundaries** *n word1 word2 ... wordn*]

}
where

- **dt_impr** *float*
- **boundaries** *n word1 word2 ... wordn*

5.25.2 NUL

Description: not_set

See also: modele_turbulence_hyd_deriv (5.25)

Usage:
NUL [**correction_visco_turb_pour_controle_pas_de_temps**] [**correction_visco_turb_pour_controle-_pas_de_temps_parametre**] [**turbulence_paroi**] [**dt_impr_ustar**] [**dt_impr_ustar_mean_only**] [**nut_max**] [**prandtl_k**] [**prandtl_eps**]
where

- **correction_visco_turb_pour_controle_pas_de_temps** : Keyword to set a limitation to low time steps due to high values of turbulent viscosity. The limit for turbulent viscosity is calculated so that diffusive time-step is equal or higher than convective time-step. For a stationary flow, the correction for turbulent viscosity should apply only during the first time steps and not when permanent state is reached. To check that, we could post process the corr_visco_turb field which is the correction of turbulent viscosity: it should be 1. on the whole domain.
- **correction_visco_turb_pour_controle_pas_de_temps_parametre** *float*: Keyword to set a limitation to low time steps due to high values of turbulent viscosity. The limit for turbulent viscosity is the ratio between diffusive time-step and convective time-step is higher or equal to the given value [0-1]
- **turbulence_paroi** *turbulence_paroi_base* (29): Keyword to set the wall law.
- **dt_impr_ustar** *float*: This keyword is used to print the values (U +, d+, u$\star$) obtained with the wall laws into a file named datafile_ProblemName_Ustar.face and periode refers to the printing period, this value is expressed in seconds.
- **dt_impr_ustar_mean_only** *dt_impr_ustar_mean_only* (5.25.1): This keyword is used to print the mean values of u* (obtained with the wall laws) on each boundary, into a file named datafile-_ProblemName_Ustar_mean_only.out. periode refers to the printing period, this value is expressed in seconds. If you don't use the optional keyword boundaries, all the boundaries will be considered. If you use it, you must specify nb_boundaries which is the number of boundaries on which you want to calculate the mean values of u*, then you have to specify their names.
- **nut_max** *float*: Upper limitation of turbulent viscosity (default value 1.e8).
- **prandtl_k** *float*: Keyword to change the Prk value (default 1.0).
- **prandtl_eps** *float*: Keyword to change the Pre value (default 1.3).

5.25.3 mod_turb_hyd_ss_maille

Description: Class for sub-grid turbulence model for NAVIER STOKES equations.

See also: modele_turbulence_hyd_deriv (5.25) sous_maille_wale (5.25.5) sous_maille_smago (5.25.6) combinaison (5.25.7) longueur_melange (5.25.8) sous_maille (5.25.9)

Usage:
mod_turb_hyd_ss_maille {

[**formulation_a_nb_points** *form_a_nb_points*]
[**longueur_maille** *str into ['volume', 'volume_sans_lissage', 'scotti', 'arrete']*]
[**correction_visco_turb_pour_controle_pas_de_temps**]
[**correction_visco_turb_pour_controle_pas_de_temps_parametre** *float*]
[**turbulence_paroi** *turbulence_paroi_base*]
[**dt_impr_ustar** *float*]
[**dt_impr_ustar_mean_only** *dt_impr_ustar_mean_only*]
[**nut_max** *float*]
[**prandtl_k** *float*]
[**prandtl_eps** *float*]

}
where

- **formulation_a_nb_points** *form_a_nb_points* (5.25.4): The structure fonction is calculated on nb points and we should add the 2 directions (0:OX, 1:OY, 2:OZ) constituting the homegeneity planes. Example for channel flows, planes parallel to the walls.
- **longueur_maille** *str into ['volume', 'volume_sans_lissage', 'scotti', 'arrete']*: different ways to calculate the characteristic length may be specified :
volume : It is the default option. Characteristic length is based on the cubic root of the volume cells. A smoothing procedure is applied to avoid discontinuities of this quantity in VEF from a cell to another.
volume_sans_lissage : For VEF only. Characteristic length is based on the cubic root of the volume cells (without smoothing procedure).
scotti : Characteristic length is based on the cubic root of the volume cells and the Scotti correction is applied to take into account the stretching of the cell in the case of anisotropic meshes.
arete : For VEF only. Characteristic length relies on the max edge (+ smoothing procedure) is taken into account.
- **correction_visco_turb_pour_controle_pas_de_temps** for inheritance: Keyword to set a limitation to low time steps due to high values of turbulent viscosity. The limit for turbulent viscosity is calculated so that diffusive time-step is equal or higher than convective time-step. For a stationary flow, the correction for turbulent viscosity should apply only during the first time steps and not when permanent state is reached. To check that, we could post process the corr_visco_turb field which is the correction of turbulent viscosity: it should be 1. on the whole domain.
- **correction_visco_turb_pour_controle_pas_de_temps_parametre** *float* for inheritance: Keyword to set a limitation to low time steps due to high values of turbulent viscosity. The limit for turbulent viscosity is the ratio between diffusive time-step and convective time-step is higher or equal to the given value [0-1]
- **turbulence_paroi** *turbulence_paroi_base* (29) for inheritance: Keyword to set the wall law.
- **dt_impr_ustar** *float* for inheritance: This keyword is used to print the values (U +, d+, u$\star$) obtained with the wall laws into a file named datafile_ProblemName_Ustar.face and periode refers to the printing period, this value is expressed in seconds.
- **dt_impr_ustar_mean_only** *dt_impr_ustar_mean_only* (5.25.1) for inheritance: This keyword is used to print the mean values of u* (obtained with the wall laws) on each boundary, into a file named datafile_ProblemName_Ustar_mean_only.out. periode refers to the printing period, this value is expressed in seconds. If you don't use the optional keyword boundaries, all the boundaries will be considered. If you use it, you must specify nb_boundaries which is the number of boundaries on which you want to calculate the mean values of u*, then you have to specify their names.
- **nut_max** *float* for inheritance: Upper limitation of turbulent viscosity (default value 1.e8).
- **prandtl_k** *float* for inheritance: Keyword to change the Prk value (default 1.0).
- **prandtl_eps** *float* for inheritance: Keyword to change the Pre value (default 1.3).

5.25.4 form_a_nb_points

Description: The structure fonction is calculated on nb points and we should add the 2 directions (0:OX, 1:OY, 2:OZ) constituting the homegeneity planes. Example for channel flows, planes parallel to the walls.

See also: objet_lecture (32)

Usage:
nb dir1 dir2
where

- **nb** *int into [4]*: Number of points.
- **dir1** *int*: First direction.
- **dir2** *int*: Second direction.

5.25.5 sous_maille_wale

Description: This is the WALE-model. It is a new sub-grid scale model for eddy-viscosity in LES that has the following properties :
- it goes naturally to 0 at the wall (it doesn't need any information on the wall position or geometry)
- it has the proper wall scaling in o(y3) in the vicinity of the wall
- it reproduces correctly the laminar to turbulent transition.

See also: mod_turb_hyd_ss_maille (5.25.3)

Usage:
sous_maille_wale {

[**cw** *float*]
[**formulation_a_nb_points** *form_a_nb_points*]
[**longueur_maille** *str into ['volume', 'volume_sans_lissage', 'scotti', 'arrete']*]
[**correction_visco_turb_pour_controle_pas_de_temps**]
[**correction_visco_turb_pour_controle_pas_de_temps_parametre** *float*]
[**turbulence_paroi** *turbulence_paroi_base*]
[**dt_impr_ustar** *float*]
[**dt_impr_ustar_mean_only** *dt_impr_ustar_mean_only*]
[**nut_max** *float*]
[**prandtl_k** *float*]
[**prandtl_eps** *float*]

}
where

- **cw** *float*: The unique parameter (constant) of the WALE-model (by default value 0.5).
- **formulation_a_nb_points** *form_a_nb_points* (5.25.4) for inheritance: The structure fonction is calculated on nb points and we should add the 2 directions (0:OX, 1:OY, 2:OZ) constituting the homegeneity planes. Example for channel flows, planes parallel to the walls.
- **longueur_maille** *str into ['volume', 'volume_sans_lissage', 'scotti', 'arrete']* for inheritance: different ways to calculate the characteristic length may be specified :
  volume : It is the default option. Characteristic length is based on the cubic root of the volume cells. A smoothing procedure is applied to avoid discontinuities of this quantity in VEF from a cell to another.
  volume_sans_lissage : For VEF only. Characteristic length is based on the cubic root of the volume cells (without smoothing procedure).
  scotti : Characteristic length is based on the cubic root of the volume cells and the Scotti correction is applied to take into account the stretching of the cell in the case of anisotropic meshes.
  arete : For VEF only. Characteristic length relies on the max edge (+ smoothing procedure) is taken into account.
- **correction_visco_turb_pour_controle_pas_de_temps** for inheritance: Keyword to set a limitation to low time steps due to high values of turbulent viscosity. The limit for turbulent viscosity is calculated so that diffusive time-step is equal or higher than convective time-step. For a stationary flow, the correction for turbulent viscosity should apply only during the first time steps and not when permanent state is reached. To check that, we could post process the corr_visco_turb field which is the correction of turbulent viscosity: it should be 1. on the whole domain.
- **correction_visco_turb_pour_controle_pas_de_temps_parametre** *float* for inheritance: Keyword to set a limitation to low time steps due to high values of turbulent viscosity. The limit for turbulent viscosity is the ratio between diffusive time-step and convective time-step is higher or equal to the given value [0-1]
- **turbulence_paroi** *turbulence_paroi_base* (29) for inheritance: Keyword to set the wall law.

- **dt_impr_ustar** *float* for inheritance: This keyword is used to print the values (U +, d+, u⋆) obtained with the wall laws into a file named datafile_ProblemName_Ustar.face and periode refers to the printing period, this value is expressed in seconds.
- **dt_impr_ustar_mean_only** *dt_impr_ustar_mean_only* (5.25.1) for inheritance: This keyword is used to print the mean values of u* (obtained with the wall laws) on each boundary, into a file named datafile_ProblemName_Ustar_mean_only.out. periode refers to the printing period, this value is expressed in seconds. If you don't use the optional keyword boundaries, all the boundaries will be considered. If you use it, you must specify nb_boundaries which is the number of boundaries on which you want to calculate the mean values of u*, then you have to specify their names.
- **nut_max** *float* for inheritance: Upper limitation of turbulent viscosity (default value 1.e8).
- **prandtl_k** *float* for inheritance: Keyword to change the Prk value (default 1.0).
- **prandtl_eps** *float* for inheritance: Keyword to change the Pre value (default 1.3).

5.25.6 sous_maille_smago

Description: Smagorinsky sub-grid turbulence model.
Nut=Cs1*Cs1*l*l*sqrt(2*S*S)
K=Cs2*Cs2*l*l*2*S

See also: mod_turb_hyd_ss_maille (5.25.3)

Usage:
sous_maille_smago {

[**cs** *float*]
[**formulation_a_nb_points** *form_a_nb_points*]
[**longueur_maille** *str into ['volume', 'volume_sans_lissage', 'scotti', 'arrete']*]
[**correction_visco_turb_pour_controle_pas_de_temps**]
[**correction_visco_turb_pour_controle_pas_de_temps_parametre** *float*]
[**turbulence_paroi** *turbulence_paroi_base*]
[**dt_impr_ustar** *float*]
[**dt_impr_ustar_mean_only** *dt_impr_ustar_mean_only*]
[**nut_max** *float*]
[**prandtl_k** *float*]
[**prandtl_eps** *float*]

}
where

- **cs** *float*: This is an optional keyword and the value is used to set the constant used in the Smagorinsky model (This is currently only valid for Smagorinsky models and it is set to 0.18 by default) .
- **formulation_a_nb_points** *form_a_nb_points* (5.25.4) for inheritance: The structure fonction is calculated on nb points and we should add the 2 directions (0:OX, 1:OY, 2:OZ) constituting the homegeneity planes. Example for channel flows, planes parallel to the walls.
- **longueur_maille** *str into ['volume', 'volume_sans_lissage', 'scotti', 'arrete']* for inheritance: different ways to calculate the characteristic length may be specified :
  volume : It is the default option. Characteristic length is based on the cubic root of the volume cells. A smoothing procedure is applied to avoid discontinuities of this quantity in VEF from a cell to another.
  volume_sans_lissage : For VEF only. Characteristic length is based on the cubic root of the volume cells (without smoothing procedure).
  scotti : Characteristic length is based on the cubic root of the volume cells and the Scotti correction is applied to take into account the stretching of the cell in the case of anisotropic meshes.
  arete : For VEF only. Characteristic length relies on the max edge (+ smoothing procedure) is taken into account.

- **correction_visco_turb_pour_controle_pas_de_temps** for inheritance: Keyword to set a limitation to low time steps due to high values of turbulent viscosity. The limit for turbulent viscosity is calculated so that diffusive time-step is equal or higher than convective time-step. For a stationary flow, the correction for turbulent viscosity should apply only during the first time steps and not when permanent state is reached. To check that, we could post process the corr_visco_turb field which is the correction of turbulent viscosity: it should be 1. on the whole domain.
- **correction_visco_turb_pour_controle_pas_de_temps_parametre** *float* for inheritance: Keyword to set a limitation to low time steps due to high values of turbulent viscosity. The limit for turbulent viscosity is the ratio between diffusive time-step and convective time-step is higher or equal to the given value [0-1]
- **turbulence_paroi** *turbulence_paroi_base* (29) for inheritance: Keyword to set the wall law.
- **dt_impr_ustar** *float* for inheritance: This keyword is used to print the values (U +, d+, u⋆) obtained with the wall laws into a file named datafile_ProblemName_Ustar.face and periode refers to the printing period, this value is expressed in seconds.
- **dt_impr_ustar_mean_only** *dt_impr_ustar_mean_only* (5.25.1) for inheritance: This keyword is used to print the mean values of u* (obtained with the wall laws) on each boundary, into a file named datafile_ProblemName_Ustar_mean_only.out. periode refers to the printing period, this value is expressed in seconds. If you don't use the optional keyword boundaries, all the boundaries will be considered. If you use it, you must specify nb_boundaries which is the number of boundaries on which you want to calculate the mean values of u*, then you have to specify their names.
- **nut_max** *float* for inheritance: Upper limitation of turbulent viscosity (default value 1.e8).
- **prandtl_k** *float* for inheritance: Keyword to change the Prk value (default 1.0).
- **prandtl_eps** *float* for inheritance: Keyword to change the Pre value (default 1.3).

5.25.7 combinaison

Description: This keyword specify a turbulent viscosity model where the turbulent viscosity is user-defined.

See also: mod_turb_hyd_ss_maille (5.25.3)

Usage:
combinaison {

[**nb_var** *n word1 word2 ... wordn*]
[**fonction** *str*]
[**formulation_a_nb_points** *form_a_nb_points*]
[**longueur_maille** *str into ['volume', 'volume_sans_lissage', 'scotti', 'arrete']*]
[**correction_visco_turb_pour_controle_pas_de_temps**]
[**correction_visco_turb_pour_controle_pas_de_temps_parametre** *float*]
[**turbulence_paroi** *turbulence_paroi_base*]
[**dt_impr_ustar** *float*]
[**dt_impr_ustar_mean_only** *dt_impr_ustar_mean_only*]
[**nut_max** *float*]
[**prandtl_k** *float*]
[**prandtl_eps** *float*]

}
where

- **nb_var** *n word1 word2 ... wordn*: Number and names of variables which will be used in the turbulent viscosity definition (by default 0)
- **fonction** *str*: Fonction for turbulent viscosity. X,Y,Z and variables defined previously can be used.
- **formulation_a_nb_points** *form_a_nb_points* (5.25.4) for inheritance: The structure fonction is calculated on nb points and we should add the 2 directions (0:OX, 1:OY, 2:OZ) constituting the homegeneity planes. Example for channel flows, planes parallel to the walls.

- **longueur_maille** *str into ['volume', 'volume_sans_lissage', 'scotti', 'arrete']* for inheritance: different ways to calculate the characteristic length may be specified :
volume : It is the default option. Characteristic length is based on the cubic root of the volume cells. A smoothing procedure is applied to avoid discontinuities of this quantity in VEF from a cell to another.
volume_sans_lissage : For VEF only. Characteristic length is based on the cubic root of the volume cells (without smoothing procedure).
scotti : Characteristic length is based on the cubic root of the volume cells and the Scotti correction is applied to take into account the stretching of the cell in the case of anisotropic meshes.
arete : For VEF only. Characteristic length relies on the max edge (+ smoothing procedure) is taken into account.
- **correction_visco_turb_pour_controle_pas_de_temps** for inheritance: Keyword to set a limitation to low time steps due to high values of turbulent viscosity. The limit for turbulent viscosity is calculated so that diffusive time-step is equal or higher than convective time-step. For a stationary flow, the correction for turbulent viscosity should apply only during the first time steps and not when permanent state is reached. To check that, we could post process the corr_visco_turb field which is the correction of turbulent viscosity: it should be 1. on the whole domain.
- **correction_visco_turb_pour_controle_pas_de_temps_parametre** *float* for inheritance: Keyword to set a limitation to low time steps due to high values of turbulent viscosity. The limit for turbulent viscosity is the ratio between diffusive time-step and convective time-step is higher or equal to the given value [0-1]
- **turbulence_paroi** *turbulence_paroi_base* (29) for inheritance: Keyword to set the wall law.
- **dt_impr_ustar** *float* for inheritance: This keyword is used to print the values (U +, d+, u$\star$) obtained with the wall laws into a file named datafile_ProblemName_Ustar.face and periode refers to the printing period, this value is expressed in seconds.
- **dt_impr_ustar_mean_only** *dt_impr_ustar_mean_only* (5.25.1) for inheritance: This keyword is used to print the mean values of u* (obtained with the wall laws) on each boundary, into a file named datafile_ProblemName_Ustar_mean_only.out. periode refers to the printing period, this value is expressed in seconds. If you don't use the optional keyword boundaries, all the boundaries will be considered. If you use it, you must specify nb_boundaries which is the number of boundaries on which you want to calculate the mean values of u*, then you have to specify their names.
- **nut_max** *float* for inheritance: Upper limitation of turbulent viscosity (default value 1.e8).
- **prandtl_k** *float* for inheritance: Keyword to change the Prk value (default 1.0).
- **prandtl_eps** *float* for inheritance: Keyword to change the Pre value (default 1.3).

5.25.8 longueur_melange

Description: This model is based on mixing length modelling. For a non academic configuration, formulation used in the code can be expressed basically as :
$nu\_t = (Kappa.y)^2$.dU/dy
Till a maximum distance (dmax) set by the user in the data file, y is set equal to the distance from the wall (dist_w) calculated previously and saved in file Wall_length.xyz. [see Distance_paroi keyword]
Then (from y=dmax), y decreases as an exponential function : y=dmax*exp[-2.*(dist_w-dmax)/dmax]

See also: mod_turb_hyd_ss_maille (5.25.3)

Usage:
longueur_melange {

[**canalx** *float*]
[**tuyauz** *float*]
[**verif_dparoi** *str*]
[**dmax** *float*]
[**fichier** *str*]

[**fichier_ecriture_K_Eps** *str*]
[**formulation_a_nb_points** *form_a_nb_points*]
[**longueur_maille** *str into ['volume', 'volume_sans_lissage', 'scotti', 'arrete']*]
[**correction_visco_turb_pour_controle_pas_de_temps**]
[**correction_visco_turb_pour_controle_pas_de_temps_parametre** *float*]
[**turbulence_paroi** *turbulence_paroi_base*]
[**dt_impr_ustar** *float*]
[**dt_impr_ustar_mean_only** *dt_impr_ustar_mean_only*]
[**nut_max** *float*]
[**prandtl_k** *float*]
[**prandtl_eps** *float*]

}
where

- **canalx** *float*: [height] : plane channel according to Ox direction (for the moment, formulation in the code relies on fixed heigh : H=2).
- **tuyauz** *float*: [diameter] : pipe according to Oz direction (for the moment, formulation in the code relies on fixed diameter : D=2).
- **verif_dparoi** *str*
- **dmax** *float*: Maximum distance.
- **fichier** *str*
- **fichier_ecriture_K_Eps** *str*: When a restart with k-epsilon model is envisaged, this keyword allows to generate external MED-format file with evaluation of k and epsilon quantities (based on eddy turbulent viscosity and turbulent characteristic length returned by mixing length model). The frequency of the MED file print is set equal to dt_impr_ustar. Moreover, k-eps MED field is automatically saved at the last time step. MED file is then used for the restarting K-Epsilon calculation with the Champ_Fonc_Med keyword.
- **formulation_a_nb_points** *form_a_nb_points* (5.25.4) for inheritance: The structure fonction is calculated on nb points and we should add the 2 directions (0:OX, 1:OY, 2:OZ) constituting the homegeneity planes. Example for channel flows, planes parallel to the walls.
- **longueur_maille** *str into ['volume', 'volume_sans_lissage', 'scotti', 'arrete']* for inheritance: different ways to calculate the characteristic length may be specified :
  volume : It is the default option. Characteristic length is based on the cubic root of the volume cells. A smoothing procedure is applied to avoid discontinuities of this quantity in VEF from a cell to another.
  volume_sans_lissage : For VEF only. Characteristic length is based on the cubic root of the volume cells (without smoothing procedure).
  scotti : Characteristic length is based on the cubic root of the volume cells and the Scotti correction is applied to take into account the stretching of the cell in the case of anisotropic meshes.
  arete : For VEF only. Characteristic length relies on the max edge (+ smoothing procedure) is taken into account.
- **correction_visco_turb_pour_controle_pas_de_temps** for inheritance: Keyword to set a limitation to low time steps due to high values of turbulent viscosity. The limit for turbulent viscosity is calculated so that diffusive time-step is equal or higher than convective time-step. For a stationary flow, the correction for turbulent viscosity should apply only during the first time steps and not when permanent state is reached. To check that, we could post process the corr_visco_turb field which is the correction of turbulent viscosity: it should be 1. on the whole domain.
- **correction_visco_turb_pour_controle_pas_de_temps_parametre** *float* for inheritance: Keyword to set a limitation to low time steps due to high values of turbulent viscosity. The limit for turbulent viscosity is the ratio between diffusive time-step and convective time-step is higher or equal to the given value [0-1]
- **turbulence_paroi** *turbulence_paroi_base* (29) for inheritance: Keyword to set the wall law.
- **dt_impr_ustar** *float* for inheritance: This keyword is used to print the values (U +, d+, u$\star$) obtained with the wall laws into a file named datafile_ProblemName_Ustar.face and periode refers to the

printing period, this value is expressed in seconds.

- **dt_impr_ustar_mean_only** *dt_impr_ustar_mean_only* (5.25.1) for inheritance: This keyword is used to print the mean values of u* (obtained with the wall laws) on each boundary, into a file named datafile_ProblemName_Ustar_mean_only.out. periode refers to the printing period, this value is expressed in seconds. If you don't use the optional keyword boundaries, all the boundaries will be considered. If you use it, you must specify nb_boundaries which is the number of boundaries on which you want to calculate the mean values of u*, then you have to specify their names.
- **nut_max** *float* for inheritance: Upper limitation of turbulent viscosity (default value 1.e8).
- **prandtl_k** *float* for inheritance: Keyword to change the Prk value (default 1.0).
- **prandtl_eps** *float* for inheritance: Keyword to change the Pre value (default 1.3).

5.25.9 sous_maille

Description: Structure sub-grid function model.

See also: mod_turb_hyd_ss_maille (5.25.3)

Usage:
sous_maille {

[**formulation_a_nb_points** *form_a_nb_points*]
[**longueur_maille** *str into ['volume', 'volume_sans_lissage', 'scotti', 'arrete']*]
[**correction_visco_turb_pour_controle_pas_de_temps**]
[**correction_visco_turb_pour_controle_pas_de_temps_parametre** *float*]
[**turbulence_paroi** *turbulence_paroi_base*]
[**dt_impr_ustar** *float*]
[**dt_impr_ustar_mean_only** *dt_impr_ustar_mean_only*]
[**nut_max** *float*]
[**prandtl_k** *float*]
[**prandtl_eps** *float*]

}
where

- **formulation_a_nb_points** *form_a_nb_points* (5.25.4) for inheritance: The structure fonction is calculated on nb points and we should add the 2 directions (0:OX, 1:OY, 2:OZ) constituting the homegeneity planes. Example for channel flows, planes parallel to the walls.
- **longueur_maille** *str into ['volume', 'volume_sans_lissage', 'scotti', 'arrete']* for inheritance: different ways to calculate the characteristic length may be specified :
  volume : It is the default option. Characteristic length is based on the cubic root of the volume cells. A smoothing procedure is applied to avoid discontinuities of this quantity in VEF from a cell to another.
  volume_sans_lissage : For VEF only. Characteristic length is based on the cubic root of the volume cells (without smoothing procedure).
  scotti : Characteristic length is based on the cubic root of the volume cells and the Scotti correction is applied to take into account the stretching of the cell in the case of anisotropic meshes.
  arete : For VEF only. Characteristic length relies on the max edge (+ smoothing procedure) is taken into account.
- **correction_visco_turb_pour_controle_pas_de_temps** for inheritance: Keyword to set a limitation to low time steps due to high values of turbulent viscosity. The limit for turbulent viscosity is calculated so that diffusive time-step is equal or higher than convective time-step. For a stationary flow, the correction for turbulent viscosity should apply only during the first time steps and not when permanent state is reached. To check that, we could post process the corr_visco_turb field which is the correction of turbulent viscosity: it should be 1. on the whole domain.

- **correction_visco_turb_pour_controle_pas_de_temps_parametre** *float* for inheritance: Keyword to set a limitation to low time steps due to high values of turbulent viscosity. The limit for turbulent viscosity is the ratio between diffusive time-step and convective time-step is higher or equal to the given value [0-1]
- **turbulence_paroi** *turbulence_paroi_base* (29) for inheritance: Keyword to set the wall law.
- **dt_impr_ustar** *float* for inheritance: This keyword is used to print the values (U +, d+, u⋆) obtained with the wall laws into a file named datafile_ProblemName_Ustar.face and periode refers to the printing period, this value is expressed in seconds.
- **dt_impr_ustar_mean_only** *dt_impr_ustar_mean_only* (5.25.1) for inheritance: This keyword is used to print the mean values of u* (obtained with the wall laws) on each boundary, into a file named datafile_ProblemName_Ustar_mean_only.out. periode refers to the printing period, this value is expressed in seconds. If you don't use the optional keyword boundaries, all the boundaries will be considered. If you use it, you must specify nb_boundaries which is the number of boundaries on which you want to calculate the mean values of u*, then you have to specify their names.
- **nut_max** *float* for inheritance: Upper limitation of turbulent viscosity (default value 1.e8).
- **prandtl_k** *float* for inheritance: Keyword to change the Prk value (default 1.0).
- **prandtl_eps** *float* for inheritance: Keyword to change the Pre value (default 1.3).

5.25.10 mod_turb_hyd_rans

Description: Class for RANS turbulence model for NAVIER STOKES equations.

See also: modele_turbulence_hyd_deriv (5.25) k_epsilon (5.25.11)

Usage:
mod_turb_hyd_rans {

[**eps_min** *float*]
[**eps_max** *float*]
[**k_min** *float*]
[**quiet**]
[**correction_visco_turb_pour_controle_pas_de_temps**]
[**correction_visco_turb_pour_controle_pas_de_temps_parametre** *float*]
[**turbulence_paroi** *turbulence_paroi_base*]
[**dt_impr_ustar** *float*]
[**dt_impr_ustar_mean_only** *dt_impr_ustar_mean_only*]
[**nut_max** *float*]
[**prandtl_k** *float*]
[**prandtl_eps** *float*]

}
where

- **eps_min** *float*: Lower limitation of epsilon (default value 1.e-10).
- **eps_max** *float*: Upper limitation of epsilon (default value 1.e+10).
- **k_min** *float*: Lower limitation of k (default value 1.e-10).
- **quiet** : To disable printing of information about k and epsilon.
- **correction_visco_turb_pour_controle_pas_de_temps** for inheritance: Keyword to set a limitation to low time steps due to high values of turbulent viscosity. The limit for turbulent viscosity is calculated so that diffusive time-step is equal or higher than convective time-step. For a stationary flow, the correction for turbulent viscosity should apply only during the first time steps and not when permanent state is reached. To check that, we could post process the corr_visco_turb field which is the correction of turbulent viscosity: it should be 1. on the whole domain.

- **correction_visco_turb_pour_controle_pas_de_temps_parametre** *float* for inheritance: Keyword to set a limitation to low time steps due to high values of turbulent viscosity. The limit for turbulent viscosity is the ratio between diffusive time-step and convective time-step is higher or equal to the given value [0-1]
- **turbulence_paroi** *turbulence_paroi_base* (29) for inheritance: Keyword to set the wall law.
- **dt_impr_ustar** *float* for inheritance: This keyword is used to print the values (U +, d+, u⋆) obtained with the wall laws into a file named datafile_ProblemName_Ustar.face and periode refers to the printing period, this value is expressed in seconds.
- **dt_impr_ustar_mean_only** *dt_impr_ustar_mean_only* (5.25.1) for inheritance: This keyword is used to print the mean values of u* (obtained with the wall laws) on each boundary, into a file named datafile_ProblemName_Ustar_mean_only.out. periode refers to the printing period, this value is expressed in seconds. If you don't use the optional keyword boundaries, all the boundaries will be considered. If you use it, you must specify nb_boundaries which is the number of boundaries on which you want to calculate the mean values of u*, then you have to specify their names.
- **nut_max** *float* for inheritance: Upper limitation of turbulent viscosity (default value 1.e8).
- **prandtl_k** *float* for inheritance: Keyword to change the Prk value (default 1.0).
- **prandtl_eps** *float* for inheritance: Keyword to change the Pre value (default 1.3).

5.25.11 k_epsilon

Description: Turbulence model (k-eps).

See also: mod_turb_hyd_rans (5.25.10)

Usage:
k_epsilon {

[**cmu** *float*]
transport_k_epsilon *transport_k_epsilon*
[**modele_fonc_bas_reynolds** *modele_fonction_bas_reynolds_base*]
[**eps_min** *float*]
[**eps_max** *float*]
[**k_min** *float*]
[**quiet**]
[**correction_visco_turb_pour_controle_pas_de_temps**]
[**correction_visco_turb_pour_controle_pas_de_temps_parametre** *float*]
[**turbulence_paroi** *turbulence_paroi_base*]
[**dt_impr_ustar** *float*]
[**dt_impr_ustar_mean_only** *dt_impr_ustar_mean_only*]
[**nut_max** *float*]
[**prandtl_k** *float*]
[**prandtl_eps** *float*]

}
where

- **cmu** *float*: Keyword to modify the Cmu constant of k-eps model : Nut=Cmu*k*k/eps Default value is 0.09
- **transport_k_epsilon** *transport_k_epsilon* (5.27): Keyword to define the (k-eps) transportation equation.
- **modele_fonc_bas_reynolds** *modele_fonction_bas_reynolds_base* (5.25.12): This keyword is used to set the bas Reynolds model used.
- **eps_min** *float* for inheritance: Lower limitation of epsilon (default value 1.e-10).
- **eps_max** *float* for inheritance: Upper limitation of epsilon (default value 1.e+10).

- **k_min** *float* for inheritance: Lower limitation of k (default value 1.e-10).
- **quiet** for inheritance: To disable printing of information about k and epsilon.
- **correction_visco_turb_pour_controle_pas_de_temps** for inheritance: Keyword to set a limitation to low time steps due to high values of turbulent viscosity. The limit for turbulent viscosity is calculated so that diffusive time-step is equal or higher than convective time-step. For a stationary flow, the correction for turbulent viscosity should apply only during the first time steps and not when permanent state is reached. To check that, we could post process the corr_visco_turb field which is the correction of turbulent viscosity: it should be 1. on the whole domain.
- **correction_visco_turb_pour_controle_pas_de_temps_parametre** *float* for inheritance: Keyword to set a limitation to low time steps due to high values of turbulent viscosity. The limit for turbulent viscosity is the ratio between diffusive time-step and convective time-step is higher or equal to the given value [0-1]
- **turbulence_paroi** *turbulence_paroi_base* (29) for inheritance: Keyword to set the wall law.
- **dt_impr_ustar** *float* for inheritance: This keyword is used to print the values (U +, d+, u$\star$) obtained with the wall laws into a file named datafile_ProblemName_Ustar.face and periode refers to the printing period, this value is expressed in seconds.
- **dt_impr_ustar_mean_only** *dt_impr_ustar_mean_only* (5.25.1) for inheritance: This keyword is used to print the mean values of u* (obtained with the wall laws) on each boundary, into a file named datafile_ProblemName_Ustar_mean_only.out. periode refers to the printing period, this value is expressed in seconds. If you don't use the optional keyword boundaries, all the boundaries will be considered. If you use it, you must specify nb_boundaries which is the number of boundaries on which you want to calculate the mean values of u*, then you have to specify their names.
- **nut_max** *float* for inheritance: Upper limitation of turbulent viscosity (default value 1.e8).
- **prandtl_k** *float* for inheritance: Keyword to change the Prk value (default 1.0).
- **prandtl_eps** *float* for inheritance: Keyword to change the Pre value (default 1.3).

5.25.12 modele_fonction_bas_reynolds_base

Description: not_set

See also: objet_lecture (32)

Usage:

5.26 navier_stokes_turbulent_qc

Description: NAVIER STOKES equations under smal Mach number as well as the associated turbulence model equations.

Keyword Discretiser should have already be used to read the object.
See also: navier_stokes_turbulent (5.24)

Usage:
navier_stokes_turbulent_qc obj Lire obj {

[**modele_turbulence** *modele_turbulence_hyd_deriv*]
[**methode_calcul_pression_initiale** *str into ['avec_les_cl', 'avec_sources', 'avec_sources_et-_operateurs', 'sans_rien']*]
[**projection_initiale** *int*]
[**solveur_pression** *solveur_sys_base*]
[**solveur_bar** *solveur_sys_base*]
[**dt_projection** *deuxmots*]
[**seuil_divU** *floatfloat*]
[**traitement_particulier** *traitement_particulier*]

[**convection** *bloc_convection*]
[**diffusion** *bloc_diffusion*]
[**initial_conditions|conditions_initiales** *condinits*]
[**boundary_conditions|conditions_limites** *condlims*]
[**sources** *sources*]
[**ecrire_fichier_xyz_valeur** *ecrire_fichier_xyz_valeur_param*]
[**ecrire_fichier_xyz_valeur_bin** *ecrire_fichier_xyz_valeur_param*]
[**parametre_equation** *parametre_equation_base*]
[**equation_non_resolue** *str*]

}
where

- **modele_turbulence** *modele_turbulence_hyd_deriv* (5.25) for inheritance: Turbulence model for NAVIER STOKES equations.
- **methode_calcul_pression_initiale** *str into ['avec_les_cl', 'avec_sources', 'avec_sources_et_operateurs', 'sans_rien']* for inheritance: Keyword to select an option for the pressure calculation before the fist time step. Options are : avec_les_cl (default option lapP=0 is solved with Neuman boundary conditions on pressure if any), avec_sources (lapP=f is solved with Neuman boundaries conditions and f integrating the source terms of the Navier Stokes equation) and avec_sources_et_operateurs (lapP=f is solved as with the previous option avec_sources but f integrating also some operators of the Navier Stokes equation). The two last options are useful and sometime necessary when source terms are implicited when using an implicit time scheme to solve the Navier Stokes equation.
- **projection_initiale** *int* for inheritance: Keyword to suppress, if boolean equals 0, the initial projection which checks DivU=0. By default, boolean equals 1.
- **solveur_pression** *solveur_sys_base* (9.12) for inheritance: Linear pressure system resolution method.

- **solveur_bar** *solveur_sys_base* (9.12) for inheritance: This keyword is used to define when filtering operation is called (typically for EF convective scheme, standard diffusion operator and Source_Qdm_lambdaup). A file (solveur.bar) is then created and used for inversion procedure. Syntax is the same then for pressure solver (GCP is required for multi-processor calculations and, in a general way, for big meshes).
- **dt_projection** *deuxmots* (5.20) for inheritance: nb value : This keyword checks every nb time-steps the equality of velocity divergence to zero. value is the criteria convergency for the solver used.
- **seuil_divU** *floatfloat* (5.21) for inheritance: value factor : this keyword is intended to minimise the number of iterations during the pressure system resolution. The convergence criteria during this step ('seuil' in solveur_pression) is dynamically adapted according to the mass conservation. At tn , the linear system Ax=B is considered as solved if the residual ||Ax-B||<seuil(tn). For tn+1, the threshold value seuil(tn+1) will be evualated as:
  If (|max(DivU)*dt|<value)
  Seuil(tn+1)= Seuil(tn)*factor
  Else
  Seuil(tn+1)= Seuil(tn)*factor
  Endif
  The first parameter (value) is the mass evolution the user is ready to accept per timestep, and the second one (factor) is the factor of evolution for 'seuil' (for example 1.1, so 10
- **traitement_particulier** *traitement_particulier* (5.22) for inheritance: Keyword to post-process particular values.
- **convection** *bloc_convection* (5.9) for inheritance: Keyword to alter the convection scheme.
- **diffusion** *bloc_diffusion* (5.2) for inheritance: Keyword to specify the diffusion operator.
- **initial_conditions|conditions_initiales** *condinits* (5.3) for inheritance: Initial conditions.
- **boundary_conditions|conditions_limites** *condlims* (5.4) for inheritance: Boundary conditions.
- **sources** *sources* (5.5) for inheritance: To introduce a source term into an equation (in case of several source terms into the same equation, the blocks corresponding to the various terms need to be separated by a comma)

- **ecrire_fichier_xyz_valeur** *ecrire_fichier_xyz_valeur_param* (5.6) for inheritance: This keyword is used to write the values of a field for the whole domain or only for some boundaries in a text file with the following format: n_valeur
x_1 y_1 [z_1] val_1
...
x_n y_n [z_n] val_n
The created files are named : pbname_fieldname_[boundaryname]_time.dat
- **ecrire_fichier_xyz_valeur_bin** *ecrire_fichier_xyz_valeur_param* (5.6) for inheritance: This keyword is used to write the values of a field for the whole domain or only for some boundaries in a binary file with the following format: n_valeur
x_1 y_1 [z_1] val_1
...
x_n y_n [z_n] val_n
The created files are named : pbname_fieldname_[boundaryname]_time.dat
- **parametre_equation** *parametre_equation_base* (5.7) for inheritance: Keyword used to specify additional parameters for the equation
- **equation_non_resolue** *str* for inheritance: The equation will not be solved while condition(t) is verified if equation_non_resolue keyword is used. Exemple: The Navier Stokes is not solved between time t0 and t1.
Navier_Sokes_Standard
{ equation_non_resolue (t>t0)*(t<t1) }

5.27 transport_k_epsilon

Description: The (k-eps) transportation equation. To restart from a previous mixing length calculation, an external MED-format file containing reconstructed K and Epsilon quantities can be read (see fichier-_ecriture_k_eps) thanks to the Champ_fonc_MED keyword.
Warning, When used with the Quasi-compressible model, k and eps should be viewed as rho k and rho epsilon when defining initial and boundary conditions or when visualizing values for k and eps. This bug will be fixed in a future version.

Keyword Discretiser should have already be used to read the object.
See also: eqn_base (5.18)

Usage:
transport_k_epsilon obj Lire obj {

[**with_nu** *str into ['yes', 'no']*]
[**convection** *bloc_convection*]
[**diffusion** *bloc_diffusion*]
[**initial_conditions|conditions_initiales** *condinits*]
[**boundary_conditions|conditions_limites** *condlims*]
[**sources** *sources*]
[**ecrire_fichier_xyz_valeur** *ecrire_fichier_xyz_valeur_param*]
[**ecrire_fichier_xyz_valeur_bin** *ecrire_fichier_xyz_valeur_param*]
[**parametre_equation** *parametre_equation_base*]
[**equation_non_resolue** *str*]

}
where

- **with_nu** *str into ['yes', 'no']*: yes/no
- **convection** *bloc_convection* (5.9) for inheritance: Keyword to alter the convection scheme.
- **diffusion** *bloc_diffusion* (5.2) for inheritance: Keyword to specify the diffusion operator.

- **initial_conditions|conditions_initiales** *condinits* (5.3) for inheritance: Initial conditions.
- **boundary_conditions|conditions_limites** *condlims* (5.4) for inheritance: Boundary conditions.
- **sources** *sources* (5.5) for inheritance: To introduce a source term into an equation (in case of several source terms into the same equation, the blocks corresponding to the various terms need to be separated by a comma)
- **ecrire_fichier_xyz_valeur** *ecrire_fichier_xyz_valeur_param* (5.6) for inheritance: This keyword is used to write the values of a field for the whole domain or only for some boundaries in a text file with the following format: n_valeur
x_1 y_1 [z_1] val_1
...
x_n y_n [z_n] val_n
The created files are named : pbname_fieldname_[boundaryname]_time.dat
- **ecrire_fichier_xyz_valeur_bin** *ecrire_fichier_xyz_valeur_param* (5.6) for inheritance: This keyword is used to write the values of a field for the whole domain or only for some boundaries in a binary file with the following format: n_valeur
x_1 y_1 [z_1] val_1
...
x_n y_n [z_n] val_n
The created files are named : pbname_fieldname_[boundaryname]_time.dat
- **parametre_equation** *parametre_equation_base* (5.7) for inheritance: Keyword used to specify additional parameters for the equation
- **equation_non_resolue** *str* for inheritance: The equation will not be solved while condition(t) is verified if equation_non_resolue keyword is used. Exemple: The Navier Stokes is not solved between time t0 and t1.
Navier_Sokes_Standard
{ equation_non_resolue (t>t0)*(t<t1) }

6 /*

6.1 /*

Description: bloc of Comment in a data file.

See also: objet_u (33)

Usage:
/* comm
where

- **comm** *str*: Text to be commented.

7 champ_generique_base

Description: not_set

See also: objet_u (33) champ_post_de_champs_post (7.1) predefini (7.15) champ_post_refchamp (7.17)

Usage:

7.1 champ_post_de_champs_post

Description: not_set

See also: champ_generique_base (7) champ_post_operateur_eqn (7.5) champ_post_transformation (7.19) champ_post_reduction_0d (7.16) champ_post_operateur_base (7.4) champ_post_statistiques_base (7.6) champ_post_extraction (7.10) champ_post_morceau_equation (7.13) champ_post_tparoi_vef (7.18) champ-_post_interpolation (7.12)

Usage:
champ_post_de_champs_post obj Lire obj {

[**source** *champ_generique_base*]
[**nom_source** *str*]
[**source_reference** *str*]
[**sources_reference** *list_nom_virgule*]
[**sources** *listchamp_generique*]

}
where

- **source** *champ_generique_base* (7): the source field.
- **nom_source** *str*: To name a source field with the nom_source keyword
- **source_reference** *str*
- **sources_reference** *list_nom_virgule* (7.2)
- **sources** *listchamp_generique* (7.3): sources { Champ_Post.... { ... } Champ_Post.. { ... }}

7.2 list_nom_virgule

Description: List of name.

See also: listobj (31.3)

Usage:
{ object1 , object2 .... }
list of *nom_anonyme* (22.1) separeted with ,

7.3 listchamp_generique

Description: XXX

See also: listobj (31.3)

Usage:
{ object1 , object2 .... }
list of *champ_generique_base* (7) separeted with ,

7.4 champ_post_operateur_base

Description: not_set

See also: champ_post_de_champs_post (7.1) champ_post_operateur_gradient (7.11) champ_post_operateur-_divergence (7.8)

Usage:
champ_post_operateur_base obj Lire obj {

[**source** *champ_generique_base*]

[**nom_source** *str*]
[**source_reference** *str*]
[**sources_reference** *list_nom_virgule*]
[**sources** *listchamp_generique*]

}
where

- **source** *champ_generique_base* (7) for inheritance: the source field.
- **nom_source** *str* for inheritance: To name a source field with the nom_source keyword
- **source_reference** *str* for inheritance
- **sources_reference** *list_nom_virgule* (7.2) for inheritance
- **sources** *listchamp_generique* (7.3) for inheritance: sources { Champ_Post.... { ... } Champ_Post.. { ... }}

7.5 champ_post_operateur_eqn

Synonymous: **operateur_eqn**

Description: not_set

See also: champ_post_de_champs_post (7.1)

Usage:
champ_post_operateur_eqn obj Lire obj {

[**numero_op** *int*]
[**numero_source** *int*]
[**sans_solveur_masse**]
[**source** *champ_generique_base*]
[**nom_source** *str*]
[**source_reference** *str*]
[**sources_reference** *list_nom_virgule*]
[**sources** *listchamp_generique*]

}
where

- **numero_op** *int*
- **numero_source** *int*
- **sans_solveur_masse**
- **source** *champ_generique_base* (7) for inheritance: the source field.
- **nom_source** *str* for inheritance: To name a source field with the nom_source keyword
- **source_reference** *str* for inheritance
- **sources_reference** *list_nom_virgule* (7.2) for inheritance
- **sources** *listchamp_generique* (7.3) for inheritance: sources { Champ_Post.... { ... } Champ_Post.. { ... }}

7.6 champ_post_statistiques_base

Description: not_set

See also: champ_post_de_champs_post (7.1) correlation (7.7) moyenne (7.14) ecart_type (7.9)

Usage:
champ_post_statistiques_base obj Lire obj {

t_deb *float*
t_fin *float*
[**source** *champ_generique_base*]
[**nom_source** *str*]
[**source_reference** *str*]
[**sources_reference** *list_nom_virgule*]
[**sources** *listchamp_generique*]

}
where

- **t_deb** *float*: Start of integration time
- **t_fin** *float*: End of integration time
- **source** *champ_generique_base* (7) for inheritance: the source field.
- **nom_source** *str* for inheritance: To name a source field with the nom_source keyword
- **source_reference** *str* for inheritance
- **sources_reference** *list_nom_virgule* (7.2) for inheritance
- **sources** *listchamp_generique* (7.3) for inheritance: sources { Champ_Post.... { ... } Champ_Post.. { ... }}

7.7 correlation

Synonymous: **champ_post_statistiques_correlation**

Description: to calculate the correlation between the two fields.

See also: champ_post_statistiques_base (7.6)

Usage:
correlation obj Lire obj {

t_deb *float*
t_fin *float*
[**source** *champ_generique_base*]
[**nom_source** *str*]
[**source_reference** *str*]
[**sources_reference** *list_nom_virgule*]
[**sources** *listchamp_generique*]

}
where

- **t_deb** *float* for inheritance: Start of integration time
- **t_fin** *float* for inheritance: End of integration time
- **source** *champ_generique_base* (7) for inheritance: the source field.
- **nom_source** *str* for inheritance: To name a source field with the nom_source keyword
- **source_reference** *str* for inheritance
- **sources_reference** *list_nom_virgule* (7.2) for inheritance
- **sources** *listchamp_generique* (7.3) for inheritance: sources { Champ_Post.... { ... } Champ_Post.. { ... }}

7.8 champ_post_operateur_divergence

Synonymous: **divergence**

Description: To calculate divergency of a given field.

See also: champ_post_operateur_base (7.4)

Usage:
champ_post_operateur_divergence obj Lire obj {

[**source** *champ_generique_base*]
[**nom_source** *str*]
[**source_reference** *str*]
[**sources_reference** *list_nom_virgule*]
[**sources** *listchamp_generique*]

}
where

- **source** *champ_generique_base* (7) for inheritance: the source field.
- **nom_source** *str* for inheritance: To name a source field with the nom_source keyword
- **source_reference** *str* for inheritance
- **sources_reference** *list_nom_virgule* (7.2) for inheritance
- **sources** *listchamp_generique* (7.3) for inheritance: sources { Champ_Post.... { ... } Champ_Post.. { ... }}

7.9 ecart_type

Synonymous: **champ_post_statistiques_ecart_type**

Description: to calculate the standard deviation (statistic rms) of the field nom_champ.

See also: champ_post_statistiques_base (7.6)

Usage:
ecart_type obj Lire obj {

t_deb *float*
t_fin *float*
[**source** *champ_generique_base*]
[**nom_source** *str*]
[**source_reference** *str*]
[**sources_reference** *list_nom_virgule*]
[**sources** *listchamp_generique*]

}
where

- **t_deb** *float* for inheritance: Start of integration time
- **t_fin** *float* for inheritance: End of integration time
- **source** *champ_generique_base* (7) for inheritance: the source field.
- **nom_source** *str* for inheritance: To name a source field with the nom_source keyword
- **source_reference** *str* for inheritance
- **sources_reference** *list_nom_virgule* (7.2) for inheritance
- **sources** *listchamp_generique* (7.3) for inheritance: sources { Champ_Post.... { ... } Champ_Post.. { ... }}

7.10 champ_post_extraction

Synonymous: **extraction**

Description: To create a surface field (values at the boundary) of a volume field

See also: champ_post_de_champs_post (7.1)

Usage:
champ_post_extraction obj Lire obj {

> **domaine** *str*
> **nom_frontiere** *str*
> [**methode** *str into ['trace', 'champ_frontiere']*]
> [**source** *champ_generique_base*]
> [**nom_source** *str*]
> [**source_reference** *str*]
> [**sources_reference** *list_nom_virgule*]
> [**sources** *listchamp_generique*]

}
where

- **domaine** *str*: name of the volume field
- **nom_frontiere** *str*: boundary name where the values of the volume field will be picked
- **methode** *str into ['trace', 'champ_frontiere']*: name of the extraction method (trace by_default or champ_frontiere)
- **source** *champ_generique_base* (7) for inheritance: the source field.
- **nom_source** *str* for inheritance: To name a source field with the nom_source keyword
- **source_reference** *str* for inheritance
- **sources_reference** *list_nom_virgule* (7.2) for inheritance
- **sources** *listchamp_generique* (7.3) for inheritance: sources { Champ_Post.... { ... } Champ_Post.. { ... }}

7.11 champ_post_operateur_gradient

Synonymous: **gradient**

Description: To calculate gradient of a given field.

See also: champ_post_operateur_base (7.4)

Usage:
champ_post_operateur_gradient obj Lire obj {

> [**source** *champ_generique_base*]
> [**nom_source** *str*]
> [**source_reference** *str*]
> [**sources_reference** *list_nom_virgule*]
> [**sources** *listchamp_generique*]

}
where

- **source** *champ_generique_base* (7) for inheritance: the source field.

- **nom_source** *str* for inheritance: To name a source field with the nom_source keyword
- **source_reference** *str* for inheritance
- **sources_reference** *list_nom_virgule* (7.2) for inheritance
- **sources** *listchamp_generique* (7.3) for inheritance: sources { Champ_Post.... { ... } Champ_Post.. { ... }}

7.12 champ_post_interpolation

Synonymous: **interpolation**

Description: To create a field which is an interpolation of the field given by the keyword source.

See also: champ_post_de_champs_post (7.1)

Usage:
champ_post_interpolation obj Lire obj {

> **localisation** *str*
> [**methode** *str*]
> [**domaine** *str*]
> [**optimisation_sous_maillage** *str into ['default', 'yes', 'no']*]
> [**source** *champ_generique_base*]
> [**nom_source** *str*]
> [**source_reference** *str*]
> [**sources_reference** *list_nom_virgule*]
> [**sources** *listchamp_generique*]

}
where

- **localisation** *str*: type_loc indicate where is done the interpolation (elem for element or som for node).
- **methode** *str*: The optional keyword methode is limited to calculer_champ_post for the moment.
- **domaine** *str*: the domain name where the interpolation is done (by default, the calculation domain)
- **optimisation_sous_maillage** *str into ['default', 'yes', 'no']*
- **source** *champ_generique_base* (7) for inheritance: the source field.
- **nom_source** *str* for inheritance: To name a source field with the nom_source keyword
- **source_reference** *str* for inheritance
- **sources_reference** *list_nom_virgule* (7.2) for inheritance
- **sources** *listchamp_generique* (7.3) for inheritance: sources { Champ_Post.... { ... } Champ_Post.. { ... }}

7.13 champ_post_morceau_equation

Synonymous: **morceau_equation**

Description: To calculate a field related to a piece of equation. For the moment, the field which can be calculated is the stability time step of an operator equation. The problem name and the unknown of the equation should be given by Source refChamp { Pb_Champ problem_name unknown_field_of_equation }

See also: champ_post_de_champs_post (7.1)

Usage:
champ_post_morceau_equation obj Lire obj {

type *str*
numero *int*
option *str into ['stabilite', 'flux_bords']*
[**compo** *int*]
[**source** *champ_generique_base*]
[**nom_source** *str*]
[**source_reference** *str*]
[**sources_reference** *list_nom_virgule*]
[**sources** *listchamp_generique*]

}
where

- **type** *str*: can only be operateur for equation operators.
- **numero** *int*: numero will be 0 (diffusive operator) or 1 (convective operator).
- **option** *str into ['stabilite', 'flux_bords']*: option is stability for time steps or flux_bords for boundary fluxes.
- **compo** *int*: compo will specify the number component of the boundary flux (for boundary fluxes, in this case compo permits to specify the number component of the boundary flux choosen).
- **source** *champ_generique_base* (7) for inheritance: the source field.
- **nom_source** *str* for inheritance: To name a source field with the nom_source keyword
- **source_reference** *str* for inheritance
- **sources_reference** *list_nom_virgule* (7.2) for inheritance
- **sources** *listchamp_generique* (7.3) for inheritance: sources { Champ_Post.... { ... } Champ_Post.. { ... }}

7.14 moyenne

Synonymous: **champ_post_statistiques_moyenne**

Description: to calculate the average of the field over time

See also: champ_post_statistiques_base (7.6)

Usage:
moyenne obj Lire obj {

[**moyenne_convergee** *champ_base*]
t_deb *float*
t_fin *float*
[**source** *champ_generique_base*]
[**nom_source** *str*]
[**source_reference** *str*]
[**sources_reference** *list_nom_virgule*]
[**sources** *listchamp_generique*]

}
where

- **moyenne_convergee** *champ_base* (15.1): This option allows to read a converged time averaged field in a .xyz file in order to calculate, when restarting the calculation, the statistics fields (rms, correlation) which depend on this average. In that case, the time averaged field is not updated during the restarting calculation. In this case, the time averaged field must be fully converged to avoid errors when calculating high order statistics.
- **t_deb** *float* for inheritance: Start of integration time

- **t_fin** *float* for inheritance: End of integration time
- **source** *champ_generique_base* (7) for inheritance: the source field.
- **nom_source** *str* for inheritance: To name a source field with the nom_source keyword
- **source_reference** *str* for inheritance
- **sources_reference** *list_nom_virgule* (7.2) for inheritance
- **sources** *listchamp_generique* (7.3) for inheritance: sources { Champ_Post.... { ... } Champ_Post.. { ... }}

7.15 predefini

Description: These keyword is used to post process predefined postprocessing fields. For the moment, only kinetic energy (energie_cinetique keyword to use for field_name) is available.

See also: champ_generique_base (7)

Usage:
predefini obj Lire obj {

pb_champ *deuxmots*

}
where

- **pb_champ** *deuxmots* (5.20): { Pb_champ nom_pb nom_champ } : nom_pb is the problem name and nom_champ is the selected field name.

7.16 champ_post_reduction_0d

Synonymous: **reduction_0d**

Description: To calculate the min, max, or mean value of a field.

See also: champ_post_de_champs_post (7.1)

Usage:
champ_post_reduction_0d obj Lire obj {

methode *str into ['min', 'max', 'moyenne', 'somme', 'moyenne_ponderee', 'somme_ponderee', 'norme_l2', 'normalized_norm_l2']*
[**source** *champ_generique_base*]
[**nom_source** *str*]
[**source_reference** *str*]
[**sources_reference** *list_nom_virgule*]
[**sources** *listchamp_generique*]

}
where

- **methode** *str into ['min', 'max', 'moyenne', 'somme', 'moyenne_ponderee', 'somme_ponderee', 'norme_l2', 'normalized_norm_l2']*: name of the reduction method (min, max, somme for the sum, somme_ponderee for a weighted sum (integral), norme_L2 for the L2 norm, normalized_norm_L2 for the L2 norm normalized, moyenne for a mean and moyenne_ponderee for a mean ponderated by integration volumes, e.g: cell volumes for temperature or pressure in VDF, volumes around faces for velocity and temperature in VEF)

- **source** *champ_generique_base* (7) for inheritance: the source field.
- **nom_source** *str* for inheritance: To name a source field with the nom_source keyword
- **source_reference** *str* for inheritance
- **sources_reference** *list_nom_virgule* (7.2) for inheritance
- **sources** *listchamp_generique* (7.3) for inheritance: sources { Champ_Post.... { ... } Champ_Post.. { ... }}

7.17 champ_post_refchamp

Synonymous: **refchamp**

Description: Field of prolem

See also: champ_generique_base (7)

Usage:
champ_post_refchamp obj Lire obj {

> **pb_champ** *deuxmots*
> [**nom_source** *str*]

}
where

- **pb_champ** *deuxmots* (5.20): { Pb_champ nom_pb nom_champ } : nom_pb is the problem name and nom_champ is the selected field name.
- **nom_source** *str*: The alias name for the field

7.18 champ_post_tparoi_vef

Synonymous: **tparoi_vef**

Description: These keyword is used to post process (only for VEF discretization) the temperature field with a slight difference on boundaries with Neumann condition where law of the wall is applied on the temperature field. nom_pb is the problem name and field_name is the selected field name. A keyword (temperature_physique) is available to post process this field without using Definition_champs.

See also: champ_post_de_champs_post (7.1)

Usage:
champ_post_tparoi_vef obj Lire obj {

> [**source** *champ_generique_base*]
> [**nom_source** *str*]
> [**source_reference** *str*]
> [**sources_reference** *list_nom_virgule*]
> [**sources** *listchamp_generique*]

}
where

- **source** *champ_generique_base* (7) for inheritance: the source field.
- **nom_source** *str* for inheritance: To name a source field with the nom_source keyword
- **source_reference** *str* for inheritance

- **sources_reference** *list_nom_virgule* (7.2) for inheritance
- **sources** *listchamp_generique* (7.3) for inheritance: sources { Champ_Post.... { ... } Champ_Post.. { ... }}

7.19 champ_post_transformation

Synonymous: **transformation**

Description: To create a field with a transformation.

See also: champ_post_de_champs_post (7.1)

Usage:
champ_post_transformation obj Lire obj {

> **methode** *str into ['produit_scalaire', 'norme', 'vecteur', 'formule', 'composante']*
> [**expression** *n word1 word2 ... wordn*]
> [**numero** *int*]
> [**localisation** *str*]
> [**source** *champ_generique_base*]
> [**nom_source** *str*]
> [**source_reference** *str*]
> [**sources_reference** *list_nom_virgule*]
> [**sources** *listchamp_generique*]

}
where

- **methode** *str into ['produit_scalaire', 'norme', 'vecteur', 'formule', 'composante']*: methode norme : will calculate the norm of a vector given by a source field
  methode produit_scalaire : will calculate the dot product of two vectors given by two sources fields
  methode composante numero integer : will create a field by extracting the integer component of a field given by a source field
  methode formule expression 1 : will create a scalar field located to elements using expressions with x,y,z,t parameters and field names given by a source field or several sources fields.
  methode vecteur expression N f1(x,y,z,t) fN(x,y,z,t) : will create a vector field located to elements by defining its N components with N expressions with x,y,z,t parameters and field names given by a source field or several sources fields.
- **expression** *n word1 word2 ... wordn*: see methodes formule and vecteur
- **numero** *int*: see methode composante
- **localisation** *str*: type_loc indicate where is done the interpolation (elem for element or som for node). The optional keyword methode is limited to calculer_champ_post for the moment
- **source** *champ_generique_base* (7) for inheritance: the source field.
- **nom_source** *str* for inheritance: To name a source field with the nom_source keyword
- **source_reference** *str* for inheritance
- **sources_reference** *list_nom_virgule* (7.2) for inheritance
- **sources** *listchamp_generique* (7.3) for inheritance: sources { Champ_Post.... { ... } Champ_Post.. { ... }}

8 chimie

Description: Keyword to describe the chmical reactions

See also: objet_u (33)

Usage:
chimie obj Lire obj {

> **reactions** *reactions*
> [**modele_micro_melange** *int*]
> [**constante_modele_micro_melange** *float*]
> [**espece_en_competition_micro_melange** *str*]

}
where

- **reactions** *reactions* (8.1): list of reactions
- **modele_micro_melange** *int*: modele_micro_melange (0 by default)
- **constante_modele_micro_melange** *float*: constante of modele (1 by default)
- **espece_en_competition_micro_melange** *str*: espece in competition in reactions

8.1 reactions

Description: list of reactions

See also: listobj (31.3)

Usage:
{ object1 , object2 .... }
list of *reaction* (8.1.1) separeted with ,

8.1.1 reaction

Description: Keyword to describe reaction:
w =K pow(T,beta) exp(-Ea/(R T)) Π pow(Reactif_i,activitivity_i).
If K_inv >0,
w= K pow(T,beta) exp(-Ea/(R T)) (Π pow(Reactif_i,activitivity_i) - Kinv/exp(-c_r_Ea/(R T)) Π pow(Produit-_i,activitivity_i))

See also: objet_lecture (32)

Usage:
{

> **reactifs** *str*
> **produits** *str*
> [**constante_taux_reaction** *float*]
> [**coefficients_activites** *bloc_lecture*]
> **enthalpie_reaction** *float*
> **energie_activation** *float*
> **exposant_beta** *float*
> [**contre_reaction** *float*]
> [**contre_energie_activation** *float*]

}
where

- **reactifs** *str*: LHS of equation (ex CH4+2*O2)
- **produits** *str*: RHS of equation (ex CO2+2*H20)

- **constante_taux_reaction** *float*: constante of cinetic K
- **coefficients_activites** *bloc_lecture* (3.39): coefficients od ativity (exemple { CH4 1 O2 2 })
- **enthalpie_reaction** *float*: DH
- **energie_activation** *float*: Ea
- **exposant_beta** *float*: Beta
- **contre_reaction** *float*: K_inv
- **contre_energie_activation** *float*: c_r_Ea

9 class_generic

Description: not_set

See also: objet_u (33) dt_start (9.5) solveur_sys_base (9.12)

Usage:

9.1 cholesky

Description: Cholesky direct method.

See also: solveur_sys_base (9.12)

Usage:
cholesky obj Lire obj {

[**impr**]
[**quiet**]

}
where

- **impr** : Keyword which may be used to print the resolution time.
- **quiet** : To disable printing of information

9.2 dt_calc

Description: The time step at first iteration is calculated in agreement with CFL condition.

See also: dt_start (9.5)

Usage:
dt_calc

9.3 dt_fixe

Description: The first time step is fixed by the user (recommended when restarting calculation with Crank Nicholson temporal scheme to ensure continuity).

See also: dt_start (9.5)

Usage:
dt_fixe value
where

- **value** *float*: first time step.

9.4 dt_min

Description: The first iteration is based on dt_min.

See also: dt_start (9.5)

Usage:
dt_min

9.5 dt_start

Description: not_set

See also: class_generic (9) dt_calc (9.2) dt_min (9.4) dt_fixe (9.3)

Usage:
dt_start

9.6 gcp_ns

Description: not_set

See also: gcp (9.11)

Usage:
gcp_ns obj Lire obj {

> **solveur0** *solveur_sys_base*
> **solveur1** *solveur_sys_base*
> [**precond** *precond_base*]
> [**precond_nul**]
> **seuil** *float*
> [**impr**]
> [**quiet**]
> [**save_matrix|save_matrice**]
> [**optimized**]
> [**nb_it_max** *int*]

}
where

- **solveur0** *solveur_sys_base* (9.12): Solver type.
- **solveur1** *solveur_sys_base* (9.12): Solver type.
- **precond** *precond_base* (24) for inheritance: Keyword to define system preconditioning in order to accelerate resolution by the conjugated gradient. Many parallel preconditioning methods are not equivalent to their sequential counterpart, and you should therefore expect differences, especially when you select a high value of the final residue (seuil). The result depends on the number of processors and on the mesh splitting. It is sometimes useful to run the solver with no preconditioning at all. In particular:
  - when the solver does not converge during initial projection,
  - when comparing sequential and parallel computations.
  With no preconditioning, except in some particular cases (no open boundary), the sequential and the parallel computations should provide exactly the same results within fpu accuracy. If not, there might be a coding error or the system of equations is singular.
- **precond_nul** for inheritance: Keyword to not use a preconditioning method.

- **seuil** *float* for inheritance: Value of the final residue. The gradient ceases iteration when the Euclidean residue standard ||Ax-B|| is less than this value.
- **impr** for inheritance: Keyword which is used to request display of the Euclidean residue standard each time this iterates through the conjugated gradient (display to the standard outlet).
- **quiet** for inheritance: To not displaying any outputs of the solver.
- **save_matrix|save_matrice** for inheritance: to save the matrix in a file.
- **optimized** for inheritance: This keyword triggers a memory and network optimized algorithms useful for strong scaling (when computing less than 100 000 elements per processor). The matrix and the vectors are duplicated, common items removed and only virtual items really used in the matrix are exchanged.
  Warning: this is experimental and known to fail in some VEF computations (L2 projection step will not converge). Works well in VDF.
- **nb_it_max** *int* for inheritance: Keyword to set the maximum iterations number for the Gcp.

9.7 gen

Description: not_set

See also: solveur_sys_base (9.12)

Usage:
gen data
where

- **data** *bloc_lecture* (3.39)

9.8 gmres

Description: Gmres method (for non symetric matrix).

See also: solveur_sys_base (9.12)

Usage:
gmres obj Lire obj {

[**impr**]
[**quiet**]
[**seuil** *float*]
[**diag**]
[**nb_it_max** *int*]
[**controle_residu** *int into [0, 1]*]
[**save_matrix|save_matrice**]
[**dim_espace_krilov** *int*]

}
where

- **impr** : Keyword which may be used to print the convergence.
- **quiet** : To disable printing of information
- **seuil** *float*: Convergence value.
- **diag** : Keyword to use diagonal preconditionner (in place of pilut that is not parallel).
- **nb_it_max** *int*: Keyword to set the maximum iterations number for the Gmres.
- **controle_residu** *int into [0, 1]*: Keyword of Boolean type (by default 0). If set to 1, the convergence occurs if the residu suddenly increases.

- **save_matrix|save_matrice** : to save the matrix in a file.
- **dim_espace_krilov** *int*

9.9 optimal

Description: Optimal is a solver which tests several solvers of the previous list to choose the fastest one for the considered linear system.

See also: solveur_sys_base (9.12)

Usage:
optimal obj Lire obj {

seuil *float*
[**impr**]
[**quiet**]
[**save_matrix|save_matrice**]
[**frequence_recalc** *int*]
[**nom_fichier_solveur** *str*]
[**fichier_solveur_non_recree**]

}
where

- **seuil** *float*: Convergence threshold
- **impr** : To print the convergency of the fastest solver
- **quiet** : To disable printing of information
- **save_matrix|save_matrice** : To save the linear system (A, x, B) into a file
- **frequence_recalc** *int*: To set a time step period (by default, 100) for re-checking the fatest solver
- **nom_fichier_solveur** *str*: To specify the file containing the list of the tested solvers
- **fichier_solveur_non_recree** : To avoid the creation of the file containing the list

9.10 petsc

Description: Solveur via Petsc API

Usage:

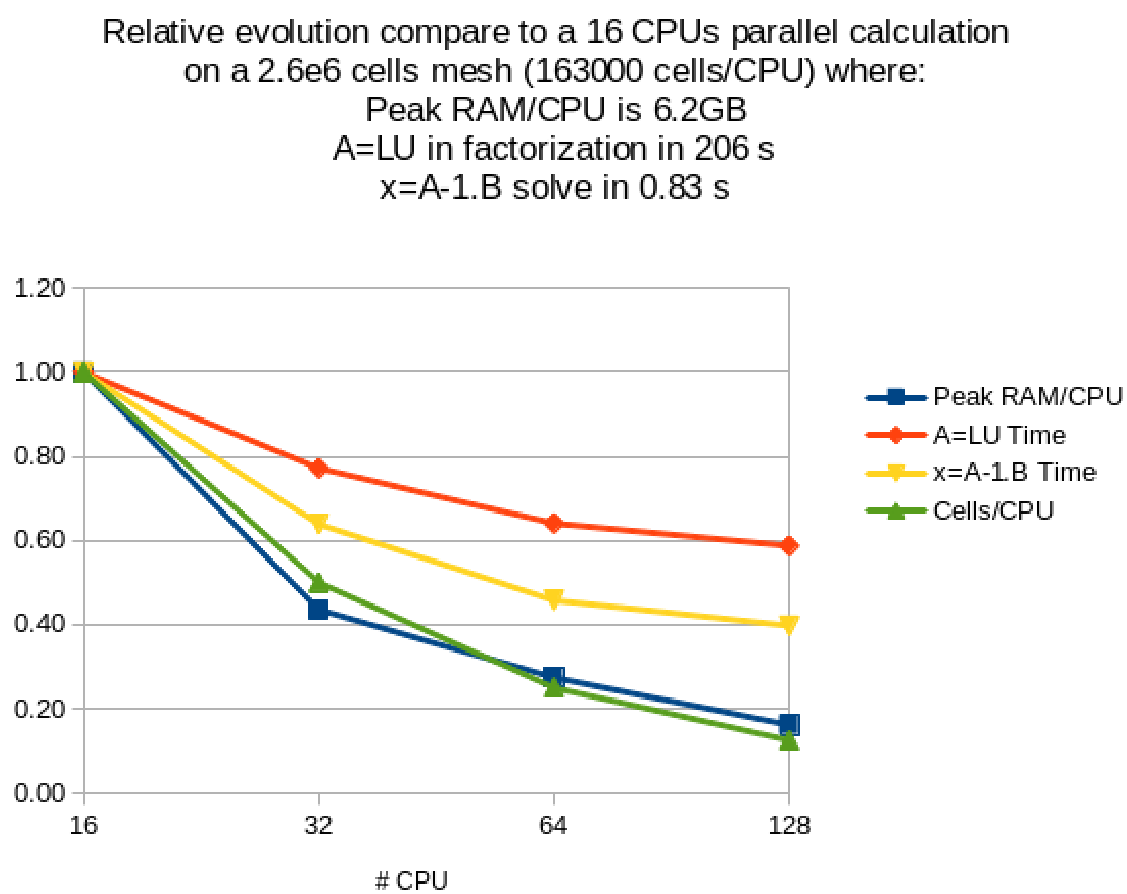
Solveur_pression **Petsc** *Solver* { **precond** *Precond*
[**seuil** *seuil* | **nb_it_max** *integer*]
[**impr** | **quiet**]
[**save_matrix** | **read_matrix**]
}

Solver : Several solvers through PETSc API are available :
GCP : Conjugate Gradient
PIPECG : Pipelined Conjugate Gradient (possible reduced CPU cost during massive parallel calculation due to a single non-blocking reduction per iteration, if TRUST is built with a MPI-3 implementation).
GMRES : Generalized Minimal Residual
BICGSTAB : Stabilized Bi-Conjugate Gradient
IBICGSTAB : Improved version of previous one for massive parallel computations (only a single global reduction operation instead of the usual 3 or 4).

CHOLESKY : Parallelized version of Cholesky from MUMPS library. This solver accepts since the 1.6.7 version an option to select a different ordering than the automatic selected one by MUMPS (and printed by using the **impr** option). The possible choices are **Metis | Scotch | PT-Scotch | Parmetis**. The two last options can't only be used during a parallel calculation, whereas the two first are available for sequential or parallel calculations. It seems that the CPU cost of A=LU factorization but also of the backward/forward elimination steps may sometimes be reduced by selecting a different ordering than the default one. Notice that this solver requires a huge amont of memory compared to iterative methods. To know how many RAM you will need by core, then use the **impr** option to have detailled informations during the analysis phase and before the factorisation phase (in the following output, you will learn that the largest memory is taken by the 0^{th} CPU with 108MB):

...
** Rank of proc needing largest memory in IC facto : 0
**** Estimated corresponding MBYTES for IC facto : 108**
...

Thanks to the following graph, you read that in order to solve for instance a flow on a mesh with 2.6e6 cells, you will need to run a parallel calculation on 32 CPUs if you have cluster nodes with only 4GB/core (6.2GB*0.42~2.6GB) :



CHOLESKY_OUT_OF_CORE : Same as the previous one but with a written LU decomposition of disc (save RAM memory but add an extra CPU cost during Ax=B solve)
CHOLESKY_SUPERLU : Parallelized Cholesky from SUPERLU_DIST library (less CPU and RAM efficient than the previous one)

CHOLESKY_PASTIX : Parallelized Cholesky from PASTIX library
CHOLESKY_UMFPACK : Sequential Cholesky from UMFPACK library (seems fast).
CLI { string } : Command Line Interface. Should be used only by advanced users, to access the whole solver/preconditioners from the PETSC API. To find all the available options, run your calculation with the -ksp_view -help options:

trust datafile [N] –ksp_view –help
. . .
Preconditioner (PC) Options ---
-pc_type Preconditioner:(one of) none jacobi pbjacobi bjacobi sor lu shell mg
eisenstat ilu icc cholesky asm ksp composite redundant nn mat fieldsplit galerkin openmp spai hypre tfs (PCSetType)
HYPRE preconditioner options
-pc_hypre_type <pilut> (choose one of) pilut parasails boomeramg
HYPRE ParaSails Options
-pc_hypre_parasails_nlevels <1>: Number of number of levels (None)
-pc_hypre_parasails_thresh <0.1>: Threshold (None)
-pc_hypre_parasails_filter <0.1>: filter (None)
-pc_hypre_parasails_loadbal <0>: Load balance (None)
-pc_hypre_parasails_logging: <FALSE> Print info to screen (None)
-pc_hypre_parasails_reuse: <FALSE> Reuse nonzero pattern in preconditioner (None)
-pc_hypre_parasails_sym <nonsymmetric> (choose one of) nonsymmetric SPD nonsymmetric,SPD
Krylov Method (KSP) Options ---
-ksp_type Krylov method:(one of) cg cgne stcg gltr richardson chebychev gmres tcqmr
bcgs bcgsl cgs tfqmr cr lsqr preonly qcg bicg fgmres minres symmlq lgmres lcd (KSPSetType)
-ksp_max_it <10000>: Maximum number of iterations (KSPSetTolerances)
-ksp_rtol <0>: Relative decrease in residual norm (KSPSetTolerances)
-ksp_atol <1e-12>: Absolute value of residual norm (KSPSetTolerances)
-ksp_divtol <10000>: Residual norm increase cause divergence (KSPSetTolerances)
-ksp_converged_use_initial_residual_norm: Use initial residual residual norm for computing relative convergence
-ksp_monitor_singular_value <stdout>: Monitor singular values (KSPMonitorSet)
-ksp_monitor_short <stdout>: Monitor preconditioned residual norm with fewer digits (KSPMonitorSet)
-ksp_monitor_draw: Monitor graphically preconditioned residual norm (KSPMonitorSet)
-ksp_monitor_draw_true_residual: Monitor graphically true residual norm (KSPMonitorSet)

Example to use the multigrid method as a solver, not only as a preconditioner:
Solveur_pression Petsc CLI { -ksp_type richardson -pc_type hypre -pc_hypre_type boomeramg -ksp_atol 1.e-7 }

Precond : Several preconditioners are available :
NULL { } : No preconditioner used
BLOCK_JACOBI_ICC { **level** k **ordering natural | rcm** } : Incomplete Cholesky factorization for symmetric matrix with the PETSc implementation. The integer k is the factorization level (default value, 1). In parallel, the factorization is done by block (one per processor by default). The ordering of the local matrix is **natural** by default, but **rcm** ordering, which reduces the bandwith of the local matrix, may interestingly improves the quality of the decomposition and reduces the number of iterations.
SSOR { **omega** double } : Symmetric Successive Over Relaxation algorithm. **omega** (default value, 1.5) defines the relaxation factor.
EISENTAT { **omega** double } : SSOR version with Eisenstat trick which reduces the number of computations and thus CPU cost
SPAI { **level** nlevels **epsilon** thresh } : Spai Approximate Inverse algorithm from Parasails Hypre library. Two parameters are available, nlevels and thresh.

PILUT { **level** k **epsilon** thresh }: Dual Threashold Incomplete LU factorization. The integer k is the factorization level and **epsilon** is the drop tolerance.
DIAG { } : Diagonal (Jacobi) preconditioner.
BOOMERAMG { } : Multigrid preconditioner (no option is available yet, look at CLI command and Petsc documentation to try other options).

seuil corresponds to the iterative solver convergence value. The iterative solver converges when the Euclidean residue standard ||Ax-B|| is less than the value *seuil*.

nb_it_max integer : In order to specify a given number of iterations instead of a condition on the residue with the keyword **seuil**. May be useful when defining a PETSc solver for the implicit time scheme where convergence is very fast: 5 or less iterations seems enough.

impr is the keyword which is used to request display of the Euclidean residue standard each time this iterates through the conjugated gradient (display to the standard outlet).

quiet is a keyword which is used to not displaying any outputs of the solver.

save_matrix|read_matrix are the keywords to save|read into a file the constant matrix A of the linear system Ax=B solved (eg: matrix from the pressure linear system for an incompressible flow). It is useful when you want to minimize the MPI communications on massive parallel calculation. Indeed, in VEF discretization, the overlapping width (generaly 2, specified with the **largeur_joint** option in the partition keyword **partition**) can be reduced to 1, once the matrix has been properly assembled and saved. The cost of the MPI communications in TRUST itself (not in PETSc) will be reduced with length messages divided by 2. So the strategy is:
I) Partition your VEF mesh with a **largeur_joint** value of 2
II) Run your parallel calculation on 0 time step, to build and save the matrix with the **save_matrix** option. A file named *Matrix_NBROWS_rows_NCPUS_cpus.petsc* will be saved to the disc (where NBROWS is the number of rows of the matrix and NCPUS the number of CPUs used).
III) Partition your VEF mesh with a **largeur_joint** value of 1
IV) Run your parallel calculation completly now and substitute the **save_matrix** option by the **read_matrix** option. Some interesting gains have been noticed when the cost of linear system solve with PETSc is small compared to all the other operations.

TIPS:
A) Solver for symmetric linear systems (e.g: Pressure system from Navier Stokes equation):
-The **CHOLESKY** parallel solver is from MUMPS library. It offers better performance than all others solvers if you have enough RAM for your calculation. A parallel calculation on a cluster with 4GBytes on each processor, 40000 cells/processor seems the upper limit. Seems to be very slow to initialize above 500 cpus/cores.

-When running a parallel calculation with a high number of cpus/cores (typically more than 500) where preconditioner scalabilty is the key for CPU performance, consider **BICGSTAB** with **BLOCK_JACOBI_ICC(1)** as preconditioner or if not converges, **GCP** with **BLOCK_JACOBI_ICC(1)** as preconditioner.

-For other situations, the first choice should be **GCP/SSOR**. In order to fine tune the solver choice, each one of the previous list should be considered. Indeed, the CPU speed of a solver depends of a lot of parameters. You may give a try to the **OPTIMAL** solver to help you to find the fastest solver on your study.

B) Solver for non symmetric linear systems (e.g.: Implicit schemes):
The **BICGSTAB/DIAG** solver seems to offer the best performances.

Additional information is available into the PETSC documentation available there: **$TRUST_ROOT/lib/src/LIBPETSC/petsc/*/do**

See also: solveur_sys_base (9.12)

Usage:
petsc solveur option_solveur
where

- **solveur** *str*
- **option_solveur** *bloc_lecture* (3.39)

9.11 gcp

Description: Preconditioned conjugated gradient.

See also: solveur_sys_base (9.12) gcp_ns (9.6)

Usage:
gcp obj Lire obj {

> [**precond** *precond_base*]
> [**precond_nul**]
> **seuil** *float*
> [**impr**]
> [**quiet**]
> [**save_matrix|save_matrice**]
> [**optimized**]
> [**nb_it_max** *int*]

}
where

- **precond** *precond_base* (24): Keyword to define system preconditioning in order to accelerate resolution by the conjugated gradient. Many parallel preconditioning methods are not equivalent to their sequential counterpart, and you should therefore expect differences, especially when you select a high value of the final residue (seuil). The result depends on the number of processors and on the mesh splitting. It is sometimes useful to run the solver with no preconditioning at all. In particular:
  - when the solver does not converge during initial projection,
  - when comparing sequential and parallel computations.
  With no preconditioning, except in some particular cases (no open boundary), the sequential and the parallel computations should provide exactly the same results within fpu accuracy. If not, there might be a coding error or the system of equations is singular.
- **precond_nul** : Keyword to not use a preconditioning method.
- **seuil** *float*: Value of the final residue. The gradient ceases iteration when the Euclidean residue standard ||Ax-B|| is less than this value.
- **impr** : Keyword which is used to request display of the Euclidean residue standard each time this iterates through the conjugated gradient (display to the standard outlet).
- **quiet** : To not displaying any outputs of the solver.
- **save_matrix|save_matrice** : to save the matrix in a file.
- **optimized** : This keyword triggers a memory and network optimized algorithms useful for strong scaling (when computing less than 100 000 elements per processor). The matrix and the vectors are duplicated, common items removed and only virtual items really used in the matrix are exchanged. Warning: this is experimental and known to fail in some VEF computations (L2 projection step will not converge). Works well in VDF.
- **nb_it_max** *int*: Keyword to set the maximum iterations number for the Gcp.

9.12 solveur_sys_base

Description: Basic class to solve the linear system.

See also: class_generic (9) optimal (9.9) gen (9.7) petsc (9.10) gcp (9.11) cholesky (9.1) gmres (9.8)

Usage:

10

10.1

Description: Comments in a data file.

See also: objet_u (33)

Usage:
 # comm
where

- **comm** *str*: Text to be commented.

11 condlim_base

Description: Basic class of boundary conditions.

See also: objet_u (33) paroi_fixe (11.31) symetrie (11.40) periodique (11.37) paroi_decalee_robin (11.23) paroi_adiabatique (11.20) dirichlet (11.2) neumann (11.19) paroi_contact (11.21) paroi_contact_fictif (11.22) paroi_echange_contact_vdf (11.27) paroi_echange_externe_impose (11.28) paroi_echange_global_impose (11.30) Paroi (11.1) frontiere_ouverte_k_eps_impose (11.11) paroi_flux_impose (11.33) frontiere_ouverte_fraction_massique_imposee (11.6) paroi_echange_contact_correlation_vdf (11.25) paroi_echange_contact_correlation_vef (11.26)

Usage:
condlim_base

11.1 Paroi

Description: Impermeability condition at a wall called bord (edge) (standard flux zero). This condition must be associated with a wall type hydraulic condition.

See also: condlim_base (11)

Usage:
Paroi

11.2 dirichlet

Description: Dirichlet condition at the boundary called bord (edge) : 1). For NAVIER STOKES equations, speed imposed at the boundary; 2). For scalar transport equation, scalar imposed at the boundary.

See also: condlim_base (11) paroi_defilante (11.24) paroi_knudsen_non_negligeable (11.34) paroi_rugueuse

(11.35) frontiere_ouverte_vitesse_imposee (11.17) frontiere_ouverte_temperature_imposee (11.16) frontiere_ouverte_concentration_imposee (11.5) paroi_temperature_imposee (11.36) scalaire_impose_paroi (11.38)

Usage:
dirichlet

11.3 entree_temperature_imposee_h

Description: Particular case of class frontiere_ouverte_temperature_imposee for enthalpy equation.

See also: frontiere_ouverte_temperature_imposee (11.16)

Usage:
entree_temperature_imposee_h ch
where

- **ch** *champ_front_base* (16.1): Boundary field type.

11.4 frontiere_ouverte

Description: Boundary outlet condition on the boundary called bord (edge) (diffusion flux zero). This condition must be associated with a boundary outlet hydraulic condition.

See also: neumann (11.19)

Usage:
frontiere_ouverte var_name ch
where

- **var_name** *str into ['T_ext', 'C_ext', 'K_Eps_ext', 'Fluctu_Temperature_ext', 'Flux_Chaleur_Turb_ext', 'V2_ext']*: Field name.
- **ch** *champ_front_base* (16.1): Boundary field type.

11.5 frontiere_ouverte_concentration_imposee

Description: Imposed concentration condition at an open boundary called bord (edge) (situation corresponding to a fluid inlet). This condition must be associated with an imposed inlet speed condition.

See also: dirichlet (11.2)

Usage:
frontiere_ouverte_concentration_imposee ch
where

- **ch** *champ_front_base* (16.1): Boundary field type.

11.6 frontiere_ouverte_fraction_massique_imposee

Description: not_set

See also: condlim_base (11)

Usage:

frontiere_ouverte_fraction_massique_imposee ch
where

- **ch** *champ_front_base* (16.1): Boundary field type.

11.7 frontiere_ouverte_gradient_pression_impose

Description: Normal imposed pressure gradient condition on the open boundary called bord (edge). This boundary condition may be only used in VDF discretization. The imposed $\partial P/\partial n$ value is expressed in Pa.m-1.

See also: neumann (11.19) frontiere_ouverte_gradient_pression_impose_vefprep1b (11.8)

Usage:
frontiere_ouverte_gradient_pression_impose ch
where

- **ch** *champ_front_base* (16.1): Boundary field type.

11.8 frontiere_ouverte_gradient_pression_impose_vefprep1b

Description: Keyword for an outlet boundary condition in VEF P1B/P1NC on the gradient of the pressure.

See also: frontiere_ouverte_gradient_pression_impose (11.7)

Usage:
frontiere_ouverte_gradient_pression_impose_vefprep1b ch
where

- **ch** *champ_front_base* (16.1): Boundary field type.

11.9 frontiere_ouverte_gradient_pression_libre_vef

Description: Class for outlet boundary condition in VEF like Orlansky. There is no reference for pressure for theses boundary conditions so it is better to add pressure condition (with Frontiere_ouverte_pression_imposee) on one or two cells (for symmetry in a channel) of the boundary where Orlansky conditions are imposed.

See also: neumann (11.19)

Usage:
frontiere_ouverte_gradient_pression_libre_vef

11.10 frontiere_ouverte_gradient_pression_libre_vefprep1b

Description: Class for outlet boundary condition in VEF P1B/P1NC like Orlansky.

See also: neumann (11.19)

Usage:
frontiere_ouverte_gradient_pression_libre_vefprep1b

11.11 frontiere_ouverte_k_eps_impose

Description: Turbulence condition imposed on an open boundary called bord (edge) (this situation corresponds to a fluid inlet). This condition must be associated with an imposed inlet speed condition.

See also: condlim_base (11)

Usage:
frontiere_ouverte_k_eps_impose ch
where

- **ch** *champ_front_base* (16.1): Boundary field type.

11.12 frontiere_ouverte_pression_imposee

Description: Imposed pressure condition at the open boundary called bord (edge). The imposed pressure field is expressed in Pa.

See also: neumann (11.19)

Usage:
frontiere_ouverte_pression_imposee ch
where

- **ch** *champ_front_base* (16.1): Boundary field type.

11.13 frontiere_ouverte_pression_imposee_orlansky

Description: This boundary condition may only be used with VDF discretization. There is no reference for pressure for this boundary condition so it is better to add pressure condition (with Frontiere_ouverte_pression_imposee) on one or two cells (for symetry in a channel) of the boundary where Orlansky conditions are imposed.

See also: neumann (11.19)

Usage:
frontiere_ouverte_pression_imposee_orlansky

11.14 frontiere_ouverte_pression_moyenne_imposee

Description: Class for open boundary with pressure mean level imposed.

See also: neumann (11.19)

Usage:
frontiere_ouverte_pression_moyenne_imposee pext
where

- **pext** *float*: Mean pressure.

11.15 frontiere_ouverte_rho_u_impose

Description: This keyword is used to designate a condition of imposed mass rate at an open boundary called bord (edge). The imposed mass rate field at the inlet is vectorial and the imposed speed values are expressed in kg.s-1. This boundary condition can be used only with the Quasi compressible model.

See also: frontiere_ouverte_vitesse_imposee_sortie (11.18)

Usage:
frontiere_ouverte_rho_u_impose ch
where

- **ch** *champ_front_base* (16.1): Boundary field type.

11.16 frontiere_ouverte_temperature_imposee

Description: Imposed temperature condition at the open boundary called bord (edge) (in the case of fluid inlet). This condition must be associated with an imposed inlet speed condition. The imposed temperature value is expressed in oC or K.

See also: dirichlet (11.2) entree_temperature_imposee_h (11.3)

Usage:
frontiere_ouverte_temperature_imposee ch
where

- **ch** *champ_front_base* (16.1): Boundary field type.

11.17 frontiere_ouverte_vitesse_imposee

Description: Class for velocity-inlet boundary condition. The imposed speed field at the inlet is vectorial and the imposed speed values are expressed in m.s-1.

See also: dirichlet (11.2) frontiere_ouverte_vitesse_imposee_sortie (11.18)

Usage:
frontiere_ouverte_vitesse_imposee ch
where

- **ch** *champ_front_base* (16.1): Boundary field type.

11.18 frontiere_ouverte_vitesse_imposee_sortie

Description: Sub-class for velocity boundary condition. The imposed speed field at the open boundary is vectorial and the imposed speed values are expressed in m.s-1.

See also: frontiere_ouverte_vitesse_imposee (11.17) frontiere_ouverte_rho_u_impose (11.15)

Usage:
frontiere_ouverte_vitesse_imposee_sortie ch
where

- **ch** *champ_front_base* (16.1): Boundary field type.

11.19 neumann

Description: Neumann condition at the boundary called bord (edge) : 1). For NAVIER STOKES equations, constraint imposed at the boundary; 2). For scalar transport equation, flux imposed at the boundary.

See also: condlim_base (11) frontiere_ouverte_gradient_pression_libre_vef (11.9) frontiere_ouverte_gradient_pression_libre_vefprep1b (11.10) frontiere_ouverte_gradient_pression_impose (11.7) frontiere_ouverte_pression_imposee (11.12) frontiere_ouverte_pression_imposee_orlansky (11.13) frontiere_ouverte_pression_moyenne_imposee (11.14) frontiere_ouverte (11.4) sortie_libre_temperature_imposee_h (11.39)

Usage:
neumann

11.20 paroi_adiabatique

Description: Normal zero flux condition at the wall called bord (edge).

See also: condlim_base (11)

Usage:
paroi_adiabatique

11.21 paroi_contact

Description: Thermal condition between two domains. Important: the name of the boundaries in the two domains should be the same. (Warning: there is also an old limitation not yet fixed on the sequential algorithm in VDF to detect the matching faces on the two boundaries: faces should be ordered in the same way). The kind of condition depends on the discretization. In VDF, it is a heat exchange condition, and in VEF, a temperature condition.
Such a coupling requires coincident meshes for the moment. In case of non-coincident meshes, run is stopped and two external files are automatically generated in VEF (connectivity_failed_boundary_name and connectivity_failed_pb_name.med). In 2D, the keyword Decouper_bord_coincident associated to the connectivity_failed_boundary_name file allows to generate a new coincident mesh.
In 3D, for a first preliminary cut domain with HOMARD (fluid for instance), the second problem associated to pb_name (solide in a fluid/solid coupling problem) has to be submitted to HOMARD cutting procedure with connectivity_failed_pb_name.med.
Such a procedure works as while the primary refined mesh (fluid in our example) impacts the fluid/solid interface with a compact shape as described below (values 2 or 4 indicates the number of division from primary faces obtained in fluid domain at the interface after HOMARD cutting):
2-2-2-2-2-2
2-4-4-4-4-4-2   2-2-2
2-4-4-4-4-2   2-4-2
2-2-2-2-2   2-2
OK

2-2   2-2-2
2-4-2   2-2
2-2   2-2
NOT OK

See also: condlim_base (11)

Usage:
paroi_contact autrepb nameb

where

- **autrepb** *str*: Name of other problem.
- **nameb** *str*: boundary name of the remote problem which should be the same than the local name

11.22 paroi_contact_fictif

Description: This keyword is derivated from paroi_contact and is especially dedicated to compute coupled fluid/solid/fluid problem in case of thin material. Thanks to this option, solid is considered as a fictitious media (no mesh, no domain associated), and coupling is performed by considering instantaneous thermal equilibrium in it (for the moment).

See also: condlim_base (11)

Usage:
paroi_contact_fictif autrepb nameb conduct_fictif ep_fictive
where

- **autrepb** *str*: Name of other problem.
- **nameb** *str*: Name of bord.
- **conduct_fictif** *float*: thermal conductivity
- **ep_fictive** *float*: thickness of the fictitious media

11.23 paroi_decalee_robin

Description: This keyword is used to designate a Robin boundary condition (a.u+b.du/dn=c) associated with the Pironneau methodology for the wall laws. The value of given by the delta option is the distance between the mesh (where symmetry boundary condition is applied) and the fictious wall. This boundary condition needs the definition of the dedicated source terms (Source_Robin or Source_Robin_Scalaire) according the equations used.

See also: condlim_base (11)

Usage:
paroi_decalee_robin obj Lire obj {

delta *float*

}
where

- **delta** *float*

11.24 paroi_defilante

Description: Keyword to designate a condition where tangential speed is imposed on the wall called bord (edge). If the speed set by the user is not tangential, projection is used.

See also: dirichlet (11.2)

Usage:
paroi_defilante ch
where

- **ch** *champ_front_base* (16.1): Boundary field type.

11.25 paroi_echange_contact_correlation_vdf

Description: Class to define a thermohydraulic 1D model which will apply to a boundary of 2D or 3D domain.
Warning : For parallel calculation, the only possible partition will be according the axis of the model with the keyword Tranche.

See also: condlim_base (11)

Usage:
paroi_echange_contact_correlation_vdf obj Lire obj {

> **dir** *int*
> **tinf** *float*
> **tsup** *float*
> **lambda** *str*
> **rho** *str*
> **cp** *float*
> **dt_impr** *float*
> **mu** *str*
> **debit** *float*
> **dh** *float*
> **volume** *str*
> **nu** *str*
> [**reprise_correlation**]

}
where

- **dir** *int*: Direction (0 : axis X, 1 : axis Y, 2 : axis Z) of the 1D model.
- **tinf** *float*: Inlet fluid temperature of the 1D model (oC or K).
- **tsup** *float*: Outlet fluid temperature of the 1D model (oC or K).
- **lambda** *str*: Thermal conductivity of the fluid (W.m-1.K-1).
- **rho** *str*: Mass density of the fluid (kg.m-3) which may be a function of the temperature T.
- **cp** *float*: Calorific capacity value at a constant pressure of the fluid (J.kg-1.K-1).
- **dt_impr** *float*: Printing period in name_of_data_file_time.dat files of the 1D model results.
- **mu** *str*: Dynamic viscosity of the fluid (kg.m-1.s-1) which may be a function of thetemperature T.
- **debit** *float*: Surface flow rate (kg.s-1.m-2) of the fluid into the channel.
- **dh** *float*: Hydraulic diameter may be a function f(x) with x position along the 1D axis (xinf <= x <= xsup)
- **volume** *str*: Exact volume of the 1D domain (m3) which may be a function of the hydraulic diameter (Dh) and the lateral surface (S) of the meshed boundary.
- **nu** *str*: Nusselt number which may be a function of the Reynolds number (Re) and the Prandtl number (Pr).
- **reprise_correlation** : Keyword in the case of a restarting calculation with this correlation.

11.26 paroi_echange_contact_correlation_vef

Description: Class to define a thermohydraulic 1D model which will apply to a boundary of 2D or 3D domain.
Warning : For parallel calculation, the only possible partition will be according the axis of the model with the keyword Tranche_geom.

See also: condlim_base (11)

Usage:
paroi_echange_contact_correlation_vef obj Lire obj {

dir *int*
tinf *float*
tsup *float*
lambda *str*
rho *str*
cp *float*
dt_impr *float*
mu *str*
debit *float*
dh *float*
n *int*
surface *str*
nu *str*
xinf *float*
xsup *float*
[**emissivite_pour_rayonnement_entre_deux_plaques_quasi_infinies** *float*]
[**reprise_correlation**]

}
where

- **dir** *int*: Direction (0 : axis X, 1 : axis Y, 2 : axis Z) of the 1D model.
- **tinf** *float*: Inlet fluid temperature of the 1D model (oC or K).
- **tsup** *float*: Outlet fluid temperature of the 1D model (oC or K).
- **lambda** *str*: Thermal conductivity of the fluid (W.m-1.K-1).
- **rho** *str*: Mass density of the fluid (kg.m-3) which may be a function of the temperature T.
- **cp** *float*: Calorific capacity value at a constant pressure of the fluid (J.kg-1.K-1).
- **dt_impr** *float*: Printing period in name_of_data_file_time.dat files of the 1D model results.
- **mu** *str*: Dynamic viscosity of the fluid (kg.m-1.s-1) which may be a function of thetemperature T.
- **debit** *float*: Surface flow rate (kg.s-1.m-2) of the fluid into the channel.
- **dh** *float*: Hydraulic diameter may be a function f(x) with x position along the 1D axis (xinf <= x <= xsup)
- **n** *int*: Number of 1D cells of the 1D mesh.
- **surface** *str*: Section surface of the channel which may be function f(Dh,x) of the hydraulic diameter (Dh) and x position along the 1D axis (xinf <= x <= xsup)
- **nu** *str*: Nusselt number which may be a function of the Reynolds number (Re) and the Prandtl number (Pr).
- **xinf** *float*: Position of the inlet of the 1D mesh on the axis direction.
- **xsup** *float*: Position of the outlet of the 1D mesh on the axis direction.
- **emissivite_pour_rayonnement_entre_deux_plaques_quasi_infinies** *float*: Coefficient of emissivity for radiation between two quasi infinite plates.
- **reprise_correlation** : Keyword in the case of a restarting calculation with this correlation.

11.27 paroi_echange_contact_vdf

Description: Boundary condition type to model the heat flux between two problems. Important: the name of the boundaries in the two problems should be the same.

See also: condlim_base (11)

Usage:
paroi_echange_contact_vdf autrepb nameb temp h
where

- **autrepb** *str*: Name of other problem.
- **nameb** *str*: Name of bord.
- **temp** *str*: Name of field.
- **h** *float*: Value assigned to a coefficient (expressed in W.K-1m-2) that characterises the contact between the two mediums. In order to model perfect contact, h must be taken to be infinite. This value must obviously be the same in both the two problems blocks.
  The surface thermal flux exchanged between the two mediums is represented by :
  fi = h (T1-T2) where 1/h = d1/lambda1 + 1/val_h_contact + d2/lambda2
  where di : distance between the node where Ti and the wall is found.

11.28 paroi_echange_externe_impose

Description: External type exchange condition with a heat exchange coefficient and an imposed external temperature.

See also: condlim_base (11) paroi_echange_externe_impose_h (11.29)

Usage:
paroi_echange_externe_impose h_imp himpc text ch
where

- **h_imp** *str*: Heat exchange coefficient value (expressed in W.m-2.K-1).
- **himpc** *champ_front_base* (16.1): Boundary field type.
- **text** *str*: External temperature value (expressed in oC or K).
- **ch** *champ_front_base* (16.1): Boundary field type.

11.29 paroi_echange_externe_impose_h

Description: Particular case of class paroi_echange_externe_impose for enthalpy equation.

See also: paroi_echange_externe_impose (11.28)

Usage:
paroi_echange_externe_impose_h h_imp himpc text ch
where

- **h_imp** *str*: Heat exchange coefficient value (expressed in W.m-2.K-1).
- **himpc** *champ_front_base* (16.1): Boundary field type.
- **text** *str*: External temperature value (expressed in oC or K).
- **ch** *champ_front_base* (16.1): Boundary field type.

11.30 paroi_echange_global_impose

Description: Global type exchange condition (internal) that is to say that diffusion on the first fluid mesh is not taken into consideration.

See also: condlim_base (11)

Usage:
paroi_echange_global_impose h_imp himpc text ch
where

- **h_imp** *str*: Global exchange coefficient value. The global exchange coefficient value is expressed in W.m-2.K-1.
- **himpc** *champ_front_base* (16.1): Boundary field type.
- **text** *str*: External temperature value. The external temperature value is expressed in oC or K.
- **ch** *champ_front_base* (16.1): Boundary field type.

11.31 paroi_fixe

Description: Keyword to designate a situation of adherence to the wall called bord (edge) (normal and tangential speed at the edge is zero).

See also: condlim_base (11) paroi_fixe_iso_Genepi2_sans_contribution_aux_vitesses_sommets (11.32)

Usage:
paroi_fixe

11.32 paroi_fixe_iso_Genepi2_sans_contribution_aux_vitesses_sommets

Description: CL pour obtenir iso Geneppi2, sans interet

See also: paroi_fixe (11.31)

Usage:
paroi_fixe_iso_Genepi2_sans_contribution_aux_vitesses_sommets

11.33 paroi_flux_impose

Description: Normal flux condition at the wall called bord (edge). The surface area of the flux (W.m-1 in 2D or W.m-2 in 3D) is imposed at the boundary according to the following convention: a positive flux is a flux that enters into the domain according to convention.

See also: condlim_base (11)

Usage:
paroi_flux_impose ch
where

- **ch** *champ_front_base* (16.1): Boundary field type.

11.34 paroi_knudsen_non_negligeable

Description: Boundary condition for number of Knudsen (Kn) above 0.001 where slip-flow condition appears: the velocity near the wall depends on the shear stress : Kn=l/L with l is the mean-free-path of the molecules and L a characteristic length scale.
U(y=0)-Uwall=k(dU/dY)
Where k is a coefficient given by several laws:
Mawxell : k=(2-s)*l/s
Bestok&Karniadakis :k=(2-s)/s*L*Kn/(1+Kn)

Xue&Fan :k=(2-s)/s*L*tanh(Kn)
s is a value between 0 and 2 named accomodation coefficient. s=1 seems a good value.
Warning : The keyword is available for VDF calculation only for the moment.

See also: dirichlet (11.2)

Usage:
paroi_knudsen_non_negligeable name_champ_1 champ_1 name_champ_2 champ_2
where

- **name_champ_1** *str into ['vitesse_paroi', 'k']*: Field name.
- **champ_1** *champ_front_base* (16.1): Boundary field type.
- **name_champ_2** *str into ['vitesse_paroi', 'k']*: Field name.
- **champ_2** *champ_front_base* (16.1): Boundary field type.

11.35 paroi_rugueuse

Description: Rough wall boundary

See also: dirichlet (11.2)

Usage:
paroi_rugueuse obj Lire obj {

erugu *float*

}
where

- **erugu** *float*: Constant value for roughness

11.36 paroi_temperature_imposee

Description: Imposed temperature condition at the wall called bord (edge).

See also: dirichlet (11.2) temperature_imposee_paroi (11.41)

Usage:
paroi_temperature_imposee ch
where

- **ch** *champ_front_base* (16.1): Boundary field type.

11.37 periodique

Description: 1). For NAVIER STOKES equations, this keyword is used to indicate the fact that the horizontal speed inlet values are the same as the outlet speed values, at every moment. As regards meshing, the inlet and outlet edges bear the same name.; 2). For scalar transport equation, this keyword is used to set a periodic condition on scalar. The two edges dealing with this periodic condition bear the same name.

See also: condlim_base (11)

Usage:
periodique

11.38 scalaire_impose_paroi

Description: Imposed temperature condition at the wall called bord (edge).

See also: dirichlet (11.2)

Usage:
scalaire_impose_paroi ch
where

- **ch** *champ_front_base* (16.1): Boundary field type.

11.39 sortie_libre_temperature_imposee_h

Description: Open boundary for heat equation with enthalpy as unknown.

See also: neumann (11.19)

Usage:
sortie_libre_temperature_imposee_h ch
where

- **ch** *champ_front_base* (16.1): Boundary field type.

11.40 symetrie

Description: 1). For NAVIER STOKES equations, this keyword is used to designate a symmetry condition concerning the speed at the boundary called bord (edge) (normal speed at the edge equal to zero and tangential speed gradient at the edge equal to zero); 2). For scalar transport equation, this keyword is used to set a symmetry condition on scalar on the boundary named bord (edge).

See also: condlim_base (11)

Usage:
symetrie

11.41 temperature_imposee_paroi

Description: Imposed temperature condition at the wall called bord (edge).

See also: paroi_temperature_imposee (11.36)

Usage:
temperature_imposee_paroi ch
where

- **ch** *champ_front_base* (16.1): Boundary field type.

12 discretisation_base

Description: Basic class for space discretization of thermohydraulic turbulent problems.

See also: objet_u (33) vdf (12.2) vef (12.3) ef (12.1)

Usage:

12.1 ef

Description: Element Finite discretization.

See also: discretisation_base (12)

Usage:

12.2 vdf

Description: Finite difference volume discretization.

See also: discretisation_base (12)

Usage:

12.3 vef

Description: Finite element volume discretization (P1NC/P0 element)
Warning: it becomes an obsolete discretization.

See also: discretisation_base (12) vefprep1b (12.4)

Usage:

12.4 vefprep1b

Description: Finite element volume discretization (P1NC/P1-bubble element). Since the 1.5.5 version, several new discretizations are available thanks to the optional keyword Lire. By default, the VEFPreP1B keyword is equivalent to the former VEFPreP1B formulation (v1.5.4 and sooner). P0P1 (if used with the strong formulation for imposed pressure boundary) is equivalent to VEFPreP1B but the convergence is slower. VEFPreP1B dis is equivalent to VEFPreP1B dis Lire dis { P0 P1 Changement_de_base_P1Bulle 1 Cl_pression_sommet_faible 0 }

See also: vef (12.3)

Usage:
vefprep1b obj Lire obj {

[**p0**]
[**p1**]
[**pa**]
[**changement_de_base_p1bulle** *int into [0, 1]*]
[**cl_pression_sommet_faible** *int into [0, 1]*]
[**modif_div_face_dirichlet** *int into [0, 1]*]

}
where

- **p0** : Pressure nodes are added on element centres
- **p1** : Pressure nodes are added on vertices
- **pa** : Only available in 3D, pressure nodes are added on bones
- **changement_de_base_p1bulle** *int into [0, 1]*: This option may be used to have the P1NC/P0P1 formulation (value set to 0) or the P1NC/P1Bulle formulation (value set to 1, the default).

- **cl_pression_sommet_faible** *int into [0, 1]*: This option is used to specify a strong formulation (value set to 0, the default) or a weak formulation (value set to 1) for an imposed pressure boundary condition. The first formulation converges quicker and is stable in general cases. The second formulation should be used if there are several outlet boundaries with Neumann condition (see Ecoulement_Neumann test case for example).
- **modif_div_face_dirichlet** *int into [0, 1]*: This option (by default 0) is used to extend control volumes for the momentum equation.

13 domaine

Description: Keyword to create a domain.

See also: objet_u (33)

Usage:

14 espece

Description: not_set

See also: objet_u (33)

Usage:
espece obj Lire obj {

> **cp** *champ_base*
> **lambda** *champ_base*
> **mu** *champ_base*
> **masse_molaire** *float*

}
where

- **cp** *champ_base* (15.1): Specific heat value (J.kg-1.K-1).
- **lambda** *champ_base* (15.1): Conductivity value (W.m-1.K-1).
- **mu** *champ_base* (15.1): Dynamic viscosity value (kg.m-1.s-1).
- **masse_molaire** *float*: Gas molar mass.

15 champ_base

15.1 champ_base

Description: Basic class of fields.

See also: objet_u (33) champ_don_base (15.2) champ_ostwald (15.15) champ_input_base (15.13) champ_fonc_med (15.6) field_uniform_keps_from_ud (15.23)

Usage:

15.2 champ_don_base

Description: Basic class for data fields (not calculated), p.e. physics properties.

See also: champ_base (15.1) uniform_field (15.26) champ_uniforme_morceaux (15.19) champ_fonc_xyz (15.22) champ_fonc_txyz (15.21) champ_don_lu (15.3) init_par_partie (15.24) champ_tabule_temps (15.18) champ_fonc_t (15.9) champ_fonc_tabule (15.10) champ_init_canal_sinal (15.11) champ_som_lu_vdf (15.16) champ_som_lu_vef (15.17) tayl_green (15.25) champ_fonc_reprise (15.7)

Usage:

15.3 champ_don_lu

Description: Field to read a data field (values located at the center of the cells) in a file.

See also: champ_don_base (15.2)

Usage:
champ_don_lu dom nb_comp file
where

- **dom** *str*: Name of the domain.
- **nb_comp** *int*: Number of field components.
- **file** *str*: Name of the file.
  This file has the following format:
  nb_val_lues -> Number of values readen in th file
  Xi Yi Zi -> Coordinates readen in the file
  Ui Vi Wi -> Value of the field

15.4 champ_fonc_fonction

Description: Field that is a function of another field.

See also: champ_fonc_tabule (15.10) champ_fonc_fonction_txyz (15.5)

Usage:
champ_fonc_fonction dim inco bloc
where

- **dim** *int*: Number of field components.
- **inco** *str*: Name of the field (for example: temperature).
- **bloc** *bloc_lecture* (3.39): Values (the table (the value of the field at any time is calculated by linear interpolation from this table) or the analytical expression (with keyword expression to use an analytical expression)).

15.5 champ_fonc_fonction_txyz

Description: this refers to a field that is a function of another field and time and/or space coordinates

See also: champ_fonc_fonction (15.4)

Usage:
champ_fonc_fonction_txyz dim inco bloc
where

- **dim** *int*: Number of field components.
- **inco** *str*: Name of the field (for example: temperature).

- **bloc** *bloc_lecture* (3.39): Values (the table (the value of the field at any time is calculated by linear interpolation from this table) or the analytical expression (with keyword expression to use an analytical expression)).

15.6 champ_fonc_med

Description: Field to read a data field in a MED-format file .med at a specified time. It is very useful, for example, to restart a calculation with a new or refined geometry. The field post-processed on the new geometry at med format is used as initial condition for restarting.

See also: champ_base (15.1)

Usage:
champ_fonc_med [**use_existing_domain**] [**last_time**] **filename** **domain_name** **field_name** **location** **time**
where

- **use_existing_domain** *str into ['use_existing_domain']*
- **last_time** *str into ['last_time']*: to use the last time of the MED file instead of the specified time.
- **filename** *str*: Name of the .med file.
- **domain_name** *str*: Name of the domain.
- **field_name** *str*: Name of the problem unknown.
- **location** *str into ['som', 'elem']*: To indicate where the field has been post-processed.
- **time** *float*: Time of the field in the .med file.

15.7 champ_fonc_reprise

Description: This field is used to read a data field in a save file (.xyz or .sauv) at a specified time. It is very useful, for example, to run a thermohydraulic calculation with velocity initial condition read into a save file from a previous hydraulic calculation.

See also: champ_don_base (15.2)

Usage:
champ_fonc_reprise [**format**] **filename** **pb_name** **champ** [**fonction**] **temps**
where

- **format** *str into ['binaire', 'formatte', 'xyz']*: Type of file (the file format). If xyz format is activated, the .xyz file from the previous calculation will be given for filename, and if formatte or binaire is choosen, the .sauv file of the previous calculation will be specified for filename. In the case of a parallel calculation, if the mesh partition does not changed between the previous calculation and the next one, the binaire format should be preferred, because is faster than the xyz format.
- **filename** *str*: Name of the save file.
- **pb_name** *str*: Name of the problem.
- **champ** *str*: Name of the problem unknown. It may also be the temporal average of a problem unknown (like moyenne_vitesse, moyenne_temperature,...)
- **fonction** *fonction_champ_reprise* (15.8): Optional keyword to apply a function on the field being read in the save file (e.g. to read a temperature field in Celsius units and convert it for the calculation on Kelvin units, you will use: fonction 1 273.+val)
- **temps** *str*: Time of the saved field in the save file or last_time. If you give the keyword last_time instead, the last time saved in the save file will be used.

15.8 fonction_champ_reprise

Description: not_set

See also: objet_lecture (32)

Usage:
mot fonction
where

- **mot** *str into ['fonction']*
- **fonction** *n word1 word2 ... wordn*: n f1(val) f2(val) ... fn(val)] time

15.9 champ_fonc_t

Description: Field that is constant in space and is a function of time.

See also: champ_don_base (15.2)

Usage:
champ_fonc_t val
where

- **val** *n word1 word2 ... wordn*: Values of field components (time dependant functions).

15.10 champ_fonc_tabule

Description: Field that is tabulated as a function of another field.

See also: champ_don_base (15.2) champ_fonc_fonction (15.4)

Usage:
champ_fonc_tabule dim inco bloc
where

- **dim** *int*: Number of field components.
- **inco** *str*: Name of the field (for example: temperature).
- **bloc** *bloc_lecture* (3.39): Values (the table (the value of the field at any time is calculated by linear interpolation from this table) or the analytical expression (with keyword expression to use an analytical expression)).

15.11 champ_init_canal_sinal

Description: For a parabolic profile on U velocity with an unpredictable disturbance on V and W and a sinusoidal disturbance on V velocity.

See also: champ_don_base (15.2)

Usage:
champ_init_canal_sinal dim bloc
where

- **dim** *int*: Number of field components.
- **bloc** *bloc_lec_champ_init_canal_sinal* (15.12): Parameters for the class champ_init_canal_sinal.

15.12 bloc_lec_champ_init_canal_sinal

Description: Parameters for the class champ_init_canal_sinal.
in 2D:
U=ucent*y(2h-y)/h/h
V=ampli_bruit*rand+ampli_sin*sin(omega*x)
rand: unpredictable value between -1 and 1.
in 3D:
U=ucent*y(2h-y)/h/h
V=ampli_bruit*rand1+ampli_sin*sin(omega*x)
W=ampli_bruit*rand2
rand1 and rand2: unpredictables values between -1 and 1.

See also: objet_lecture (32)

Usage:
{

ucent *float*
h *float*
ampli_bruit *float*
[**ampli_sin** *float*]
omega *float*
[**dir_flow** *int into [0, 1, 2]*]
[**dir_wall** *int into [0, 1, 2]*]
[**min_dir_flow** *float*]
[**min_dir_wall** *float*]

}
where

- **ucent** *float*: Velocity value at the center of the channel.
- **h** *float*: Half hength of the channel.
- **ampli_bruit** *float*: Amplitude for the disturbance.
- **ampli_sin** *float*: Amplitude for the sinusoidal disturbance (by default equals to ucent/10).
- **omega** *float*: Value of pulsation for the of the sinusoidal disturbance.
- **dir_flow** *int into [0, 1, 2]*: Flow direction for the initialization of the flow in a channel.
  - if dir_flow=0, the flow direction is X
  - if dir_flow=1, the flow direction is Y
  - if dir_flow=2, the flow direction is Z
  Default value for dir_flow is 0
- **dir_wall** *int into [0, 1, 2]*: Wall direction for the initialization of the flow in a channel.
  - if dir_wall=0, the normal to the wall is in X direction
  - if dir_wall=1, the normal to the wall is in Y direction
  - if dir_wall=2, the normal to the wall is in Z direction
  Default value for dir_flow is 1
- **min_dir_flow** *float*: Value of the minimum coordinate in the flow direction for the initialization of the flow in a channel. Default value for dir_flow is 0.
- **min_dir_wall** *float*: Value of the minimum coordinate in the wall direction for the initialization of the flow in a channel. Default value for dir_flow is 0.

15.13 champ_input_base

Description: not_set

See also: champ_base (15.1) champ_input_p0 (15.14)

Usage:
champ_input_base obj Lire obj {

> **nb_comp** *int*
> **nom** *str*
> [**initial_value** *n x1 x2 ... xn*]
> **probleme** *str*
> [**sous_zone** *str*]

}
where

- **nb_comp** *int*
- **nom** *str*
- **initial_value** *n x1 x2 ... xn*
- **probleme** *str*
- **sous_zone** *str*

15.14 champ_input_p0

Description: not_set

See also: champ_input_base (15.13)

Usage:
champ_input_p0 obj Lire obj {

> **nb_comp** *int*
> **nom** *str*
> [**initial_value** *n x1 x2 ... xn*]
> **probleme** *str*
> [**sous_zone** *str*]

}
where

- **nb_comp** *int* for inheritance
- **nom** *str* for inheritance
- **initial_value** *n x1 x2 ... xn* for inheritance
- **probleme** *str* for inheritance
- **sous_zone** *str* for inheritance

15.15 champ_ostwald

Description: This keyword is used to define the viscosity variation law:
Mu(T)= K(T)*(D:D/2)**((n-1)/2)

See also: champ_base (15.1)

Usage:
champ_ostwald

15.16 champ_som_lu_vdf

Description: Keyword to read in a file values located at the nodes of a mesh in VDF discretisation.

See also: champ_don_base (15.2)

Usage:
champ_som_lu_vdf domain_name dim tolerance file
where

- **domain_name** *str*: Name of the domain.
- **dim** *int*: Value of the dimension of the field.
- **tolerance** *float*: Value of the tolerance to check the coordinates of the nodes.
- **file** *str*: name of the file
  This file has the following format:
  Xi Yi Zi -> Coordinates of the node
  Ui Vi Wi -> Value of the field on this node
  Xi+1 Yi+1 Zi+1 -> Next point
  Ui+1 Vi+1 Zi+1 -> Next value ...

15.17 champ_som_lu_vef

Description: Keyword to read in a file values located at the nodes of a mesh in VEF discretisation.

See also: champ_don_base (15.2)

Usage:
champ_som_lu_vef domain_name dim tolerance file
where

- **domain_name** *str*: Name of the domain.
- **dim** *int*: Value of the dimension of the field.
- **tolerance** *float*: Value of the tolerance to check the coordinates of the nodes.
- **file** *str*: Name of the file.
  This file has the following format:
  Xi Yi Zi -> Coordinates of the node
  Ui Vi Wi -> Value of the field on this node
  Xi+1 Yi+1 Zi+1 -> Next point
  Ui+1 Vi+1 Zi+1 -> Next value ...

15.18 champ_tabule_temps

Description: Field that is constant in space and tabulated as a function of time.

See also: champ_don_base (15.2)

Usage:
champ_tabule_temps dim bloc
where

- **dim** *int*: Number of field components.
- **bloc** *bloc_lecture* (3.39): Values as a table. The value of the field at any time is calculated by linear interpolation from this table.

15.19 champ_uniforme_morceaux

Description: Field which is partly constant in space and stationary.

See also: champ_don_base (15.2) champ_uniforme_morceaux_tabule_temps (15.20) valeur_totale_sur-_volume (15.27)

Usage:
champ_uniforme_morceaux nom_dom nb_comp data
where

- **nom_dom** *str*: Name of the domain to which the sub-areas belong.
- **nb_comp** *int*: Number of field components.
- **data** *bloc_lecture* (3.39): { Defaut val_def sous_zone_1 val_1 ... sous_zone_i val_i } By default, the value val_def is assigned to the field. It takes the sous_zone_i identifier Sous_Zone (sub_area) type object value, val_i. Sous_Zone (sub_area) type objects must have been previously defined if the operator wishes to use a Champ_Uniforme_Morceaux(partly_uniform_field) type object.

15.20 champ_uniforme_morceaux_tabule_temps

Description: this type of field is constant in space on one or several sub_zones and tabulated as a function of time.

See also: champ_uniforme_morceaux (15.19)

Usage:
champ_uniforme_morceaux_tabule_temps nom_dom nb_comp data
where

- **nom_dom** *str*: Name of the domain to which the sub-areas belong.
- **nb_comp** *int*: Number of field components.
- **data** *bloc_lecture* (3.39): { Defaut val_def sous_zone_1 val_1 ... sous_zone_i val_i } By default, the value val_def is assigned to the field. It takes the sous_zone_i identifier Sous_Zone (sub_area) type object value, val_i. Sous_Zone (sub_area) type objects must have been previously defined if the operator wishes to use a Champ_Uniforme_Morceaux(partly_uniform_field) type object.

15.21 champ_fonc_txyz

Description: Field defined by analytical functions. It makes it possible the definition of a field that depends on the time and the space.

See also: champ_don_base (15.2)

Usage:
champ_fonc_txyz dom val
where

- **dom** *str*: Name of domain of calculation.
- **val** *n word1 word2 ... wordn*: List of functions on (t,x,y,z).

15.22 champ_fonc_xyz

Description: Field defined by analytical functions. It makes it possible the definition of a field that depends on (x,y,z).

See also: champ_don_base (15.2)

Usage:
champ_fonc_xyz dom val
where

- **dom** *str*: Name of domain of calculation.
- **val** *n word1 word2 ... wordn*: List of functions on (x,y,z).

15.23 field_uniform_keps_from_ud

Description: field which allows to impose on a domain K and EPS values derived from U velocity and D hydraulic diameter

See also: champ_base (15.1)

Usage:
field_uniform_keps_from_ud obj Lire obj {

u *float*
d *float*

}
where

- **u** *float*: value of velocity specified in boundary condition.
- **d** *float*: value of hydraulic diameter specified in boundary condition

15.24 init_par_partie

Description: ne marche que pour n_comp=1

See also: champ_don_base (15.2)

Usage:
init_par_partie n_comp val1 val2 val3
where

- **n_comp** *int into [1]*
- **val1** *float*
- **val2** *float*
- **val3** *float*

15.25 tayl_green

Description: Class Tayl_green.

See also: champ_don_base (15.2)

Usage:
tayl_green dim
where

- **dim** *int*: Dimension.

15.26 uniform_field

Synonymous: **champ_uniforme**

Description: Field that is constant in space and stationary.

See also: champ_don_base (15.2)

Usage:
uniform_field val
where

- **val** *n x1 x2 ... xn*: Values of field components.

15.27 valeur_totale_sur_volume

Description: Similar as Champ_Uniforme_Morceaux with the same syntax. Used for source terms when we want to specify a source term with a value given for the volume (eg: heat in Watts) and not a value per volume unit (eg: heat in Watts/m3).

See also: champ_uniforme_morceaux (15.19)

Usage:
valeur_totale_sur_volume nom_dom nb_comp data
where

- **nom_dom** *str*: Name of the domain to which the sub-areas belong.
- **nb_comp** *int*: Number of field components.
- **data** *bloc_lecture* (3.39): { Defaut val_def sous_zone_1 val_1 ... sous_zone_i val_i } By default, the value val_def is assigned to the field. It takes the sous_zone_i identifier Sous_Zone (sub_area) type object value, val_i. Sous_Zone (sub_area) type objects must have been previously defined if the operator wishes to use a Champ_Uniforme_Morceaux(partly_uniform_field) type object.

16 champ_front_base

16.1 champ_front_base

Description: Basic class for fields at domain boundaries.

See also: objet_u (33) champ_front_uniforme (16.22) champ_front_fonc_xyz (16.14) champ_front_fonc_txyz (16.13) champ_front_fonc_pois_ipsn (16.11) champ_front_fonc_pois_tube (16.12) champ_front_tabule (16.20) champ_front_fonction (16.15) champ_front_bruite (16.7) champ_front_tangentiel_vef (16.21) champ_front_lu (16.16) boundary_field_inward (16.2) champ_front_pression_from_u (16.18) champ_front_debit (16.10) champ_front_contact_vef (16.9) champ_front_calc (16.8) champ_front_recyclage (16.19) ch_front_input (16.4) boundary_field_uniform_keps_from_ud (16.3) champ_front_normal_vef (16.17) champ_front_MED (16.6)

Usage:

16.2 boundary_field_inward

Description: this field is used to define the normal vector field standard at the boundary in VDF or VEF discretization.

See also: champ_front_base (16.1)

Usage:
boundary_field_inward obj Lire obj {

normal_value *str*

}
where

- **normal_value** *str*: normal vector value (positive value for a vector oriented outside to inside) which can depend of the time.

16.3 boundary_field_uniform_keps_from_ud

Description: field which allows to impose on a boundary K and EPS values derived from U velocity and D hydraulic diameter

See also: champ_front_base (16.1)

Usage:
boundary_field_uniform_keps_from_ud obj Lire obj {

u *float*
d *float*

}
where

- **u** *float*: value of velocity
- **d** *float*: value of hydraulic diameter

16.4 ch_front_input

Description: not_set

See also: champ_front_base (16.1) ch_front_input_uniforme (16.5)

Usage:
ch_front_input obj Lire obj {

nb_comp *int*
nom *str*
[**initial_value** *n x1 x2 ... xn*]
probleme *str*
[**sous_zone** *str*]

}
where

- **nb_comp** *int*
- **nom** *str*
- **initial_value** *n x1 x2 ... xn*
- **probleme** *str*
- **sous_zone** *str*

16.5 ch_front_input_uniforme

Description: for coupling, you can use ch_front_input_uniforme which is a champ_front_uniforme, which use an external value. It must be used with Problem.setInputField.

See also: ch_front_input (16.4)

Usage:
ch_front_input_uniforme obj Lire obj {

nb_comp *int*
nom *str*
[**initial_value** *n x1 x2 ... xn*]
probleme *str*
[**sous_zone** *str*]

}
where

- **nb_comp** *int* for inheritance
- **nom** *str* for inheritance
- **initial_value** *n x1 x2 ... xn* for inheritance
- **probleme** *str* for inheritance
- **sous_zone** *str* for inheritance

16.6 champ_front_MED

Description: Field allowing the loading of a boundary condition from a MED file using Champ_fonc_med

See also: champ_front_base (16.1)

Usage:
champ_front_MED **champ_fonc_med**
where

- **champ_fonc_med** *champ_base* (15.1): a champ_fonc_med loading the values of the unknown on a domain boundary

16.7 champ_front_bruite

Description: Field which is variable in time and space in a random manner.

See also: champ_front_base (16.1)

Usage:
champ_front_bruite nb_comp bloc
where

- **nb_comp** *int*: Number of field components.
- **bloc** *bloc_lecture* (3.39): { [N val L val] Moyenne m_1.....[m_i] Amplitude A_1.....[A_ i]}: Random nois: If N and L are not defined, the ith component of the field varies randomly around an average value m_i with a maximum amplitude A_i.
White noise: If N and L are defined, these two additional parameters correspond to L, the domain length and N, the number of nodes in the domain. Noise frequency will be between 2*Pi/L and 2*Pi*N/(4*L).
For example, formula for speed: u=U0(t) v=U1(t)Uj(t)=Mj+2*Aj*bruit_blanc where bruit_blanc (white_noise) is the formula given in the mettre_a_jour (update) method of the Champ_front_bruite (noise_boundary_field) (Refer to the Ch_fr_bruite.cpp file).

16.8 champ_front_calc

Description: This keyword is used on a boundary to get a field from another boundary. The local and remote boundaries should have the same mesh. If not, the Champ_front_recyclage keyword could be used instead. It is used in the condition block at the limits of equation which itself refers to a problem called pb1. We are working under the supposition that pb1 is coupled to another problem.

See also: champ_front_base (16.1)

Usage:
champ_front_calc problem_name bord field_name
where

- **problem_name** *str*: Name of the other problem to which pb1 is coupled.
- **bord** *str*: Name of the side which is the boundary between the 2 domains in the domain object description associated with the problem_name object.
- **field_name** *str*: Name of the field containing the value that the user wishes to use at the boundary. The field_name object must be recognised by the problem_name object.

16.9 champ_front_contact_vef

Description: This field is used on a boundary between a solid and fluid domain to exchange a calculated temperature at the contact face of the two domains according to the flux of the two problems.

See also: champ_front_base (16.1)

Usage:
champ_front_contact_vef local_pb local_boundary remote_pb remote_boundary
where

- **local_pb** *str*: Name of the problem.
- **local_boundary** *str*: Name of the boundary.
- **remote_pb** *str*: Name of the second problem.
- **remote_boundary** *str*: Name of the boundary in the second problem.

16.10 champ_front_debit

Description: This field is used to define a flow rate field instead of a velocity field for a Dirichlet boundary condition on Navier Stokes equation.

See also: champ_front_base (16.1)

Usage:
champ_front_debit ch
where

- **ch** *champ_front_base* (16.1): field (champ_front_uniforme) to define the flow rate.

16.11 champ_front_fonc_pois_ipsn

Description: Boundary field champ_front_fonc_pois_ipsn.

See also: champ_front_base (16.1)

Usage:
champ_front_fonc_pois_ipsn r_tube umoy r_loc
where

- **r_tube** *float*
- **umoy** *n x1 x2 ... xn*
- **r_loc** *x1 x2 (x3)*

16.12 champ_front_fonc_pois_tube

Description: Boundary field champ_front_fonc_pois_tube.

See also: champ_front_base (16.1)

Usage:
champ_front_fonc_pois_tube r_tube umoy r_loc r_loc_mult
where

- **r_tube** *float*
- **umoy** *n x1 x2 ... xn*
- **r_loc** *x1 x2 (x3)*
- **r_loc_mult** *n1 n2 (n3)*

16.13 champ_front_fonc_txyz

Description: Boundary field which is not constant in space and in time.

See also: champ_front_base (16.1)

Usage:
champ_front_fonc_txyz val
where

- **val** *n word1 word2 ... wordn*: Values of field components (mathematical expressions).

16.14 champ_front_fonc_xyz

Description: Boundary field which is not constant in space.

See also: champ_front_base (16.1)

Usage:
champ_front_fonc_xyz val
where

- **val** *n word1 word2 ... wordn*: Values of field components (mathematical expressions).

16.15 champ_front_fonction

Description: boundary field that is function of another field

See also: champ_front_base (16.1)

Usage:
champ_front_fonction dim inco expression
where

- **dim** *int*: Number of field components.
- **inco** *str*: Name of the field (for example: temperature).
- **expression** *str*: keyword to use a analytical expression like 10.*EXP(-0.1*val) where val be the keyword for the field.

16.16 champ_front_lu

Description: boundary field which is given from data issued from a read file. The format of this file has to be the same that the one generated by Ecrire_fichier_xyz_valeur
Example for K and epsilon quantities to be defined for inlet condition in a boundary named 'entree':
entree frontiere_ouverte_K_Eps_impose Champ_Front_lu dom 2pb_K_EPS_PERIO_1006.306198.dat

See also: champ_front_base (16.1)

Usage:
champ_front_lu domaine dim file
where

- **domaine** *str*: Name of domain
- **dim** *int*: number of components
- **file** *str*: path for the read file

16.17 champ_front_normal_vef

Description: Field to define the normal vector field standard at the boundary in VEF discretization.

See also: champ_front_base (16.1)

Usage:
champ_front_normal_vef mot vit_tan
where

- **mot** *str into ['valeur_normale']*: Name of vector field.
- **vit_tan** *float*: normal vector value (positive value for a vector oriented outside to inside).

16.18 champ_front_pression_from_u

Description: this field is used to define a pressure field depending of a velocity field.

See also: champ_front_base (16.1)

Usage:
champ_front_pression_from_u expression
where

- **expression** *str*: value depending of a velocity (like $2 * u\_moy^2$).

16.19 champ_front_recyclage

Description: This keyword is used on a boundary to get a field from another boundary. New keyword in the 1.6.1 version which replaces and generalizes several obsolete ones:
Champ_front_calc_intern
Champ_front_calc_recycl_fluct_pbperio
Champ_front_calc_recycl_champ
Champ_front_calc_intern_2pbs
Champ_front_calc_recycl_fluct
Champ_front_recyclage {
pb_champ_evaluateur pb field nb_comp
[distance_plan dist0 dist1 [dist2]]
[moyenne_imposee methode_moy [fichier file [second_file]]
[moyenne_recyclee methode_recyc [fichier file [second_file]]
[direction_anisotrope 1|2|3]
[ampli_moyenne_imposee 2|3 alpha(0) alpha(1) [alpha(2)]]
[ampli_moyenne_recyclee 2|3 beta(0) beta(1) [beta(2)]]
[ampli_fluctuation 2|3 gamma(0) gamma(1) [gamma(2)]]
}
This keyword is to use, in a general way, on a boundary of a local_pb problem, a field calculated from a linear combination of an imposed field g(x,y,z,t) with an instantaneous f(x,y,z,t) and a spatial mean field <f>(t) or a temporal mean field <f>(x,y,z) field extracted from a plane of a problem named pb (pb may be local_pb itself) :
For each component i, the field F applied on the boundary will be:
Fi(x,y,z,t) = alpha_i*gi(x,y,z,t) + xsi_i*[fi(x,y,z,t)- beta_i*<fi>]
The different options are:
pb_champ_evaluateur pb field nb_comp : To give the name of the pb problem, the name of the field of the problem and its number of components nb_comp.
distance_plan dist0 dist1 [dist2] : Vector which gives the distance between the boundary and the plane from where the field F will be extracted. By default, the vector is zero, that should imply the two domains have coincident boundaries.
ampli_moyenne_imposee 2|3 alpha(0) alpha(1) [alpha(2)] : alpha_i coefficients (by default =1)
ampli_moyenne_recyclee 2|3 beta(0) beta(1) [beta(2)] : beta_i coefficients (by default =1)
ampli_fluctuation 2|3 gamma(0) gamma(1) [gamma(2)] : gamma_i coefficients (by default =1)
direction_anisotrope direction : If an integer is given for direction (X:1, Y:2, Z:3, by default, direction is negative), the imposed field g will be 0 for the 2 other directions.
moyenne_imposee methode_moy : Value of the imposed g field. The methode_moy option can be :

profil [2|3] valx(x,y,z,t) valy(x,y,z,t) [valz(x,y,z,t)] : to specify analytic profile for the imposed g field.
interpolation fichier file : to create a imposed field built by interpolation of values read into a file. The imposed field is applied on the direction given by the keyword direction_anisotrope (the field is zero for the other directions). The format of the file is:
pos(1) val(1)
pos(2) val(2)

pos(N) val(N)
If direction given by direction_anisotrope is 1 (or 2 or 3), then pos will be X (or Y or Z) coordinate and val will be X value (or Y value, or Z value) of the imposed field.
connexion_approchee fichier file : to read the imposed field into a file where positions and values are given (it is not necessary that the coordinates of the points match the coordinates of the faces of the boundary, indeed, the nearest point of each face of the boundary will be used). The format of the file is:
N
x(1) y(1) [z(1)] valx(1) valy(1) [valz(1)]
x(2) y(2) [z(2)] valx(2) valy(2) [valz(2)]

x(N) y(N) [z(N)] valx(N) valy(N) [valz(N)]
connection_exacte fichier file second_file : to read the imposed field into two files. The first file contains the points coordinates (which should be the same than the coordinates of each faces of the boundary) and the second_file contains the mean values. The format of the first file is:
N
1 x(1) y(1) [z(1)]
2 x(2) y(2) [z(2)]

N x(N) y(N) [z(N)]
The format of the second_file is:
N
1 valx(1) valy(1) [valz(1)]
2 valx(2) valy(2) [valz(2)]
...
N valx(N) valy(N) [valz(N)]
logarithmique diametre double u_tau double visco_cin double direction integer : to specify the imposed field (in this case, velocity) by an analytical logarithmic law of the wall :
g(x,y,z) = u_tau * (log(0.5*diametre*u_tau/visco_cin)/Kappa + 5.1)
With g(x,y,z)=u(x,y,z) if direction is set to 1 (g=v(x,y,z) if direction is set to 2, and g=w(w,y,z) if set to 3)
moyenne_recylee methode_recyc : Method used to do a spatial or a temporal averaging of f field to specify <f>. <f> can be the surface mean of f on the plane (surface option, see below) or it can be read from several files (for example generated by the chmoy_faceperio option of the Traitement_particulier keyword to obtain a temporal mean field). The option methode_recyc can be :
surfacique : surface mean for <f> from f values on the plane
Same options of methode_moy options but applied to read a temporal mean field <f>(x,y,z):
interpolation
connexion_approchee fichier file
connexion_exacte fichier file second_file

See also: champ_front_base (16.1)

Usage:
champ_front_recyclage bloc
where

- **bloc** *str*

16.20 champ_front_tabule

Description: Constant field on the boundary, tabulated as a function of time.

See also: champ_front_base (16.1)

Usage:
champ_front_tabule nb_comp bloc
where

- **nb_comp** *int*: Number of field components.
- **bloc** *bloc_lecture* (3.39): {nt1 t2 t3 ....tn u1 [v1 w1 ...] u2 [v2 w2 ...] u3 [v3 w3 ...] ... un [vn wn ...] }
  Values are entered into a table based on n couples (ti, ui) if nb_comp value is 1. The value of a field at a given time is calculated by linear interpolation from this table.

16.21 champ_front_tangentiel_vef

Description: Field to define the tangential speed vector field standard at the boundary in VEF discretisation.

See also: champ_front_base (16.1)

Usage:
champ_front_tangentiel_vef mot vit_tan
where

- **mot** *str into ['vitesse_tangentielle']*: Name of vector field.
- **vit_tan** *float*: Vector field standard [m/s].

16.22 champ_front_uniforme

Description: Boundary field which is constant in space and stationary.

See also: champ_front_base (16.1)

Usage:
champ_front_uniforme val
where

- **val** *n x1 x2 ... xn*: Values of field components.

17 loi_etat_base

Description: Basic class for state laws.

See also: objet_u (33) gaz_parfait (17.3) gaz_reel_rhot (17.1) melange_gaz_parfait (17.2)

Usage:

17.1 gaz_reel_rhot

Description: Real gas.

See also: loi_etat_base (17)

Usage:
gaz_reel_rhot bloc
where

- **bloc** *bloc_lecture* (3.39): Description.

17.2 melange_gaz_parfait

Description: Mixing of perfect gas.

See also: loi_etat_base (17)

Usage:
melange_gaz_parfait obj Lire obj {

> **sc** *float*
> [**cp** *float*]
> [**prandtl** *float*]
> [**correction_fraction**]
> [**ignore_check_fraction**]
> [**dtol_fraction** *float*]

}
where

- **sc** *float*: Schmidt number of the gas Sc=nu/D (D: diffusion coefficient of the mixing).
- **cp** *float*: Specific heat at constant pressure of the gas Cp.
- **prandtl** *float*: Prandtl number of the gas Pr=mu*Cp/lambda
- **correction_fraction** : To force mass fractions between 0. and 1.
- **ignore_check_fraction** : Not to check if mass fractions between 0. and 1.
- **dtol_fraction** *float*: Delta tolerance on mass fractions for check testing (default value 1.e-6).

17.3 gaz_parfait

Description: Perfect gas.

See also: loi_etat_base (17)

Usage:
gaz_parfait obj Lire obj {

> **Cp** *float*
> [**Cv** *float*]
> [**gamma** *float*]
> **Prandtl** *float*
> [**rho_constant_pour_debug** *champ_base*]

}
where

- **Cp** *float*: Specific heat at constant pressure (J/kg/K).
- **Cv** *float*: Specific heat at constant volume (J/kg/K).
- **gamma** *float*: Cp/Cv
- **Prandtl** *float*: Prandtl number of the gas Pr=mu*Cp/lambda
- **rho_constant_pour_debug** *champ_base* (15.1)

18 loi_fermeture_base

Description: Class for appends fermeture to problem

Keyword Discretiser should have already be used to read the object.
See also: objet_u (33) loi_fermeture_test (18.1)

Usage:

18.1 loi_fermeture_test

Description: Loi for test only

Keyword Discretiser should have already be used to read the object.
See also: loi_fermeture_base (18)

Usage:
loi_fermeture_test obj Lire obj {

[**coef** *float*]

}
where

- **coef** *float*: coefficient

19 loi_horaire

Description: to define the movement with a time-dependant law for the solid interface.

See also: objet_u (33)

Usage:
loi_horaire obj Lire obj {

position *n word1 word2 ... wordn*
vitesse *n word1 word2 ... wordn*
[**rotation** *n word1 word2 ... wordn*]
[**derivee_rotation** *n word1 word2 ... wordn*]

}
where

- **position** *n word1 word2 ... wordn*
- **vitesse** *n word1 word2 ... wordn*
- **rotation** *n word1 word2 ... wordn*
- **derivee_rotation** *n word1 word2 ... wordn*

20 milieu_base

Description: Basic class for medium (physics properties of medium).

See also: objet_u (33) solide (20.6) constituant (20.1) fluide_incompressible (20.2)

Usage:
milieu_base obj Lire obj {

[**rho** *champ_base*]
[**cp** *champ_base*]
[**lambda** *champ_base*]

}
where

- **rho** *champ_base* (15.1): Density (kg.m-3).
- **cp** *champ_base* (15.1): Specific heat (J.kg-1.K-1).
- **lambda** *champ_base* (15.1): Conductivity (W.m-1.K-1).

20.1 constituant

Description: Constituent.

See also: milieu_base (20)

Usage:
constituant obj Lire obj {

[**coefficient_diffusion** *champ_base*]
[**rho** *champ_base*]
[**cp** *champ_base*]
[**lambda** *champ_base*]

}
where

- **coefficient_diffusion** *champ_base* (15.1): Constituent diffusion coefficient value (m2.s-1). If a multi-constituent problem is being processed, the diffusivite will be a vectorial and each components will be the diffusion of the constituent.
- **rho** *champ_base* (15.1) for inheritance: Density (kg.m-3).
- **cp** *champ_base* (15.1) for inheritance: Specific heat (J.kg-1.K-1).
- **lambda** *champ_base* (15.1) for inheritance: Conductivity (W.m-1.K-1).

20.2 fluide_incompressible

Description: This is a uncompressible fluid.

See also: milieu_base (20) fluide_quasi_compressible (20.4) fluide_ostwald (20.3)

Usage:
fluide_incompressible obj Lire obj {

[**beta_th** *champ_base*]
[**mu** *champ_base*]

[**beta_co** *champ_base*]
[**indice** *champ_base*]
[**kappa** *champ_base*]
[**rho** *champ_base*]
[**cp** *champ_base*]
[**lambda** *champ_base*]

}
where

- **beta_th** *champ_base* (15.1): Thermal expansion (K-1).
- **mu** *champ_base* (15.1): Dynamic viscosity (kg.m-1.s-1).
- **beta_co** *champ_base* (15.1): Volume expansion coefficient values in concentration.
- **indice** *champ_base* (15.1): Refractivity of fluid.
- **kappa** *champ_base* (15.1): Absorptivity of fluid (m-1).
- **rho** *champ_base* (15.1) for inheritance: Density (kg.m-3).
- **cp** *champ_base* (15.1) for inheritance: Specific heat (J.kg-1.K-1).
- **lambda** *champ_base* (15.1) for inheritance: Conductivity (W.m-1.K-1).

20.3 fluide_ostwald

Description: Non-Newtonian fluids governed by Ostwald's law. The law applicable to stress tensor is:
tau=K(T)*(D:D/2)**((n-1)/2)*D Where:
D refers to the deformation speed tensor
K refers to fluid consistency (may be a function of the temperature T)
n refers to the fluid structure index n=1 for a Newtonian fluid, n<1 for a rheofluidifier fluid, n>1 for a rheothickening fluid.

See also: fluide_incompressible (20.2)

Usage:
fluide_ostwald obj Lire obj {

[**k** *champ_base*]
[**n** *champ_base*]
[**beta_th** *champ_base*]
[**mu** *champ_base*]
[**beta_co** *champ_base*]
[**indice** *champ_base*]
[**kappa** *champ_base*]
[**rho** *champ_base*]
[**cp** *champ_base*]
[**lambda** *champ_base*]

}
where

- **k** *champ_base* (15.1): Fluid consistency.
- **n** *champ_base* (15.1): Fluid structure index.
- **beta_th** *champ_base* (15.1) for inheritance: Thermal expansion (K-1).
- **mu** *champ_base* (15.1) for inheritance: Dynamic viscosity (kg.m-1.s-1).
- **beta_co** *champ_base* (15.1) for inheritance: Volume expansion coefficient values in concentration.
- **indice** *champ_base* (15.1) for inheritance: Refractivity of fluid.
- **kappa** *champ_base* (15.1) for inheritance: Absorptivity of fluid (m-1).
- **rho** *champ_base* (15.1) for inheritance: Density (kg.m-3).

- **cp** *champ_base* (15.1) for inheritance: Specific heat (J.kg-1.K-1).
- **lambda** *champ_base* (15.1) for inheritance: Conductivity (W.m-1.K-1).

20.4 fluide_quasi_compressible

Description: Compressible flow at low mach number.

See also: fluide_incompressible (20.2)

Usage:
fluide_quasi_compressible obj Lire obj {

[**sutherland** *bloc_sutherland*]
[**pression** *float*]
[**loi_etat** *loi_etat_base*]
[**traitement_pth** *str into ['edo', 'constant', 'conservation_masse']*]
[**traitement_rho_gravite** *str into ['standard', 'moins_rho_moyen']*]
[**temps_debut_prise_en_compte_drho_dt** *float*]
[**omega_relaxation_drho_dt** *float*]
[**mu** *champ_base*]
[**indice** *champ_base*]
[**kappa** *champ_base*]
[**rho** *champ_base*]
[**cp** *champ_base*]
[**lambda** *champ_base*]

}
where

- **sutherland** *bloc_sutherland* (20.5): Sutherland law for viscosity and for conductivity.
- **pression** *float*: Initial pression.
- **loi_etat** *loi_etat_base* (17): State law.
- **traitement_pth** *str into ['edo', 'constant', 'conservation_masse']*: Particular treatment for the thermodynamic pressure Pth ; there are three possibilities:
  1) with the keyword 'edo' the code computes Pth solving an O.D.E. ; in this case, the mass is not strictly conserved (it is the default case for quasi compressible computation):
  2) the keyword 'conservation_masse' forces the conservation of the mass (closed geometry or with periodic boundaries condition)
  3) the keyword 'constant' makes it possible to have a constant Pth ; it's the good choice when the flow is open (e.g. with pressure boundary conditions).
- **traitement_rho_gravite** *str into ['standard', 'moins_rho_moyen']*: It may be :1) 'standard': the gravity term is evaluted with rho*g (It is the default). 2) 'moins_rho_moyen': the gravity term is evaluated with (rho-rhomoy) *g.
- **temps_debut_prise_en_compte_drho_dt** *float*: While time<value, dRho/dt is set to zero (Rho, volumic mass). Useful for some calculation during the first time steps with big variation of temperature and volumic mass.
- **omega_relaxation_drho_dt** *float*: Optional option to have a relaxed algorithm to solve the mass equation. value is used (1 per default) to specify omega.
- **mu** *champ_base* (15.1) for inheritance: Dynamic viscosity (kg.m-1.s-1).
- **indice** *champ_base* (15.1) for inheritance: Refractivity of fluid.
- **kappa** *champ_base* (15.1) for inheritance: Absorptivity of fluid (m-1).
- **rho** *champ_base* (15.1) for inheritance: Density (kg.m-3).
- **cp** *champ_base* (15.1) for inheritance: Specific heat (J.kg-1.K-1).
- **lambda** *champ_base* (15.1) for inheritance: Conductivity (W.m-1.K-1).

20.5 bloc_sutherland

Description: Sutherland law for viscosity mu(T)=mu0*((T0+C)/(T+C))*(T/T0)**1.5 and (optional) for conductivity lambda(T)=mu0*Cp/Prandtl*((T0+Slambda)/(T+Slambda))*(T/T0)**1.5

See also: objet_lecture (32)

Usage:
m mu0 t t0 [**ms**] [**s**] **mc c**
where

- **m** *str into ['mu0']*
- **mu0** *float*
- **t** *str into ['T0']*
- **t0** *float*
- **ms** *str into ['Slambda']*
- **s** *float*
- **mc** *str into ['C']*
- **c** *float*

20.6 solide

Description: Solid.

See also: milieu_base (20)

Usage:
solide obj Lire obj {

[**rho** *champ_base*]
[**cp** *champ_base*]
[**lambda** *champ_base*]

}
where

- **rho** *champ_base* (15.1) for inheritance: Density (kg.m-3).
- **cp** *champ_base* (15.1) for inheritance: Specific heat (J.kg-1.K-1).
- **lambda** *champ_base* (15.1) for inheritance: Conductivity (W.m-1.K-1).

21 modele_turbulence_scal_base

Description: Basic class for turbulence model for energy equation.

See also: objet_u (33) prandtl (21.1) schmidt (21.2)

Usage:
modele_turbulence_scal_base obj Lire obj {

[**turbulence_paroi** *turbulence_paroi_scalaire_base*]
[**dt_impr_nusselt** *float*]

}
where

- **turbulence_paroi** *turbulence_paroi_scalaire_base* (30): Keyword to set the wall law.
- **dt_impr_nusselt** *float*: Keyword to print local values of Nusselt number and temperature near a wall during a turbulent calculation. The values wil be printed in the _Nusselt.face file each dt-_impr_nusselt time period. The local Nusselt expression is as follows : Nu = ((lambda+lambda-_t)/lambda)*d_wall/d_eq where d_wall is the distance from the first mesh to the wall and d_eq is given by the wall law. This option also gives the value of d_eq and h = (lambda+lambda_t)/d_eq and the fluid temperature of the first mesh near the wall.
  For the Neumann boundary conditions (flux_impose), the «equivalent» wall temperature given by the wall law is also printed (Tparoi equiv.) preceded for VEF calculation by the edge temperature «T face de bord».

21.1 prandtl

Description: The Prandtl model. For the scalar equations, only the model based on Reynolds analogy is available. If K_Epsilon was selected in the hydraulic equation, Prandtl must be selected for the convection-diffusion temperature equation coupled to the hydraulic equation and Schmidt for the concentration equations.

See also: modele_turbulence_scal_base (21)

Usage:
prandtl obj Lire obj {

  [**prdt** *str*]
  [**prandt_turbulent_fonction_nu_t_alpha** *str*]
  [**turbulence_paroi** *turbulence_paroi_scalaire_base*]
  [**dt_impr_nusselt** *float*]

}
where

- **prdt** *str*: Keyword to modify the constant (Prdt) of Prandtl model : Alphat=Nut/Prdt Default value is 0.9
- **prandt_turbulent_fonction_nu_t_alpha** *str*: Optional keyword to specify turbulent diffusivity (by default, alpha_t=nu_t/Prt) with another formulae, for example: alpha_t=nu_t2/(0,7*alpha+0,85*nu-_tt) with the string nu_t*nu_t/(0,7*alpha+0,85*nu_t) where alpha is the thermal diffusivity.
- **turbulence_paroi** *turbulence_paroi_scalaire_base* (30) for inheritance: Keyword to set the wall law.
- **dt_impr_nusselt** *float* for inheritance: Keyword to print local values of Nusselt number and temperature near a wall during a turbulent calculation. The values wil be printed in the _Nusselt.face file each dt_impr_nusselt time period. The local Nusselt expression is as follows : Nu = ((lambda+lambda-_t)/lambda)*d_wall/d_eq where d_wall is the distance from the first mesh to the wall and d_eq is given by the wall law. This option also gives the value of d_eq and h = (lambda+lambda_t)/d_eq and the fluid temperature of the first mesh near the wall.
  For the Neumann boundary conditions (flux_impose), the «equivalent» wall temperature given by the wall law is also printed (Tparoi equiv.) preceded for VEF calculation by the edge temperature «T face de bord».

21.2 schmidt

Description: The Schmidt model. For the scalar equations, only the model based on Reynolds analogy is available. If K_Epsilon was selected in the hydraulic equation, Prandtl must be selected for the convection-diffusion temperature equation coupled to the hydraulic equation and Schmidt for the concentration equations.

See also: modele_turbulence_scal_base (21)

Usage:
schmidt obj Lire obj {

> [**scturb** *float*]
> [**turbulence_paroi** *turbulence_paroi_scalaire_base*]
> [**dt_impr_nusselt** *float*]

}
where

- **scturb** *float*: Keyword to modify the constant (Sct) of Schmlidt model : Dt=Nut/Sct Default value is 0.7.
- **turbulence_paroi** *turbulence_paroi_scalaire_base* (30) for inheritance: Keyword to set the wall law.
- **dt_impr_nusselt** *float* for inheritance: Keyword to print local values of Nusselt number and temperature near a wall during a turbulent calculation. The values wil be printed in the _Nusselt.face file each dt_impr_nusselt time period. The local Nusselt expression is as follows : Nu = ((lambda+lambda-_t)/lambda)*d_wall/d_eq where d_wall is the distance from the first mesh to the wall and d_eq is given by the wall law. This option also gives the value of d_eq and h = (lambda+lambda_t)/d_eq and the fluid temperature of the first mesh near the wall.
  For the Neumann boundary conditions (flux_impose), the «equivalent» wall temperature given by the wall law is also printed (Tparoi equiv.) preceded for VEF calculation by the edge temperature «T face de bord».

22 nom

Description: Class to name the TRUST objects.

See also: objet_u (33) nom_anonyme (22.1)

Usage:
nom [**mot**]
where

- **mot** *str*: Chain of characters.

22.1 nom_anonyme

Description: not_set

See also: nom (22)

Usage:
[**mot**]
where

- **mot** *str*: Chain of characters.

23 partitionneur_deriv

Description: not_set

See also: objet_u (33) metis (23.2) sous_zones (23.4) tranche (23.5) partition (23.3) fichier_decoupage (23.1)

Usage:
partitionneur_deriv obj Lire obj {

[**nb_parts** *int*]

}
where

- **nb_parts** *int*: The number of non empty parts that must be generated (generally equal to the number of processors in the parallel run).

23.1 fichier_decoupage

Description: This algorithm reads an array of integer values on the disc, one value for each mesh element. Each value is interpreted as the target part number n>=0 for this element. The number of parts created is the highest value in the array plus one. Empty parts can be created if some values are not present in the array.
The file format is ASCII, and contains space, tab or carriage-return separated integer values. The first value is the number nb_elem of elements in the domain, followed by nb_elem integer values (positive or zero).
This algorithm has been designed to work together with the 'ecrire_decoupage' option. You can generate a partition with any other algorithm, write it to disc, modify it, and read it again to generate the .Zone files.
Contrary to other partitioning algorithms, no correction is applied by default to the partition (eg. element 0 on processor 0 and corrections for periodic boundaries). If 'corriger_partition' is specified, these corrections are applied.

See also: partitionneur_deriv (23)

Usage:
fichier_decoupage obj Lire obj {

fichier *str*
[**corriger_partition**]
[**nb_parts** *int*]

}
where

- **fichier** *str*: FILENAME
- **corriger_partition**
- **nb_parts** *int* for inheritance: The number of non empty parts that must be generated (generally equal to the number of processors in the parallel run).

23.2 metis

Description: Metis is an external partitionning library. It is a general algorithm that will generate a partition of the domain.

See also: partitionneur_deriv (23)

Usage:
metis obj Lire obj {

[**kmetis**]
[**use_weights**]
[**nb_parts** *int*]

}
where

- **kmetis** : The default values are pmetis, default parameters are automatically chosen by Metis. 'kmetis' is faster than pmetis option but the last option produces better partitioning quality. In both cases, the partitioning quality may be slightly improved by increasing the nb_essais option (by default N=1). It will compute N partitions and will keep the best one (smallest edge cut number). But this option is CPU expensive, taking N=10 will multiply the CPU cost of partitioning by 10.
Experiments show that only marginal improvements can be obtained with non default parameters.
- **use_weights** : If use_weights is specified, weighting of the element-element links in the graph is used to force metis to keep opposite periodic elements on the same processor. This option can slightly improve the partitionning quality but it consumes more memory and takes more time. It is not mandatory since a correction algorithm is always applied afterwards to ensure a correct partitionning for periodic boundaries.
- **nb_parts** *int* for inheritance: The number of non empty parts that must be generated (generally equal to the number of processors in the parallel run).

23.3 partition

Synonymous: **decouper**

Description: This algorithm re-use the partition of the domain named DOMAINE_NAME. It is useful to partition for example a post processing domain. The partition should match with the calculation domain.

See also: partitionneur_deriv (23)

Usage:
partition obj Lire obj {

domaine *str*
[**nb_parts** *int*]

}
where

- **domaine** *str*: domain name
- **nb_parts** *int* for inheritance: The number of non empty parts that must be generated (generally equal to the number of processors in the parallel run).

23.4 sous_zones

Description: This algorithm will create one part for each specified subzone. All elements contained in the first subzone are put in the first part, all remaining elements contained in the second subzone in the second part, etc...
If all elements of the domain are contained in the specified subzones, then N parts are created, otherwise, a

supplemental part is created with the remaining elements.
If no subzone is specified, all subzones defined in the domain are used to split the mesh.

See also: partitionneur_deriv (23)

Usage:
sous_zones obj Lire obj {

> **sous_zones** *n word1 word2 ... wordn*
> [**nb_parts** *int*]

}
where

- **sous_zones** *n word1 word2 ... wordn*: N SUBZONE_NAME_1 SUBZONE_NAME_2 ...
- **nb_parts** *int* for inheritance: The number of non empty parts that must be generated (generally equal to the number of processors in the parallel run).

23.5 tranche

Description: This algorithm will create a geometrical partitionning by slicing the mesh in the two or three axis directions, based on the geometric center of each mesh element. nz must be given if dimension=3. Each slice contains the same number of elements (slices don't have the same geometrical width, and for VDF meshes, slice boundaries are generally not flat except if the number of mesh elements in each direction is an exact multiple of the number of slices). First, nx slices in the X direction are created, then each slice is split in ny slices in the Y direction, and finally, each part is split in nz slices in the Z direction. The resulting number of parts is nx*ny*nz. If one particular direction has been declared periodic, the default slicing (0, 1, 2, ..., n-1)is replaced by (0, 1, 2, ... n-1, 0), each of the two '0' slices having twice less elements than the other slices.

See also: partitionneur_deriv (23)

Usage:
tranche obj Lire obj {

> [**tranches** *n1 n2 (n3)*]
> [**nb_parts** *int*]

}
where

- **tranches** *n1 n2 (n3)*: Partitioned by nx in the X direction, ny in the Y direction, nz in the Z direction. Works only for structured meshes. No warranty for unstructured meshes.
- **nb_parts** *int* for inheritance: The number of non empty parts that must be generated (generally equal to the number of processors in the parallel run).

24 precond_base

Description: Basic class for preconditioning.

See also: objet_u (33) ssor (24.2) ssor_bloc (24.3) precondsolv (24.1)

Usage:

24.1 precondsolv

Description: not_set

See also: precond_base (24)

Usage:
precondsolv **solveur**
where

- **solveur** *solveur_sys_base* (9.12): Solver type.

24.2 ssor

Description: Symmetric successive over-relaxation algorithm.

See also: precond_base (24)

Usage:
ssor obj Lire obj {

omega *float*

}
where

- **omega** *float*: Over-relaxation facteur (between 1 and 2, optimal value around 1.5-1.6).

24.3 ssor_bloc

Description: not_set

See also: precond_base (24)

Usage:
ssor_bloc obj Lire obj {

[**alpha_0** *float*]
[**precond0** *precond_base*]
[**alpha_1** *float*]
[**precond1** *precond_base*]
[**alpha_a** *float*]
[**preconda** *precond_base*]

}
where

- **alpha_0** *float*
- **precond0** *precond_base* (24)
- **alpha_1** *float*
- **precond1** *precond_base* (24)
- **alpha_a** *float*
- **preconda** *precond_base* (24)

25 schema_temps_base

Description: Basic class for time schemes. This scheme will be associated with a problem and the equations of this problem.

See also: objet_u (33) scheme_euler_explicit (25.3) schema_predictor_corrector (25.16) Sch_CN_iteratif (25.2) runge_kutta_ordre_3 (25.5) runge_kutta_ordre_4_d3p (25.6) leap_frog (25.4) runge_kutta_rationnel_ordre_2 (25.7) schema_implicite_base (25.15) schema_adams_bashforth_order_2 (25.8) schema_adams_bashforth_order_3 (25.9)

Usage:
schema_temps_base obj Lire obj {

[**tinit** *float*]
[**tmax** *float*]
[**tcpumax** *float*]
[**dt_min** *float*]
[**dt_max** *float*]
[**facsec** *float*]
[**nb_pas_dt_max** *int*]
[**dt_sauv** *float*]
[**dt_impr** *float*]
[**dt_start** *dt_start*]
[**seuil_statio** *float*]
[**seuil_statio_relatif_deconseille** *int into [0, 1]*]
[**diffusion_implicite** *int into [0, 1]*]
[**niter_max_diffusion_implicite** *int*]
[**seuil_diffusion_implicite** *float*]
[**impr_diffusion_implicite** *int into [0, 1]*]
[**precision_impr** *int*]
[**no_error_if_not_converged_diffusion_implicite** *int into [0, 1]*]
[**no_conv_subiteration_diffusion_implicite** *int into [0, 1]*]
[**periode_sauvegarde_securite_en_heures** *int*]
[**no_check_disk_space**]

}
where

- **tinit** *float*: Value of initial calculation time (0 by default).
- **tmax** *float*: Time during which the calculation will be stopped (1e30s by default).
- **tcpumax** *float*: CPU time limit (must be specified in hours) for which the calculation is stopped (1e30s by default).
- **dt_min** *float*: Minimum calculation time step (1e-16s by default).
- **dt_max** *float*: Maximum calculation time step (1e30s by default).
- **facsec** *float*: Value assigned to the safety factor for the time step (1. by default). The time step calculated is multiplied by the safety factor. The first thing to try when a calculation does not converge with an explicit time scheme is to reduce the facsec to 0.5.
  Warning: Some schemes needs a facsec lower than 1 (0.5 is a good start), for example Schema_Adams_Bashforth_order_3
- **nb_pas_dt_max** *int*: Maximum number of calculation time steps (1e9 by default).
- **dt_sauv** *float*: Save time step value (1e30s by default). Every dt_sauv, fields are saved in the .sauv file. The file contains all the information saved over time. If this instruction is not entered, results are saved only upon calculation completion.
- **dt_impr** *float*: Scheme parameter printing time step in time (1e30s by default). The time steps and the flux balances are printed (incorporated onto every side of processed domains) into the .out file.

- **dt_start** *dt_start* (9.5): dt_min : the first iteration is based on dt_min
dt_start dt_calc : the time step at first iteration is calculated in agreement with CFL condition.
dt_start dt_fixe value : the first time step is fixed by the user (recommended when restarting calculation with Crank Nicholson temporal scheme to ensure continuity).
By default, the first iteration is based on dt_calc.
- **seuil_statio** *float*: Value of the convergence threshold (1e-12 by default). Problems using this type of time scheme converge when the derivatives dGi/dt of all the unknown transported values Gi have a combined absolute value less than this value. This is the keyword used to set the permanent rating threshold.
- **seuil_statio_relatif_deconseille** *int into [0, 1]*
- **diffusion_implicite** *int into [0, 1]*: Keyword to make the diffusion term in the Navier Stokes equation implicit (in this case, vrel should be set to 1). The stability time step is then only based on the convection time step (dt=facsec*dt_convection). Thus, in some circumstances, an important gain is achieved with respect to the time step (large diffusion with respect to convection on tightened meshes). Caution: It is however recommended that the user should avoid exceeding the calculation convection time step by selecting a facsec that is too large. Start with a facsec of 1 and then increase this gradually if you wish to accelerate calculation. In addition, for a natural convection calculation with a zero initial speed, in the first time step, the convection time is infinite and therefore dt=facsec*dt_max.
- **niter_max_diffusion_implicite** *int*: This keyword changes the default value (number of unknowns) of the maximal iterations number in the conjugate gradient method used for implicit diffusion.
- **seuil_diffusion_implicite** *float*: This keyword changes the default value (1e-6) of convergency criteria for the resolution by conjugate gradient used for implicit diffusion.
- **impr_diffusion_implicite** *int into [0, 1]*: Unactivate (default) or not the printing of the convergence during the resolution of the conjugate gradient.
- **precision_impr** *int*: Optional keyword to define the digit number for flux values printed into .out files (by default 3).
- **no_error_if_not_converged_diffusion_implicite** *int into [0, 1]*
- **no_conv_subiteration_diffusion_implicite** *int into [0, 1]*
- **periode_sauvegarde_securite_en_heures** *int*: To change the default period (23 hours) between the save of the fields in .sauv file.
- **no_check_disk_space** : To disable the check of the available amount of disk space during the calculation.

25.1 Sch_CN_EX_iteratif

Description: This keyword also describes a Crank-Nicholson method of second order accuracy but here, for scalars, because of instablities encountered when dt>dt_CFL, the Crank Nicholson scheme is not applied to scalar quantities. Scalars are treated according to Euler-Explicite scheme at the end of the CN treatment for velocity flow fields (by doing p Euler explicite under-iterations at dt<=dt_CFL). Parameters are the sames (but default values may change) compare to the Sch_CN_iterative scheme plus a relaxation keyword: niter_min (2 by default), niter_max (6 by default), niter_avg (3 by default), facsec_max (20 by default), seuil (0.05 by default)

See also: Sch_CN_iteratif (25.2)

Usage:
Sch_CN_EX_iteratif obj Lire obj {

[**omega** *float*]
[**niter_min** *int*]
[**niter_max** *int*]
[**niter_avg** *int*]

[**facsec_max** *float*]
[**seuil** *float*]
[**tinit** *float*]
[**tmax** *float*]
[**tcpumax** *float*]
[**dt_min** *float*]
[**dt_max** *float*]
[**facsec** *float*]
[**nb_pas_dt_max** *int*]
[**dt_sauv** *float*]
[**dt_impr** *float*]
[**dt_start** *dt_start*]
[**seuil_statio** *float*]
[**seuil_statio_relatif_deconseille** *int into [0, 1]*]
[**diffusion_implicite** *int into [0, 1]*]
[**niter_max_diffusion_implicite** *int*]
[**seuil_diffusion_implicite** *float*]
[**impr_diffusion_implicite** *int into [0, 1]*]
[**precision_impr** *int*]
[**no_error_if_not_converged_diffusion_implicite** *int into [0, 1]*]
[**no_conv_subiteration_diffusion_implicite** *int into [0, 1]*]
[**periode_sauvegarde_securite_en_heures** *int*]
[**no_check_disk_space**]

}
where

- **omega** *float*: relaxation factor (0.1 by default)
- **niter_min** *int* for inheritance: minimal number of p-iterations to satisfy convergence criteria (2 by default)
- **niter_max** *int* for inheritance: number of maximum p-iterations allowed to satisfy convergence criteria (6 by default)
- **niter_avg** *int* for inheritance: threshold of p-iterations (3 by default). If the number of p-iterations is greater than niter_avg, facsec is reduced, if lesser than niter_avg, facsec is increased (but limited by the facsec_max value).
- **facsec_max** *float* for inheritance: maximum ratio allowed between dynamical time step returned by iterative process and stability time returned by CFL condition (2 by default).
- **seuil** *float* for inheritance: criteria for ending iterative process (Max(|| u(p) - u(p-1)||/Max || u(p) ||) < seuil) (0.001 by default)
- **tinit** *float* for inheritance: Value of initial calculation time (0 by default).
- **tmax** *float* for inheritance: Time during which the calculation will be stopped (1e30s by default).
- **tcpumax** *float* for inheritance: CPU time limit (must be specified in hours) for which the calculation is stopped (1e30s by default).
- **dt_min** *float* for inheritance: Minimum calculation time step (1e-16s by default).
- **dt_max** *float* for inheritance: Maximum calculation time step (1e30s by default).
- **facsec** *float* for inheritance: Value assigned to the safety factor for the time step (1. by default). The time step calculated is multiplied by the safety factor. The first thing to try when a calculation does not converge with an explicit time scheme is to reduce the facsec to 0.5.
  Warning: Some schemes needs a facsec lower than 1 (0.5 is a good start), for example Schema_Adams_Bashforth_order_3
- **nb_pas_dt_max** *int* for inheritance: Maximum number of calculation time steps (1e9 by default).
- **dt_sauv** *float* for inheritance: Save time step value (1e30s by default). Every dt_sauv, fields are saved in the .sauv file. The file contains all the information saved over time. If this instruction is not entered, results are saved only upon calculation completion.

- **dt_impr** *float* for inheritance: Scheme parameter printing time step in time (1e30s by default). The time steps and the flux balances are printed (incorporated onto every side of processed domains) into the .out file.
- **dt_start** *dt_start* (9.5) for inheritance: dt_min : the first iteration is based on dt_min
  dt_start dt_calc : the time step at first iteration is calculated in agreement with CFL condition.
  dt_start dt_fixe value : the first time step is fixed by the user (recommended when restarting calculation with Crank Nicholson temporal scheme to ensure continuity).
  By default, the first iteration is based on dt_calc.
- **seuil_statio** *float* for inheritance: Value of the convergence threshold (1e-12 by default). Problems using this type of time scheme converge when the derivatives dGi/dt of all the unknown transported values Gi have a combined absolute value less than this value. This is the keyword used to set the permanent rating threshold.
- **seuil_statio_relatif_deconseille** *int into [0, 1]* for inheritance
- **diffusion_implicite** *int into [0, 1]* for inheritance: Keyword to make the diffusion term in the Navier Stokes equation implicit (in this case, vrel should be set to 1). The stability time step is then only based on the convection time step (dt=facsec*dt_convection). Thus, in some circumstances, an important gain is achieved with respect to the time step (large diffusion with respect to convection on tightened meshes). Caution: It is however recommended that the user should avoid exceeding the calculation convection time step by selecting a facsec that is too large. Start with a facsec of 1 and then increase this gradually if you wish to accelerate calculation. In addition, for a natural convection calculation with a zero initial speed, in the first time step, the convection time is infinite and therefore dt=facsec*dt_max.
- **niter_max_diffusion_implicite** *int* for inheritance: This keyword changes the default value (number of unknowns) of the maximal iterations number in the conjugate gradient method used for implicit diffusion.
- **seuil_diffusion_implicite** *float* for inheritance: This keyword changes the default value (1e-6) of convergency criteria for the resolution by conjugate gradient used for implicit diffusion.
- **impr_diffusion_implicite** *int into [0, 1]* for inheritance: Unactivate (default) or not the printing of the convergence during the resolution of the conjugate gradient.
- **precision_impr** *int* for inheritance: Optional keyword to define the digit number for flux values printed into .out files (by default 3).
- **no_error_if_not_converged_diffusion_implicite** *int into [0, 1]* for inheritance
- **no_conv_subiteration_diffusion_implicite** *int into [0, 1]* for inheritance
- **periode_sauvegarde_securite_en_heures** *int* for inheritance: To change the default period (23 hours) between the save of the fields in .sauv file.
- **no_check_disk_space** for inheritance: To disable the check of the available amount of disk space during the calculation.

25.2 Sch_CN_iteratif

Description: The Crank-Nicholson method of second order accuracy. A mid-point rule formulation is used (Euler-centered scheme). The basic scheme is:

$$u(t+1) = u(t) + du/dt(t+1/2) * dt$$

The estimation of the time derivative du/dt at the level (t+1/2) is obtained either by iterative process. The time derivative du/dt at the level (t+1/2) is calculated iteratively with a simple under-relaxations method. Since the method is implicit, neither the cfl nor the fourier stability criteria must be respected. The time step is calculated in a way that the iterative procedure converges with the less iterations as possible.
Remark : for stationary or RANS calculations, no limitation can be given for time step through high value of facsec_max parameter (for instance : facsec_max 1000). In counterpart, for LES calculations, high values of facsec_max may engender numerical instabilities.

See also: schema_temps_base (25) Sch_CN_EX_iteratif (25.1)

Usage:
Sch_CN_iteratif obj Lire obj {

[**niter_min** *int*]
[**niter_max** *int*]
[**niter_avg** *int*]
[**facsec_max** *float*]
[**seuil** *float*]
[**tinit** *float*]
[**tmax** *float*]
[**tcpumax** *float*]
[**dt_min** *float*]
[**dt_max** *float*]
[**facsec** *float*]
[**nb_pas_dt_max** *int*]
[**dt_sauv** *float*]
[**dt_impr** *float*]
[**dt_start** *dt_start*]
[**seuil_statio** *float*]
[**seuil_statio_relatif_deconseille** *int into [0, 1]*]
[**diffusion_implicite** *int into [0, 1]*]
[**niter_max_diffusion_implicite** *int*]
[**seuil_diffusion_implicite** *float*]
[**impr_diffusion_implicite** *int into [0, 1]*]
[**precision_impr** *int*]
[**no_error_if_not_converged_diffusion_implicite** *int into [0, 1]*]
[**no_conv_subiteration_diffusion_implicite** *int into [0, 1]*]
[**periode_sauvegarde_securite_en_heures** *int*]
[**no_check_disk_space**]

}
where

- **niter_min** *int*: minimal number of p-iterations to satisfy convergence criteria (2 by default)
- **niter_max** *int*: number of maximum p-iterations allowed to satisfy convergence criteria (6 by default)
- **niter_avg** *int*: threshold of p-iterations (3 by default). If the number of p-iterations is greater than niter_avg, facsec is reduced, if lesser than niter_avg, facsec is increased (but limited by the facsec_max value).
- **facsec_max** *float*: maximum ratio allowed between dynamical time step returned by iterative process and stability time returned by CFL condition (2 by default).
- **seuil** *float*: criteria for ending iterative process (Max(|| u(p) - u(p-1)||/Max || u(p) ||) < seuil) (0.001 by default)
- **tinit** *float* for inheritance: Value of initial calculation time (0 by default).
- **tmax** *float* for inheritance: Time during which the calculation will be stopped (1e30s by default).
- **tcpumax** *float* for inheritance: CPU time limit (must be specified in hours) for which the calculation is stopped (1e30s by default).
- **dt_min** *float* for inheritance: Minimum calculation time step (1e-16s by default).
- **dt_max** *float* for inheritance: Maximum calculation time step (1e30s by default).
- **facsec** *float* for inheritance: Value assigned to the safety factor for the time step (1. by default). The time step calculated is multiplied by the safety factor. The first thing to try when a calculation does not converge with an explicit time scheme is to reduce the facsec to 0.5.
  Warning: Some schemes needs a facsec lower than 1 (0.5 is a good start), for example Schema_Adams_Bashforth_order_3

- **nb_pas_dt_max** *int* for inheritance: Maximum number of calculation time steps (1e9 by default).
- **dt_sauv** *float* for inheritance: Save time step value (1e30s by default). Every dt_sauv, fields are saved in the .sauv file. The file contains all the information saved over time. If this instruction is not entered, results are saved only upon calculation completion.
- **dt_impr** *float* for inheritance: Scheme parameter printing time step in time (1e30s by default). The time steps and the flux balances are printed (incorporated onto every side of processed domains) into the .out file.
- **dt_start** *dt_start* (9.5) for inheritance: dt_min : the first iteration is based on dt_min
  dt_start dt_calc : the time step at first iteration is calculated in agreement with CFL condition.
  dt_start dt_fixe value : the first time step is fixed by the user (recommended when restarting calculation with Crank Nicholson temporal scheme to ensure continuity).
  By default, the first iteration is based on dt_calc.
- **seuil_statio** *float* for inheritance: Value of the convergence threshold (1e-12 by default). Problems using this type of time scheme converge when the derivatives dGi/dt of all the unknown transported values Gi have a combined absolute value less than this value. This is the keyword used to set the permanent rating threshold.
- **seuil_statio_relatif_deconseille** *int into [0, 1]* for inheritance
- **diffusion_implicite** *int into [0, 1]* for inheritance: Keyword to make the diffusion term in the Navier Stokes equation implicit (in this case, vrel should be set to 1). The stability time step is then only based on the convection time step (dt=facsec*dt_convection). Thus, in some circumstances, an important gain is achieved with respect to the time step (large diffusion with respect to convection on tightened meshes). Caution: It is however recommended that the user should avoid exceeding the calculation convection time step by selecting a facsec that is too large. Start with a facsec of 1 and then increase this gradually if you wish to accelerate calculation. In addition, for a natural convection calculation with a zero initial speed, in the first time step, the convection time is infinite and therefore dt=facsec*dt_max.
- **niter_max_diffusion_implicite** *int* for inheritance: This keyword changes the default value (number of unknowns) of the maximal iterations number in the conjugate gradient method used for implicit diffusion.
- **seuil_diffusion_implicite** *float* for inheritance: This keyword changes the default value (1e-6) of convergency criteria for the resolution by conjugate gradient used for implicit diffusion.
- **impr_diffusion_implicite** *int into [0, 1]* for inheritance: Unactivate (default) or not the printing of the convergence during the resolution of the conjugate gradient.
- **precision_impr** *int* for inheritance: Optional keyword to define the digit number for flux values printed into .out files (by default 3).
- **no_error_if_not_converged_diffusion_implicite** *int into [0, 1]* for inheritance
- **no_conv_subiteration_diffusion_implicite** *int into [0, 1]* for inheritance
- **periode_sauvegarde_securite_en_heures** *int* for inheritance: To change the default period (23 hours) between the save of the fields in .sauv file.
- **no_check_disk_space** for inheritance: To disable the check of the available amount of disk space during the calculation.

25.3 scheme_euler_explicit

Synonymous: **schema_euler_explicite**

Description: This is the Euler explicite scheme.

See also: schema_temps_base (25)

Usage:
scheme_euler_explicit obj Lire obj {

  [**tinit** *float*]

[**tmax** *float*]
[**tcpumax** *float*]
[**dt_min** *float*]
[**dt_max** *float*]
[**facsec** *float*]
[**nb_pas_dt_max** *int*]
[**dt_sauv** *float*]
[**dt_impr** *float*]
[**dt_start** *dt_start*]
[**seuil_statio** *float*]
[**seuil_statio_relatif_deconseille** *int into [0, 1]*]
[**diffusion_implicite** *int into [0, 1]*]
[**niter_max_diffusion_implicite** *int*]
[**seuil_diffusion_implicite** *float*]
[**impr_diffusion_implicite** *int into [0, 1]*]
[**precision_impr** *int*]
[**no_error_if_not_converged_diffusion_implicite** *int into [0, 1]*]
[**no_conv_subiteration_diffusion_implicite** *int into [0, 1]*]
[**periode_sauvegarde_securite_en_heures** *int*]
[**no_check_disk_space**]

}
where

- **tinit** *float* for inheritance: Value of initial calculation time (0 by default).
- **tmax** *float* for inheritance: Time during which the calculation will be stopped (1e30s by default).
- **tcpumax** *float* for inheritance: CPU time limit (must be specified in hours) for which the calculation is stopped (1e30s by default).
- **dt_min** *float* for inheritance: Minimum calculation time step (1e-16s by default).
- **dt_max** *float* for inheritance: Maximum calculation time step (1e30s by default).
- **facsec** *float* for inheritance: Value assigned to the safety factor for the time step (1. by default). The time step calculated is multiplied by the safety factor. The first thing to try when a calculation does not converge with an explicit time scheme is to reduce the facsec to 0.5.
  Warning: Some schemes needs a facsec lower than 1 (0.5 is a good start), for example Schema_Adams_Bashforth_order_3
- **nb_pas_dt_max** *int* for inheritance: Maximum number of calculation time steps (1e9 by default).
- **dt_sauv** *float* for inheritance: Save time step value (1e30s by default). Every dt_sauv, fields are saved in the .sauv file. The file contains all the information saved over time. If this instruction is not entered, results are saved only upon calculation completion.
- **dt_impr** *float* for inheritance: Scheme parameter printing time step in time (1e30s by default). The time steps and the flux balances are printed (incorporated onto every side of processed domains) into the .out file.
- **dt_start** *dt_start* (9.5) for inheritance: dt_min : the first iteration is based on dt_min
  dt_start dt_calc : the time step at first iteration is calculated in agreement with CFL condition.
  dt_start dt_fixe value : the first time step is fixed by the user (recommended when restarting calculation with Crank Nicholson temporal scheme to ensure continuity).
  By default, the first iteration is based on dt_calc.
- **seuil_statio** *float* for inheritance: Value of the convergence threshold (1e-12 by default). Problems using this type of time scheme converge when the derivatives dGi/dt of all the unknown transported values Gi have a combined absolute value less than this value. This is the keyword used to set the permanent rating threshold.
- **seuil_statio_relatif_deconseille** *int into [0, 1]* for inheritance
- **diffusion_implicite** *int into [0, 1]* for inheritance: Keyword to make the diffusion term in the Navier Stokes equation implicit (in this case, vrel should be set to 1). The stability time step is then only based on the convection time step (dt=facsec*dt_convection). Thus, in some circumstances, an

important gain is achieved with respect to the time step (large diffusion with respect to convection on tightened meshes). Caution: It is however recommended that the user should avoid exceeding the calculation convection time step by selecting a facsec that is too large. Start with a facsec of 1 and then increase this gradually if you wish to accelerate calculation. In addition, for a natural convection calculation with a zero initial speed, in the first time step, the convection time is infinite and therefore dt=facsec*dt_max.

- **niter_max_diffusion_implicite** *int* for inheritance: This keyword changes the default value (number of unknowns) of the maximal iterations number in the conjugate gradient method used for implicit diffusion.
- **seuil_diffusion_implicite** *float* for inheritance: This keyword changes the default value (1e-6) of convergency criteria for the resolution by conjugate gradient used for implicit diffusion.
- **impr_diffusion_implicite** *int into [0, 1]* for inheritance: Unactivate (default) or not the printing of the convergence during the resolution of the conjugate gradient.
- **precision_impr** *int* for inheritance: Optional keyword to define the digit number for flux values printed into .out files (by default 3).
- **no_error_if_not_converged_diffusion_implicite** *int into [0, 1]* for inheritance
- **no_conv_subiteration_diffusion_implicite** *int into [0, 1]* for inheritance
- **periode_sauvegarde_securite_en_heures** *int* for inheritance: To change the default period (23 hours) between the save of the fields in .sauv file.
- **no_check_disk_space** for inheritance: To disable the check of the available amount of disk space during the calculation.

25.4 leap_frog

Description: This is the leap-frog scheme.

See also: schema_temps_base (25)

Usage:
leap_frog obj Lire obj {

[**tinit** *float*]
[**tmax** *float*]
[**tcpumax** *float*]
[**dt_min** *float*]
[**dt_max** *float*]
[**facsec** *float*]
[**nb_pas_dt_max** *int*]
[**dt_sauv** *float*]
[**dt_impr** *float*]
[**dt_start** *dt_start*]
[**seuil_statio** *float*]
[**seuil_statio_relatif_deconseille** *int into [0, 1]*]
[**diffusion_implicite** *int into [0, 1]*]
[**niter_max_diffusion_implicite** *int*]
[**seuil_diffusion_implicite** *float*]
[**impr_diffusion_implicite** *int into [0, 1]*]
[**precision_impr** *int*]
[**no_error_if_not_converged_diffusion_implicite** *int into [0, 1]*]
[**no_conv_subiteration_diffusion_implicite** *int into [0, 1]*]
[**periode_sauvegarde_securite_en_heures** *int*]
[**no_check_disk_space**]

}

where

- **tinit** *float* for inheritance: Value of initial calculation time (0 by default).
- **tmax** *float* for inheritance: Time during which the calculation will be stopped (1e30s by default).
- **tcpumax** *float* for inheritance: CPU time limit (must be specified in hours) for which the calculation is stopped (1e30s by default).
- **dt_min** *float* for inheritance: Minimum calculation time step (1e-16s by default).
- **dt_max** *float* for inheritance: Maximum calculation time step (1e30s by default).
- **facsec** *float* for inheritance: Value assigned to the safety factor for the time step (1. by default). The time step calculated is multiplied by the safety factor. The first thing to try when a calculation does not converge with an explicit time scheme is to reduce the facsec to 0.5.
  Warning: Some schemes needs a facsec lower than 1 (0.5 is a good start), for example Schema_Adams_Bashforth_order_3
- **nb_pas_dt_max** *int* for inheritance: Maximum number of calculation time steps (1e9 by default).
- **dt_sauv** *float* for inheritance: Save time step value (1e30s by default). Every dt_sauv, fields are saved in the .sauv file. The file contains all the information saved over time. If this instruction is not entered, results are saved only upon calculation completion.
- **dt_impr** *float* for inheritance: Scheme parameter printing time step in time (1e30s by default). The time steps and the flux balances are printed (incorporated onto every side of processed domains) into the .out file.
- **dt_start** *dt_start* (9.5) for inheritance: dt_min : the first iteration is based on dt_min
  dt_start dt_calc : the time step at first iteration is calculated in agreement with CFL condition.
  dt_start dt_fixe value : the first time step is fixed by the user (recommended when restarting calculation with Crank Nicholson temporal scheme to ensure continuity).
  By default, the first iteration is based on dt_calc.
- **seuil_statio** *float* for inheritance: Value of the convergence threshold (1e-12 by default). Problems using this type of time scheme converge when the derivatives dGi/dt of all the unknown transported values Gi have a combined absolute value less than this value. This is the keyword used to set the permanent rating threshold.
- **seuil_statio_relatif_deconseille** *int into [0, 1]* for inheritance
- **diffusion_implicite** *int into [0, 1]* for inheritance: Keyword to make the diffusion term in the Navier Stokes equation implicit (in this case, vrel should be set to 1). The stability time step is then only based on the convection time step (dt=facsec*dt_convection). Thus, in some circumstances, an important gain is achieved with respect to the time step (large diffusion with respect to convection on tightened meshes). Caution: It is however recommended that the user should avoid exceeding the calculation convection time step by selecting a facsec that is too large. Start with a facsec of 1 and then increase this gradually if you wish to accelerate calculation. In addition, for a natural convection calculation with a zero initial speed, in the first time step, the convection time is infinite and therefore dt=facsec*dt_max.
- **niter_max_diffusion_implicite** *int* for inheritance: This keyword changes the default value (number of unknowns) of the maximal iterations number in the conjugate gradient method used for implicit diffusion.
- **seuil_diffusion_implicite** *float* for inheritance: This keyword changes the default value (1e-6) of convergency criteria for the resolution by conjugate gradient used for implicit diffusion.
- **impr_diffusion_implicite** *int into [0, 1]* for inheritance: Unactivate (default) or not the printing of the convergence during the resolution of the conjugate gradient.
- **precision_impr** *int* for inheritance: Optional keyword to define the digit number for flux values printed into .out files (by default 3).
- **no_error_if_not_converged_diffusion_implicite** *int into [0, 1]* for inheritance
- **no_conv_subiteration_diffusion_implicite** *int into [0, 1]* for inheritance
- **periode_sauvegarde_securite_en_heures** *int* for inheritance: To change the default period (23 hours) between the save of the fields in .sauv file.
- **no_check_disk_space** for inheritance: To disable the check of the available amount of disk space during the calculation.

25.5 runge_kutta_ordre_3

Description: This is the Runge-Kutta scheme of third order.

See also: schema_temps_base (25)

Usage:
runge_kutta_ordre_3 obj Lire obj {

[**tinit** *float*]
[**tmax** *float*]
[**tcpumax** *float*]
[**dt_min** *float*]
[**dt_max** *float*]
[**facsec** *float*]
[**nb_pas_dt_max** *int*]
[**dt_sauv** *float*]
[**dt_impr** *float*]
[**dt_start** *dt_start*]
[**seuil_statio** *float*]
[**seuil_statio_relatif_deconseille** *int into [0, 1]*]
[**diffusion_implicite** *int into [0, 1]*]
[**niter_max_diffusion_implicite** *int*]
[**seuil_diffusion_implicite** *float*]
[**impr_diffusion_implicite** *int into [0, 1]*]
[**precision_impr** *int*]
[**no_error_if_not_converged_diffusion_implicite** *int into [0, 1]*]
[**no_conv_subiteration_diffusion_implicite** *int into [0, 1]*]
[**periode_sauvegarde_securite_en_heures** *int*]
[**no_check_disk_space**]

}
where

- **tinit** *float* for inheritance: Value of initial calculation time (0 by default).
- **tmax** *float* for inheritance: Time during which the calculation will be stopped (1e30s by default).
- **tcpumax** *float* for inheritance: CPU time limit (must be specified in hours) for which the calculation is stopped (1e30s by default).
- **dt_min** *float* for inheritance: Minimum calculation time step (1e-16s by default).
- **dt_max** *float* for inheritance: Maximum calculation time step (1e30s by default).
- **facsec** *float* for inheritance: Value assigned to the safety factor for the time step (1. by default). The time step calculated is multiplied by the safety factor. The first thing to try when a calculation does not converge with an explicit time scheme is to reduce the facsec to 0.5.
  Warning: Some schemes needs a facsec lower than 1 (0.5 is a good start), for example Schema_Adams_Bashforth_order_3
- **nb_pas_dt_max** *int* for inheritance: Maximum number of calculation time steps (1e9 by default).
- **dt_sauv** *float* for inheritance: Save time step value (1e30s by default). Every dt_sauv, fields are saved in the .sauv file. The file contains all the information saved over time. If this instruction is not entered, results are saved only upon calculation completion.
- **dt_impr** *float* for inheritance: Scheme parameter printing time step in time (1e30s by default). The time steps and the flux balances are printed (incorporated onto every side of processed domains) into the .out file.
- **dt_start** *dt_start* (9.5) for inheritance: dt_min : the first iteration is based on dt_min
  dt_start dt_calc : the time step at first iteration is calculated in agreement with CFL condition.
  dt_start dt_fixe value : the first time step is fixed by the user (recommended when restarting calcula-

tion with Crank Nicholson temporal scheme to ensure continuity).
By default, the first iteration is based on dt_calc.

- **seuil_statio** *float* for inheritance: Value of the convergence threshold (1e-12 by default). Problems using this type of time scheme converge when the derivatives dGi/dt of all the unknown transported values Gi have a combined absolute value less than this value. This is the keyword used to set the permanent rating threshold.
- **seuil_statio_relatif_deconseille** *int into [0, 1]* for inheritance
- **diffusion_implicite** *int into [0, 1]* for inheritance: Keyword to make the diffusion term in the Navier Stokes equation implicit (in this case, vrel should be set to 1). The stability time step is then only based on the convection time step (dt=facsec*dt_convection). Thus, in some circumstances, an important gain is achieved with respect to the time step (large diffusion with respect to convection on tightened meshes). Caution: It is however recommended that the user should avoid exceeding the calculation convection time step by selecting a facsec that is too large. Start with a facsec of 1 and then increase this gradually if you wish to accelerate calculation. In addition, for a natural convection calculation with a zero initial speed, in the first time step, the convection time is infinite and therefore dt=facsec*dt_max.
- **niter_max_diffusion_implicite** *int* for inheritance: This keyword changes the default value (number of unknowns) of the maximal iterations number in the conjugate gradient method used for implicit diffusion.
- **seuil_diffusion_implicite** *float* for inheritance: This keyword changes the default value (1e-6) of convergency criteria for the resolution by conjugate gradient used for implicit diffusion.
- **impr_diffusion_implicite** *int into [0, 1]* for inheritance: Unactivate (default) or not the printing of the convergence during the resolution of the conjugate gradient.
- **precision_impr** *int* for inheritance: Optional keyword to define the digit number for flux values printed into .out files (by default 3).
- **no_error_if_not_converged_diffusion_implicite** *int into [0, 1]* for inheritance
- **no_conv_subiteration_diffusion_implicite** *int into [0, 1]* for inheritance
- **periode_sauvegarde_securite_en_heures** *int* for inheritance: To change the default period (23 hours) between the save of the fields in .sauv file.
- **no_check_disk_space** for inheritance: To disable the check of the available amount of disk space during the calculation.

25.6 runge_kutta_ordre_4_d3p

Description: not_set

See also: schema_temps_base (25)

Usage:
runge_kutta_ordre_4_d3p obj Lire obj {

[**tinit** *float*]
[**tmax** *float*]
[**tcpumax** *float*]
[**dt_min** *float*]
[**dt_max** *float*]
[**facsec** *float*]
[**nb_pas_dt_max** *int*]
[**dt_sauv** *float*]
[**dt_impr** *float*]
[**dt_start** *dt_start*]
[**seuil_statio** *float*]
[**seuil_statio_relatif_deconseille** *int into [0, 1]*]

[**diffusion_implicite** *int into [0, 1]*]
[**niter_max_diffusion_implicite** *int*]
[**seuil_diffusion_implicite** *float*]
[**impr_diffusion_implicite** *int into [0, 1]*]
[**precision_impr** *int*]
[**no_error_if_not_converged_diffusion_implicite** *int into [0, 1]*]
[**no_conv_subiteration_diffusion_implicite** *int into [0, 1]*]
[**periode_sauvegarde_securite_en_heures** *int*]
[**no_check_disk_space**]

}
where

- **tinit** *float* for inheritance: Value of initial calculation time (0 by default).
- **tmax** *float* for inheritance: Time during which the calculation will be stopped (1e30s by default).
- **tcpumax** *float* for inheritance: CPU time limit (must be specified in hours) for which the calculation is stopped (1e30s by default).
- **dt_min** *float* for inheritance: Minimum calculation time step (1e-16s by default).
- **dt_max** *float* for inheritance: Maximum calculation time step (1e30s by default).
- **facsec** *float* for inheritance: Value assigned to the safety factor for the time step (1. by default). The time step calculated is multiplied by the safety factor. The first thing to try when a calculation does not converge with an explicit time scheme is to reduce the facsec to 0.5.
  Warning: Some schemes needs a facsec lower than 1 (0.5 is a good start), for example Schema_Adams_Bashforth_order_3
- **nb_pas_dt_max** *int* for inheritance: Maximum number of calculation time steps (1e9 by default).
- **dt_sauv** *float* for inheritance: Save time step value (1e30s by default). Every dt_sauv, fields are saved in the .sauv file. The file contains all the information saved over time. If this instruction is not entered, results are saved only upon calculation completion.
- **dt_impr** *float* for inheritance: Scheme parameter printing time step in time (1e30s by default). The time steps and the flux balances are printed (incorporated onto every side of processed domains) into the .out file.
- **dt_start** *dt_start* (9.5) for inheritance: dt_min : the first iteration is based on dt_min
  dt_start dt_calc : the time step at first iteration is calculated in agreement with CFL condition.
  dt_start dt_fixe value : the first time step is fixed by the user (recommended when restarting calculation with Crank Nicholson temporal scheme to ensure continuity).
  By default, the first iteration is based on dt_calc.
- **seuil_statio** *float* for inheritance: Value of the convergence threshold (1e-12 by default). Problems using this type of time scheme converge when the derivatives dGi/dt of all the unknown transported values Gi have a combined absolute value less than this value. This is the keyword used to set the permanent rating threshold.
- **seuil_statio_relatif_deconseille** *int into [0, 1]* for inheritance
- **diffusion_implicite** *int into [0, 1]* for inheritance: Keyword to make the diffusion term in the Navier Stokes equation implicit (in this case, vrel should be set to 1). The stability time step is then only based on the convection time step (dt=facsec*dt_convection). Thus, in some circumstances, an important gain is achieved with respect to the time step (large diffusion with respect to convection on tightened meshes). Caution: It is however recommended that the user should avoid exceeding the calculation convection time step by selecting a facsec that is too large. Start with a facsec of 1 and then increase this gradually if you wish to accelerate calculation. In addition, for a natural convection calculation with a zero initial speed, in the first time step, the convection time is infinite and therefore dt=facsec*dt_max.
- **niter_max_diffusion_implicite** *int* for inheritance: This keyword changes the default value (number of unknowns) of the maximal iterations number in the conjugate gradient method used for implicit diffusion.
- **seuil_diffusion_implicite** *float* for inheritance: This keyword changes the default value (1e-6) of convergency criteria for the resolution by conjugate gradient used for implicit diffusion.

- **impr_diffusion_implicite** *int into [0, 1]* for inheritance: Unactivate (default) or not the printing of the convergence during the resolution of the conjugate gradient.
- **precision_impr** *int* for inheritance: Optional keyword to define the digit number for flux values printed into .out files (by default 3).
- **no_error_if_not_converged_diffusion_implicite** *int into [0, 1]* for inheritance
- **no_conv_subiteration_diffusion_implicite** *int into [0, 1]* for inheritance
- **periode_sauvegarde_securite_en_heures** *int* for inheritance: To change the default period (23 hours) between the save of the fields in .sauv file.
- **no_check_disk_space** for inheritance: To disable the check of the available amount of disk space during the calculation.

25.7 runge_kutta_rationnel_ordre_2

Description: This is the Runge-Kutta rational scheme of second order. The method is described in the note: Wambeck - Rational Runge-Kutta methods for solving systems of ordinary differential equations, at the link: https://link.springer.com/article/10.1007/BF02252381. Although rational methods require more computational work than linear ones, they can have some other properties, such as a stable behaviour with explicitness, which make them preferable. The CFD application of this RRK2 scheme is described in the note: https://link.springer.com/content/pdf/10.1007%2F3-540-13917-6_112.pdf.

See also: schema_temps_base (25)

Usage:
runge_kutta_rationnel_ordre_2 obj Lire obj {

[**tinit** *float*]
[**tmax** *float*]
[**tcpumax** *float*]
[**dt_min** *float*]
[**dt_max** *float*]
[**facsec** *float*]
[**nb_pas_dt_max** *int*]
[**dt_sauv** *float*]
[**dt_impr** *float*]
[**dt_start** *dt_start*]
[**seuil_statio** *float*]
[**seuil_statio_relatif_deconseille** *int into [0, 1]*]
[**diffusion_implicite** *int into [0, 1]*]
[**niter_max_diffusion_implicite** *int*]
[**seuil_diffusion_implicite** *float*]
[**impr_diffusion_implicite** *int into [0, 1]*]
[**precision_impr** *int*]
[**no_error_if_not_converged_diffusion_implicite** *int into [0, 1]*]
[**no_conv_subiteration_diffusion_implicite** *int into [0, 1]*]
[**periode_sauvegarde_securite_en_heures** *int*]
[**no_check_disk_space**]

}
where

- **tinit** *float* for inheritance: Value of initial calculation time (0 by default).
- **tmax** *float* for inheritance: Time during which the calculation will be stopped (1e30s by default).
- **tcpumax** *float* for inheritance: CPU time limit (must be specified in hours) for which the calculation is stopped (1e30s by default).

- **dt_min** *float* for inheritance: Minimum calculation time step (1e-16s by default).
- **dt_max** *float* for inheritance: Maximum calculation time step (1e30s by default).
- **facsec** *float* for inheritance: Value assigned to the safety factor for the time step (1. by default). The time step calculated is multiplied by the safety factor. The first thing to try when a calculation does not converge with an explicit time scheme is to reduce the facsec to 0.5.
  Warning: Some schemes needs a facsec lower than 1 (0.5 is a good start), for example Schema_Adams_Bashforth_order_3
- **nb_pas_dt_max** *int* for inheritance: Maximum number of calculation time steps (1e9 by default).
- **dt_sauv** *float* for inheritance: Save time step value (1e30s by default). Every dt_sauv, fields are saved in the .sauv file. The file contains all the information saved over time. If this instruction is not entered, results are saved only upon calculation completion.
- **dt_impr** *float* for inheritance: Scheme parameter printing time step in time (1e30s by default). The time steps and the flux balances are printed (incorporated onto every side of processed domains) into the .out file.
- **dt_start** *dt_start* (9.5) for inheritance: dt_min : the first iteration is based on dt_min
  dt_start dt_calc : the time step at first iteration is calculated in agreement with CFL condition.
  dt_start dt_fixe value : the first time step is fixed by the user (recommended when restarting calculation with Crank Nicholson temporal scheme to ensure continuity).
  By default, the first iteration is based on dt_calc.
- **seuil_statio** *float* for inheritance: Value of the convergence threshold (1e-12 by default). Problems using this type of time scheme converge when the derivatives dGi/dt of all the unknown transported values Gi have a combined absolute value less than this value. This is the keyword used to set the permanent rating threshold.
- **seuil_statio_relatif_deconseille** *int into [0, 1]* for inheritance
- **diffusion_implicite** *int into [0, 1]* for inheritance: Keyword to make the diffusion term in the Navier Stokes equation implicit (in this case, vrel should be set to 1). The stability time step is then only based on the convection time step (dt=facsec*dt_convection). Thus, in some circumstances, an important gain is achieved with respect to the time step (large diffusion with respect to convection on tightened meshes). Caution: It is however recommended that the user should avoid exceeding the calculation convection time step by selecting a facsec that is too large. Start with a facsec of 1 and then increase this gradually if you wish to accelerate calculation. In addition, for a natural convection calculation with a zero initial speed, in the first time step, the convection time is infinite and therefore dt=facsec*dt_max.
- **niter_max_diffusion_implicite** *int* for inheritance: This keyword changes the default value (number of unknowns) of the maximal iterations number in the conjugate gradient method used for implicit diffusion.
- **seuil_diffusion_implicite** *float* for inheritance: This keyword changes the default value (1e-6) of convergency criteria for the resolution by conjugate gradient used for implicit diffusion.
- **impr_diffusion_implicite** *int into [0, 1]* for inheritance: Unactivate (default) or not the printing of the convergence during the resolution of the conjugate gradient.
- **precision_impr** *int* for inheritance: Optional keyword to define the digit number for flux values printed into .out files (by default 3).
- **no_error_if_not_converged_diffusion_implicite** *int into [0, 1]* for inheritance
- **no_conv_subiteration_diffusion_implicite** *int into [0, 1]* for inheritance
- **periode_sauvegarde_securite_en_heures** *int* for inheritance: To change the default period (23 hours) between the save of the fields in .sauv file.
- **no_check_disk_space** for inheritance: To disable the check of the available amount of disk space during the calculation.

25.8 schema_adams_bashforth_order_2

Description: not_set

See also: schema_temps_base (25)

Usage:
schema_adams_bashforth_order_2 obj Lire obj {

[**tinit** *float*]
[**tmax** *float*]
[**tcpumax** *float*]
[**dt_min** *float*]
[**dt_max** *float*]
[**facsec** *float*]
[**nb_pas_dt_max** *int*]
[**dt_sauv** *float*]
[**dt_impr** *float*]
[**dt_start** *dt_start*]
[**seuil_statio** *float*]
[**seuil_statio_relatif_deconseille** *int into [0, 1]*]
[**diffusion_implicite** *int into [0, 1]*]
[**niter_max_diffusion_implicite** *int*]
[**seuil_diffusion_implicite** *float*]
[**impr_diffusion_implicite** *int into [0, 1]*]
[**precision_impr** *int*]
[**no_error_if_not_converged_diffusion_implicite** *int into [0, 1]*]
[**no_conv_subiteration_diffusion_implicite** *int into [0, 1]*]
[**periode_sauvegarde_securite_en_heures** *int*]
[**no_check_disk_space**]

}
where

- **tinit** *float* for inheritance: Value of initial calculation time (0 by default).
- **tmax** *float* for inheritance: Time during which the calculation will be stopped (1e30s by default).
- **tcpumax** *float* for inheritance: CPU time limit (must be specified in hours) for which the calculation is stopped (1e30s by default).
- **dt_min** *float* for inheritance: Minimum calculation time step (1e-16s by default).
- **dt_max** *float* for inheritance: Maximum calculation time step (1e30s by default).
- **facsec** *float* for inheritance: Value assigned to the safety factor for the time step (1. by default). The time step calculated is multiplied by the safety factor. The first thing to try when a calculation does not converge with an explicit time scheme is to reduce the facsec to 0.5.
  Warning: Some schemes needs a facsec lower than 1 (0.5 is a good start), for example Schema-_Adams_Bashforth_order_3
- **nb_pas_dt_max** *int* for inheritance: Maximum number of calculation time steps (1e9 by default).
- **dt_sauv** *float* for inheritance: Save time step value (1e30s by default). Every dt_sauv, fields are saved in the .sauv file. The file contains all the information saved over time. If this instruction is not entered, results are saved only upon calculation completion.
- **dt_impr** *float* for inheritance: Scheme parameter printing time step in time (1e30s by default). The time steps and the flux balances are printed (incorporated onto every side of processed domains) into the .out file.
- **dt_start** *dt_start* (9.5) for inheritance: dt_min : the first iteration is based on dt_min
  dt_start dt_calc : the time step at first iteration is calculated in agreement with CFL condition.
  dt_start dt_fixe value : the first time step is fixed by the user (recommended when restarting calculation with Crank Nicholson temporal scheme to ensure continuity).
  By default, the first iteration is based on dt_calc.
- **seuil_statio** *float* for inheritance: Value of the convergence threshold (1e-12 by default). Problems using this type of time scheme converge when the derivatives dGi/dt of all the unknown transported

values Gi have a combined absolute value less than this value. This is the keyword used to set the permanent rating threshold.

- **seuil_statio_relatif_deconseille** *int into [0, 1]* for inheritance
- **diffusion_implicite** *int into [0, 1]* for inheritance: Keyword to make the diffusion term in the Navier Stokes equation implicit (in this case, vrel should be set to 1). The stability time step is then only based on the convection time step (dt=facsec*dt_convection). Thus, in some circumstances, an important gain is achieved with respect to the time step (large diffusion with respect to convection on tightened meshes). Caution: It is however recommended that the user should avoid exceeding the calculation convection time step by selecting a facsec that is too large. Start with a facsec of 1 and then increase this gradually if you wish to accelerate calculation. In addition, for a natural convection calculation with a zero initial speed, in the first time step, the convection time is infinite and therefore dt=facsec*dt_max.
- **niter_max_diffusion_implicite** *int* for inheritance: This keyword changes the default value (number of unknowns) of the maximal iterations number in the conjugate gradient method used for implicit diffusion.
- **seuil_diffusion_implicite** *float* for inheritance: This keyword changes the default value (1e-6) of convergency criteria for the resolution by conjugate gradient used for implicit diffusion.
- **impr_diffusion_implicite** *int into [0, 1]* for inheritance: Unactivate (default) or not the printing of the convergence during the resolution of the conjugate gradient.
- **precision_impr** *int* for inheritance: Optional keyword to define the digit number for flux values printed into .out files (by default 3).
- **no_error_if_not_converged_diffusion_implicite** *int into [0, 1]* for inheritance
- **no_conv_subiteration_diffusion_implicite** *int into [0, 1]* for inheritance
- **periode_sauvegarde_securite_en_heures** *int* for inheritance: To change the default period (23 hours) between the save of the fields in .sauv file.
- **no_check_disk_space** for inheritance: To disable the check of the available amount of disk space during the calculation.

25.9 schema_adams_bashforth_order_3

Description: not_set

See also: schema_temps_base (25)

Usage:
schema_adams_bashforth_order_3 obj Lire obj {

[**tinit** *float*]
[**tmax** *float*]
[**tcpumax** *float*]
[**dt_min** *float*]
[**dt_max** *float*]
[**facsec** *float*]
[**nb_pas_dt_max** *int*]
[**dt_sauv** *float*]
[**dt_impr** *float*]
[**dt_start** *dt_start*]
[**seuil_statio** *float*]
[**seuil_statio_relatif_deconseille** *int into [0, 1]*]
[**diffusion_implicite** *int into [0, 1]*]
[**niter_max_diffusion_implicite** *int*]
[**seuil_diffusion_implicite** *float*]
[**impr_diffusion_implicite** *int into [0, 1]*]

[**precision_impr** *int*]
[**no_error_if_not_converged_diffusion_implicite** *int into [0, 1]*]
[**no_conv_subiteration_diffusion_implicite** *int into [0, 1]*]
[**periode_sauvegarde_securite_en_heures** *int*]
[**no_check_disk_space**]

}
where

- **tinit** *float* for inheritance: Value of initial calculation time (0 by default).
- **tmax** *float* for inheritance: Time during which the calculation will be stopped (1e30s by default).
- **tcpumax** *float* for inheritance: CPU time limit (must be specified in hours) for which the calculation is stopped (1e30s by default).
- **dt_min** *float* for inheritance: Minimum calculation time step (1e-16s by default).
- **dt_max** *float* for inheritance: Maximum calculation time step (1e30s by default).
- **facsec** *float* for inheritance: Value assigned to the safety factor for the time step (1. by default). The time step calculated is multiplied by the safety factor. The first thing to try when a calculation does not converge with an explicit time scheme is to reduce the facsec to 0.5.
  Warning: Some schemes needs a facsec lower than 1 (0.5 is a good start), for example Schema_Adams_Bashforth_order_3
- **nb_pas_dt_max** *int* for inheritance: Maximum number of calculation time steps (1e9 by default).
- **dt_sauv** *float* for inheritance: Save time step value (1e30s by default). Every dt_sauv, fields are saved in the .sauv file. The file contains all the information saved over time. If this instruction is not entered, results are saved only upon calculation completion.
- **dt_impr** *float* for inheritance: Scheme parameter printing time step in time (1e30s by default). The time steps and the flux balances are printed (incorporated onto every side of processed domains) into the .out file.
- **dt_start** *dt_start* (9.5) for inheritance: dt_min : the first iteration is based on dt_min
  dt_start dt_calc : the time step at first iteration is calculated in agreement with CFL condition.
  dt_start dt_fixe value : the first time step is fixed by the user (recommended when restarting calculation with Crank Nicholson temporal scheme to ensure continuity).
  By default, the first iteration is based on dt_calc.
- **seuil_statio** *float* for inheritance: Value of the convergence threshold (1e-12 by default). Problems using this type of time scheme converge when the derivatives dGi/dt of all the unknown transported values Gi have a combined absolute value less than this value. This is the keyword used to set the permanent rating threshold.
- **seuil_statio_relatif_deconseille** *int into [0, 1]* for inheritance
- **diffusion_implicite** *int into [0, 1]* for inheritance: Keyword to make the diffusion term in the Navier Stokes equation implicit (in this case, vrel should be set to 1). The stability time step is then only based on the convection time step (dt=facsec*dt_convection). Thus, in some circumstances, an important gain is achieved with respect to the time step (large diffusion with respect to convection on tightened meshes). Caution: It is however recommended that the user should avoid exceeding the calculation convection time step by selecting a facsec that is too large. Start with a facsec of 1 and then increase this gradually if you wish to accelerate calculation. In addition, for a natural convection calculation with a zero initial speed, in the first time step, the convection time is infinite and therefore dt=facsec*dt_max.
- **niter_max_diffusion_implicite** *int* for inheritance: This keyword changes the default value (number of unknowns) of the maximal iterations number in the conjugate gradient method used for implicit diffusion.
- **seuil_diffusion_implicite** *float* for inheritance: This keyword changes the default value (1e-6) of convergency criteria for the resolution by conjugate gradient used for implicit diffusion.
- **impr_diffusion_implicite** *int into [0, 1]* for inheritance: Unactivate (default) or not the printing of the convergence during the resolution of the conjugate gradient.
- **precision_impr** *int* for inheritance: Optional keyword to define the digit number for flux values printed into .out files (by default 3).

- **no_error_if_not_converged_diffusion_implicite** *int into [0, 1]* for inheritance
- **no_conv_subiteration_diffusion_implicite** *int into [0, 1]* for inheritance
- **periode_sauvegarde_securite_en_heures** *int* for inheritance: To change the default period (23 hours) between the save of the fields in .sauv file.
- **no_check_disk_space** for inheritance: To disable the check of the available amount of disk space during the calculation.

25.10 schema_adams_moulton_order_2

Description: not_set

See also: schema_implicite_base (25.15)

Usage:
schema_adams_moulton_order_2 obj Lire obj {

[**facsec_max** *float*]
[**max_iter_implicite** *int*]
solveur *solveur_implicite_base*
[**tinit** *float*]
[**tmax** *float*]
[**tcpumax** *float*]
[**dt_min** *float*]
[**dt_max** *float*]
[**facsec** *float*]
[**nb_pas_dt_max** *int*]
[**dt_sauv** *float*]
[**dt_impr** *float*]
[**dt_start** *dt_start*]
[**seuil_statio** *float*]
[**seuil_statio_relatif_deconseille** *int into [0, 1]*]
[**diffusion_implicite** *int into [0, 1]*]
[**niter_max_diffusion_implicite** *int*]
[**seuil_diffusion_implicite** *float*]
[**impr_diffusion_implicite** *int into [0, 1]*]
[**precision_impr** *int*]
[**no_error_if_not_converged_diffusion_implicite** *int into [0, 1]*]
[**no_conv_subiteration_diffusion_implicite** *int into [0, 1]*]
[**periode_sauvegarde_securite_en_heures** *int*]
[**no_check_disk_space**]

}
where

- **facsec_max** *float*: Maximum ratio allowed between time step and stability time returned by CFL condition. The initial ratio given by facsec keyword is changed during the calculation with the implicit scheme but it couldn't be higher than facsec_max value.
  Warning: Some implicit schemes do not permit high facsec_max, example Schema_Adams_Moulton-_order_3 needs facsec=facsec_max=1.
  Advice:
  The calculation may start with a facsec specified by the user and increased by the algorithm up to the facsec_max limit. But the user can also choose to specify a constant facsec (facsec_max will be set to facsec value then). Faster convergence has been seen and depends on the kind of calculation:
  -Hydraulic only or thermal hydraulic with forced convection and low coupling between velocity and

temperature (Boussinesq value beta low), facsec between 20-30
-Thermal hydraulic with forced convection and strong coupling between velocity and temperature (Boussinesq value beta high), facsec between 90-100
-Thermohydralic with natural convection, facsec around 300
-Conduction only, facsec can be set to a very high value (1e8) as if the scheme was unconditionally stable
These values can also be used as rule of thumb for initial facsec with a facsec_max limit higher.

- **max_iter_implicite** *int* for inheritance: Maximum number of iterations allowed for the solver (by default 200).
- **solveur** *solveur_implicite_base* (26) for inheritance: This keyword is used to designate the solver selected in the situation where the time scheme is an implicit scheme. solver is the name of the solver that allows equation diffusion and convection operators to be set as implicit terms. Keywords corresponding to this functionality are Simple (SIMPLE type algorithm), Simpler (SIMPLER type algorithm) for incompressible systems, Piso (Pressure Implicit with Split Operator), and Implicite (similar to PISO, but as it looks like a simplified solver, it will use fewer timesteps. But it may run faster because the pressure matrix is not re-assembled and thus provides CPU gains.
Advice: Since the 1.6.0 version, we recommend to use first the Implicite or Simple, then Piso, and at least Simpler. Because the two first give a fastest convergence (several times) than Piso and the Simpler has not been validated. It seems also than Implicite and Piso schemes give better results than the Simple scheme when the flow is not fully stationary. Thus, if the solution obtained with Simple is not stationary, it is recommended to switch to Piso or Implicite scheme.
- **tinit** *float* for inheritance: Value of initial calculation time (0 by default).
- **tmax** *float* for inheritance: Time during which the calculation will be stopped (1e30s by default).
- **tcpumax** *float* for inheritance: CPU time limit (must be specified in hours) for which the calculation is stopped (1e30s by default).
- **dt_min** *float* for inheritance: Minimum calculation time step (1e-16s by default).
- **dt_max** *float* for inheritance: Maximum calculation time step (1e30s by default).
- **facsec** *float* for inheritance: Value assigned to the safety factor for the time step (1. by default). The time step calculated is multiplied by the safety factor. The first thing to try when a calculation does not converge with an explicit time scheme is to reduce the facsec to 0.5.
Warning: Some schemes needs a facsec lower than 1 (0.5 is a good start), for example Schema-_Adams_Bashforth_order_3
- **nb_pas_dt_max** *int* for inheritance: Maximum number of calculation time steps (1e9 by default).
- **dt_sauv** *float* for inheritance: Save time step value (1e30s by default). Every dt_sauv, fields are saved in the .sauv file. The file contains all the information saved over time. If this instruction is not entered, results are saved only upon calculation completion.
- **dt_impr** *float* for inheritance: Scheme parameter printing time step in time (1e30s by default). The time steps and the flux balances are printed (incorporated onto every side of processed domains) into the .out file.
- **dt_start** *dt_start* (9.5) for inheritance: dt_min : the first iteration is based on dt_min
dt_start dt_calc : the time step at first iteration is calculated in agreement with CFL condition.
dt_start dt_fixe value : the first time step is fixed by the user (recommended when restarting calculation with Crank Nicholson temporal scheme to ensure continuity).
By default, the first iteration is based on dt_calc.
- **seuil_statio** *float* for inheritance: Value of the convergence threshold (1e-12 by default). Problems using this type of time scheme converge when the derivatives dGi/dt of all the unknown transported values Gi have a combined absolute value less than this value. This is the keyword used to set the permanent rating threshold.
- **seuil_statio_relatif_deconseille** *int into [0, 1]* for inheritance
- **diffusion_implicite** *int into [0, 1]* for inheritance: Keyword to make the diffusion term in the Navier Stokes equation implicit (in this case, vrel should be set to 1). The stability time step is then only based on the convection time step (dt=facsec*dt_convection). Thus, in some circumstances, an important gain is achieved with respect to the time step (large diffusion with respect to convection on tightened meshes). Caution: It is however recommended that the user should avoid exceeding the

calculation convection time step by selecting a facsec that is too large. Start with a facsec of 1 and then increase this gradually if you wish to accelerate calculation. In addition, for a natural convection calculation with a zero initial speed, in the first time step, the convection time is infinite and therefore dt=facsec*dt_max.

- **niter_max_diffusion_implicite** *int* for inheritance: This keyword changes the default value (number of unknowns) of the maximal iterations number in the conjugate gradient method used for implicit diffusion.
- **seuil_diffusion_implicite** *float* for inheritance: This keyword changes the default value (1e-6) of convergency criteria for the resolution by conjugate gradient used for implicit diffusion.
- **impr_diffusion_implicite** *int into [0, 1]* for inheritance: Unactivate (default) or not the printing of the convergence during the resolution of the conjugate gradient.
- **precision_impr** *int* for inheritance: Optional keyword to define the digit number for flux values printed into .out files (by default 3).
- **no_error_if_not_converged_diffusion_implicite** *int into [0, 1]* for inheritance
- **no_conv_subiteration_diffusion_implicite** *int into [0, 1]* for inheritance
- **periode_sauvegarde_securite_en_heures** *int* for inheritance: To change the default period (23 hours) between the save of the fields in .sauv file.
- **no_check_disk_space** for inheritance: To disable the check of the available amount of disk space during the calculation.

25.11 schema_adams_moulton_order_3

Description: not_set

See also: schema_implicite_base (25.15)

Usage:
schema_adams_moulton_order_3 obj Lire obj {

[**facsec_max** *float*]
[**max_iter_implicite** *int*]
solveur *solveur_implicite_base*
[**tinit** *float*]
[**tmax** *float*]
[**tcpumax** *float*]
[**dt_min** *float*]
[**dt_max** *float*]
[**facsec** *float*]
[**nb_pas_dt_max** *int*]
[**dt_sauv** *float*]
[**dt_impr** *float*]
[**dt_start** *dt_start*]
[**seuil_statio** *float*]
[**seuil_statio_relatif_deconseille** *int into [0, 1]*]
[**diffusion_implicite** *int into [0, 1]*]
[**niter_max_diffusion_implicite** *int*]
[**seuil_diffusion_implicite** *float*]
[**impr_diffusion_implicite** *int into [0, 1]*]
[**precision_impr** *int*]
[**no_error_if_not_converged_diffusion_implicite** *int into [0, 1]*]
[**no_conv_subiteration_diffusion_implicite** *int into [0, 1]*]
[**periode_sauvegarde_securite_en_heures** *int*]
[**no_check_disk_space**]

}
where

- **facsec_max** *float*: Maximum ratio allowed between time step and stability time returned by CFL condition. The initial ratio given by facsec keyword is changed during the calculation with the implicit scheme but it couldn't be higher than facsec_max value.
  Warning: Some implicit schemes do not permit high facsec_max, example Schema_Adams_Moulton_order_3 needs facsec=facsec_max=1.
  Advice:
  The calculation may start with a facsec specified by the user and increased by the algorithm up to the facsec_max limit. But the user can also choose to specify a constant facsec (facsec_max will be set to facsec value then). Faster convergence has been seen and depends on the kind of calculation:
  -Hydraulic only or thermal hydraulic with forced convection and low coupling between velocity and temperature (Boussinesq value beta low), facsec between 20-30
  -Thermal hydraulic with forced convection and strong coupling between velocity and temperature (Boussinesq value beta high), facsec between 90-100
  -Thermohydralic with natural convection, facsec around 300
  -Conduction only, facsec can be set to a very high value (1e8) as if the scheme was unconditionally stable
  These values can also be used as rule of thumb for initial facsec with a facsec_max limit higher.
- **max_iter_implicite** *int* for inheritance: Maximum number of iterations allowed for the solver (by default 200).
- **solveur** *solveur_implicite_base* (26) for inheritance: This keyword is used to designate the solver selected in the situation where the time scheme is an implicit scheme. solver is the name of the solver that allows equation diffusion and convection operators to be set as implicit terms. Keywords corresponding to this functionality are Simple (SIMPLE type algorithm), Simpler (SIMPLER type algorithm) for incompressible systems, Piso (Pressure Implicit with Split Operator), and Implicite (similar to PISO, but as it looks like a simplified solver, it will use fewer timesteps. But it may run faster because the pressure matrix is not re-assembled and thus provides CPU gains.
  Advice: Since the 1.6.0 version, we recommend to use first the Implicite or Simple, then Piso, and at least Simpler. Because the two first give a fastest convergence (several times) than Piso and the Simpler has not been validated. It seems also than Implicite and Piso schemes give better results than the Simple scheme when the flow is not fully stationary. Thus, if the solution obtained with Simple is not stationary, it is recommended to switch to Piso or Implicite scheme.
- **tinit** *float* for inheritance: Value of initial calculation time (0 by default).
- **tmax** *float* for inheritance: Time during which the calculation will be stopped (1e30s by default).
- **tcpumax** *float* for inheritance: CPU time limit (must be specified in hours) for which the calculation is stopped (1e30s by default).
- **dt_min** *float* for inheritance: Minimum calculation time step (1e-16s by default).
- **dt_max** *float* for inheritance: Maximum calculation time step (1e30s by default).
- **facsec** *float* for inheritance: Value assigned to the safety factor for the time step (1. by default). The time step calculated is multiplied by the safety factor. The first thing to try when a calculation does not converge with an explicit time scheme is to reduce the facsec to 0.5.
  Warning: Some schemes needs a facsec lower than 1 (0.5 is a good start), for example Schema_Adams_Bashforth_order_3
- **nb_pas_dt_max** *int* for inheritance: Maximum number of calculation time steps (1e9 by default).
- **dt_sauv** *float* for inheritance: Save time step value (1e30s by default). Every dt_sauv, fields are saved in the .sauv file. The file contains all the information saved over time. If this instruction is not entered, results are saved only upon calculation completion.
- **dt_impr** *float* for inheritance: Scheme parameter printing time step in time (1e30s by default). The time steps and the flux balances are printed (incorporated onto every side of processed domains) into the .out file.
- **dt_start** *dt_start* (9.5) for inheritance: dt_min : the first iteration is based on dt_min
  dt_start dt_calc : the time step at first iteration is calculated in agreement with CFL condition.

dt_start dt_fixe value : the first time step is fixed by the user (recommended when restarting calculation with Crank Nicholson temporal scheme to ensure continuity).
By default, the first iteration is based on dt_calc.

- **seuil_statio** *float* for inheritance: Value of the convergence threshold (1e-12 by default). Problems using this type of time scheme converge when the derivatives dGi/dt of all the unknown transported values Gi have a combined absolute value less than this value. This is the keyword used to set the permanent rating threshold.
- **seuil_statio_relatif_deconseille** *int into [0, 1]* for inheritance
- **diffusion_implicite** *int into [0, 1]* for inheritance: Keyword to make the diffusion term in the Navier Stokes equation implicit (in this case, vrel should be set to 1). The stability time step is then only based on the convection time step (dt=facsec*dt_convection). Thus, in some circumstances, an important gain is achieved with respect to the time step (large diffusion with respect to convection on tightened meshes). Caution: It is however recommended that the user should avoid exceeding the calculation convection time step by selecting a facsec that is too large. Start with a facsec of 1 and then increase this gradually if you wish to accelerate calculation. In addition, for a natural convection calculation with a zero initial speed, in the first time step, the convection time is infinite and therefore dt=facsec*dt_max.
- **niter_max_diffusion_implicite** *int* for inheritance: This keyword changes the default value (number of unknowns) of the maximal iterations number in the conjugate gradient method used for implicit diffusion.
- **seuil_diffusion_implicite** *float* for inheritance: This keyword changes the default value (1e-6) of convergency criteria for the resolution by conjugate gradient used for implicit diffusion.
- **impr_diffusion_implicite** *int into [0, 1]* for inheritance: Unactivate (default) or not the printing of the convergence during the resolution of the conjugate gradient.
- **precision_impr** *int* for inheritance: Optional keyword to define the digit number for flux values printed into .out files (by default 3).
- **no_error_if_not_converged_diffusion_implicite** *int into [0, 1]* for inheritance
- **no_conv_subiteration_diffusion_implicite** *int into [0, 1]* for inheritance
- **periode_sauvegarde_securite_en_heures** *int* for inheritance: To change the default period (23 hours) between the save of the fields in .sauv file.
- **no_check_disk_space** for inheritance: To disable the check of the available amount of disk space during the calculation.

25.12 schema_backward_differentiation_order_2

Description: not_set

See also: schema_implicite_base (25.15)

Usage:
schema_backward_differentiation_order_2 obj Lire obj {

[**facsec_max** *float*]
[**max_iter_implicite** *int*]
solveur *solveur_implicite_base*
[**tinit** *float*]
[**tmax** *float*]
[**tcpumax** *float*]
[**dt_min** *float*]
[**dt_max** *float*]
[**facsec** *float*]
[**nb_pas_dt_max** *int*]
[**dt_sauv** *float*]

[**dt_impr** *float*]
[**dt_start** *dt_start*]
[**seuil_statio** *float*]
[**seuil_statio_relatif_deconseille** *int into [0, 1]*]
[**diffusion_implicite** *int into [0, 1]*]
[**niter_max_diffusion_implicite** *int*]
[**seuil_diffusion_implicite** *float*]
[**impr_diffusion_implicite** *int into [0, 1]*]
[**precision_impr** *int*]
[**no_error_if_not_converged_diffusion_implicite** *int into [0, 1]*]
[**no_conv_subiteration_diffusion_implicite** *int into [0, 1]*]
[**periode_sauvegarde_securite_en_heures** *int*]
[**no_check_disk_space**]

}
where

- **facsec_max** *float*: Maximum ratio allowed between time step and stability time returned by CFL condition. The initial ratio given by facsec keyword is changed during the calculation with the implicit scheme but it couldn't be higher than facsec_max value.
  Warning: Some implicit schemes do not permit high facsec_max, example Schema_Adams_Moulton_order_3 needs facsec=facsec_max=1.
  Advice:
  The calculation may start with a facsec specified by the user and increased by the algorithm up to the facsec_max limit. But the user can also choose to specify a constant facsec (facsec_max will be set to facsec value then). Faster convergence has been seen and depends on the kind of calculation:
  -Hydraulic only or thermal hydraulic with forced convection and low coupling between velocity and temperature (Boussinesq value beta low), facsec between 20-30
  -Thermal hydraulic with forced convection and strong coupling between velocity and temperature (Boussinesq value beta high), facsec between 90-100
  -Thermohydralic with natural convection, facsec around 300
  -Conduction only, facsec can be set to a very high value (1e8) as if the scheme was unconditionally stable
  These values can also be used as rule of thumb for initial facsec with a facsec_max limit higher.
- **max_iter_implicite** *int* for inheritance: Maximum number of iterations allowed for the solver (by default 200).
- **solveur** *solveur_implicite_base* (26) for inheritance: This keyword is used to designate the solver selected in the situation where the time scheme is an implicit scheme. solver is the name of the solver that allows equation diffusion and convection operators to be set as implicit terms. Keywords corresponding to this functionality are Simple (SIMPLE type algorithm), Simpler (SIMPLER type algorithm) for incompressible systems, Piso (Pressure Implicit with Split Operator), and Implicite (similar to PISO, but as it looks like a simplified solver, it will use fewer timesteps. But it may run faster because the pressure matrix is not re-assembled and thus provides CPU gains.
  Advice: Since the 1.6.0 version, we recommend to use first the Implicite or Simple, then Piso, and at least Simpler. Because the two first give a fastest convergence (several times) than Piso and the Simpler has not been validated. It seems also than Implicite and Piso schemes give better results than the Simple scheme when the flow is not fully stationary. Thus, if the solution obtained with Simple is not stationary, it is recommended to switch to Piso or Implicite scheme.
- **tinit** *float* for inheritance: Value of initial calculation time (0 by default).
- **tmax** *float* for inheritance: Time during which the calculation will be stopped (1e30s by default).
- **tcpumax** *float* for inheritance: CPU time limit (must be specified in hours) for which the calculation is stopped (1e30s by default).
- **dt_min** *float* for inheritance: Minimum calculation time step (1e-16s by default).
- **dt_max** *float* for inheritance: Maximum calculation time step (1e30s by default).

- **facsec** *float* for inheritance: Value assigned to the safety factor for the time step (1. by default). The time step calculated is multiplied by the safety factor. The first thing to try when a calculation does not converge with an explicit time scheme is to reduce the facsec to 0.5.
  Warning: Some schemes needs a facsec lower than 1 (0.5 is a good start), for example Schema_Adams_Bashforth_order_3
- **nb_pas_dt_max** *int* for inheritance: Maximum number of calculation time steps (1e9 by default).
- **dt_sauv** *float* for inheritance: Save time step value (1e30s by default). Every dt_sauv, fields are saved in the .sauv file. The file contains all the information saved over time. If this instruction is not entered, results are saved only upon calculation completion.
- **dt_impr** *float* for inheritance: Scheme parameter printing time step in time (1e30s by default). The time steps and the flux balances are printed (incorporated onto every side of processed domains) into the .out file.
- **dt_start** *dt_start* (9.5) for inheritance: dt_min : the first iteration is based on dt_min
  dt_start dt_calc : the time step at first iteration is calculated in agreement with CFL condition.
  dt_start dt_fixe value : the first time step is fixed by the user (recommended when restarting calculation with Crank Nicholson temporal scheme to ensure continuity).
  By default, the first iteration is based on dt_calc.
- **seuil_statio** *float* for inheritance: Value of the convergence threshold (1e-12 by default). Problems using this type of time scheme converge when the derivatives dGi/dt of all the unknown transported values Gi have a combined absolute value less than this value. This is the keyword used to set the permanent rating threshold.
- **seuil_statio_relatif_deconseille** *int into [0, 1]* for inheritance
- **diffusion_implicite** *int into [0, 1]* for inheritance: Keyword to make the diffusion term in the Navier Stokes equation implicit (in this case, vrel should be set to 1). The stability time step is then only based on the convection time step (dt=facsec*dt_convection). Thus, in some circumstances, an important gain is achieved with respect to the time step (large diffusion with respect to convection on tightened meshes). Caution: It is however recommended that the user should avoid exceeding the calculation convection time step by selecting a facsec that is too large. Start with a facsec of 1 and then increase this gradually if you wish to accelerate calculation. In addition, for a natural convection calculation with a zero initial speed, in the first time step, the convection time is infinite and therefore dt=facsec*dt_max.
- **niter_max_diffusion_implicite** *int* for inheritance: This keyword changes the default value (number of unknowns) of the maximal iterations number in the conjugate gradient method used for implicit diffusion.
- **seuil_diffusion_implicite** *float* for inheritance: This keyword changes the default value (1e-6) of convergency criteria for the resolution by conjugate gradient used for implicit diffusion.
- **impr_diffusion_implicite** *int into [0, 1]* for inheritance: Unactivate (default) or not the printing of the convergence during the resolution of the conjugate gradient.
- **precision_impr** *int* for inheritance: Optional keyword to define the digit number for flux values printed into .out files (by default 3).
- **no_error_if_not_converged_diffusion_implicite** *int into [0, 1]* for inheritance
- **no_conv_subiteration_diffusion_implicite** *int into [0, 1]* for inheritance
- **periode_sauvegarde_securite_en_heures** *int* for inheritance: To change the default period (23 hours) between the save of the fields in .sauv file.
- **no_check_disk_space** for inheritance: To disable the check of the available amount of disk space during the calculation.

25.13 schema_backward_differentiation_order_3

Description: not_set

See also: schema_implicite_base (25.15)

Usage:
schema_backward_differentiation_order_3 obj Lire obj {

[**facsec_max** *float*]
[**max_iter_implicite** *int*]
solveur *solveur_implicite_base*
[**tinit** *float*]
[**tmax** *float*]
[**tcpumax** *float*]
[**dt_min** *float*]
[**dt_max** *float*]
[**facsec** *float*]
[**nb_pas_dt_max** *int*]
[**dt_sauv** *float*]
[**dt_impr** *float*]
[**dt_start** *dt_start*]
[**seuil_statio** *float*]
[**seuil_statio_relatif_deconseille** *int into [0, 1]*]
[**diffusion_implicite** *int into [0, 1]*]
[**niter_max_diffusion_implicite** *int*]
[**seuil_diffusion_implicite** *float*]
[**impr_diffusion_implicite** *int into [0, 1]*]
[**precision_impr** *int*]
[**no_error_if_not_converged_diffusion_implicite** *int into [0, 1]*]
[**no_conv_subiteration_diffusion_implicite** *int into [0, 1]*]
[**periode_sauvegarde_securite_en_heures** *int*]
[**no_check_disk_space**]

}
where

- **facsec_max** *float*: Maximum ratio allowed between time step and stability time returned by CFL condition. The initial ratio given by facsec keyword is changed during the calculation with the implicit scheme but it couldn't be higher than facsec_max value.
  Warning: Some implicit schemes do not permit high facsec_max, example Schema_Adams_Moulton-_order_3 needs facsec=facsec_max=1.
  Advice:
  The calculation may start with a facsec specified by the user and increased by the algorithm up to the facsec_max limit. But the user can also choose to specify a constant facsec (facsec_max will be set to facsec value then). Faster convergence has been seen and depends on the kind of calculation:
  -Hydraulic only or thermal hydraulic with forced convection and low coupling between velocity and temperature (Boussinesq value beta low), facsec between 20-30
  -Thermal hydraulic with forced convection and strong coupling between velocity and temperature (Boussinesq value beta high), facsec between 90-100
  -Thermohydralic with natural convection, facsec around 300
  -Conduction only, facsec can be set to a very high value (1e8) as if the scheme was unconditionally stable
  These values can also be used as rule of thumb for initial facsec with a facsec_max limit higher.
- **max_iter_implicite** *int* for inheritance: Maximum number of iterations allowed for the solver (by default 200).
- **solveur** *solveur_implicite_base* (26) for inheritance: This keyword is used to designate the solver selected in the situation where the time scheme is an implicit scheme. solver is the name of the solver that allows equation diffusion and convection operators to be set as implicit terms. Keywords corresponding to this functionality are Simple (SIMPLE type algorithm), Simpler (SIMPLER type algorithm) for incompressible systems, Piso (Pressure Implicit with Split Operator), and Implicite

(similar to PISO, but as it looks like a simplified solver, it will use fewer timesteps. But it may run faster because the pressure matrix is not re-assembled and thus provides CPU gains.
Advice: Since the 1.6.0 version, we recommend to use first the Implicite or Simple, then Piso, and at least Simpler. Because the two first give a fastest convergence (several times) than Piso and the Simpler has not been validated. It seems also than Implicite and Piso schemes give better results than the Simple scheme when the flow is not fully stationary. Thus, if the solution obtained with Simple is not stationary, it is recommended to switch to Piso or Implicite scheme.

- **tinit** *float* for inheritance: Value of initial calculation time (0 by default).
- **tmax** *float* for inheritance: Time during which the calculation will be stopped (1e30s by default).
- **tcpumax** *float* for inheritance: CPU time limit (must be specified in hours) for which the calculation is stopped (1e30s by default).
- **dt_min** *float* for inheritance: Minimum calculation time step (1e-16s by default).
- **dt_max** *float* for inheritance: Maximum calculation time step (1e30s by default).
- **facsec** *float* for inheritance: Value assigned to the safety factor for the time step (1. by default). The time step calculated is multiplied by the safety factor. The first thing to try when a calculation does not converge with an explicit time scheme is to reduce the facsec to 0.5.
  Warning: Some schemes needs a facsec lower than 1 (0.5 is a good start), for example Schema_Adams_Bashforth_order_3
- **nb_pas_dt_max** *int* for inheritance: Maximum number of calculation time steps (1e9 by default).
- **dt_sauv** *float* for inheritance: Save time step value (1e30s by default). Every dt_sauv, fields are saved in the .sauv file. The file contains all the information saved over time. If this instruction is not entered, results are saved only upon calculation completion.
- **dt_impr** *float* for inheritance: Scheme parameter printing time step in time (1e30s by default). The time steps and the flux balances are printed (incorporated onto every side of processed domains) into the .out file.
- **dt_start** *dt_start* (9.5) for inheritance: dt_min : the first iteration is based on dt_min
  dt_start dt_calc : the time step at first iteration is calculated in agreement with CFL condition.
  dt_start dt_fixe value : the first time step is fixed by the user (recommended when restarting calculation with Crank Nicholson temporal scheme to ensure continuity).
  By default, the first iteration is based on dt_calc.
- **seuil_statio** *float* for inheritance: Value of the convergence threshold (1e-12 by default). Problems using this type of time scheme converge when the derivatives dGi/dt of all the unknown transported values Gi have a combined absolute value less than this value. This is the keyword used to set the permanent rating threshold.
- **seuil_statio_relatif_deconseille** *int into [0, 1]* for inheritance
- **diffusion_implicite** *int into [0, 1]* for inheritance: Keyword to make the diffusion term in the Navier Stokes equation implicit (in this case, vrel should be set to 1). The stability time step is then only based on the convection time step (dt=facsec*dt_convection). Thus, in some circumstances, an important gain is achieved with respect to the time step (large diffusion with respect to convection on tightened meshes). Caution: It is however recommended that the user should avoid exceeding the calculation convection time step by selecting a facsec that is too large. Start with a facsec of 1 and then increase this gradually if you wish to accelerate calculation. In addition, for a natural convection calculation with a zero initial speed, in the first time step, the convection time is infinite and therefore dt=facsec*dt_max.
- **niter_max_diffusion_implicite** *int* for inheritance: This keyword changes the default value (number of unknowns) of the maximal iterations number in the conjugate gradient method used for implicit diffusion.
- **seuil_diffusion_implicite** *float* for inheritance: This keyword changes the default value (1e-6) of convergency criteria for the resolution by conjugate gradient used for implicit diffusion.
- **impr_diffusion_implicite** *int into [0, 1]* for inheritance: Unactivate (default) or not the printing of the convergence during the resolution of the conjugate gradient.
- **precision_impr** *int* for inheritance: Optional keyword to define the digit number for flux values printed into .out files (by default 3).
- **no_error_if_not_converged_diffusion_implicite** *int into [0, 1]* for inheritance

- **no_conv_subiteration_diffusion_implicite** *int into [0, 1]* for inheritance
- **periode_sauvegarde_securite_en_heures** *int* for inheritance: To change the default period (23 hours) between the save of the fields in .sauv file.
- **no_check_disk_space** for inheritance: To disable the check of the available amount of disk space during the calculation.

25.14 scheme_euler_implicit

Synonymous: **schema_euler_implicite**

Description: This is the Euler implicite scheme.

See also: schema_implicite_base (25.15)

Usage:
scheme_euler_implicit obj Lire obj {

[**facsec_max** *float*]
[**max_iter_implicite** *int*]
solveur *solveur_implicite_base*
[**tinit** *float*]
[**tmax** *float*]
[**tcpumax** *float*]
[**dt_min** *float*]
[**dt_max** *float*]
[**facsec** *float*]
[**nb_pas_dt_max** *int*]
[**dt_sauv** *float*]
[**dt_impr** *float*]
[**dt_start** *dt_start*]
[**seuil_statio** *float*]
[**seuil_statio_relatif_deconseille** *int into [0, 1]*]
[**diffusion_implicite** *int into [0, 1]*]
[**niter_max_diffusion_implicite** *int*]
[**seuil_diffusion_implicite** *float*]
[**impr_diffusion_implicite** *int into [0, 1]*]
[**precision_impr** *int*]
[**no_error_if_not_converged_diffusion_implicite** *int into [0, 1]*]
[**no_conv_subiteration_diffusion_implicite** *int into [0, 1]*]
[**periode_sauvegarde_securite_en_heures** *int*]
[**no_check_disk_space**]

}
where

- **facsec_max** *float*: Maximum ratio allowed between time step and stability time returned by CFL condition. The initial ratio given by facsec keyword is changed during the calculation with the implicit scheme but it couldn't be higher than facsec_max value.
  Warning: Some implicit schemes do not permit high facsec_max, example Schema_Adams_Moulton-_order_3 needs facsec=facsec_max=1.
  Advice:
  The calculation may start with a facsec specified by the user and increased by the algorithm up to the facsec_max limit. But the user can also choose to specify a constant facsec (facsec_max will be set to facsec value then). Faster convergence has been seen and depends on the kind of calculation:

-Hydraulic only or thermal hydraulic with forced convection and low coupling between velocity and temperature (Boussinesq value beta low), facsec between 20-30
-Thermal hydraulic with forced convection and strong coupling between velocity and temperature (Boussinesq value beta high), facsec between 90-100
-Thermohydralic with natural convection, facsec around 300
-Conduction only, facsec can be set to a very high value (1e8) as if the scheme was unconditionally stable
These values can also be used as rule of thumb for initial facsec with a facsec_max limit higher.

- **max_iter_implicite** *int* for inheritance: Maximum number of iterations allowed for the solver (by default 200).
- **solveur** *solveur_implicite_base* (26) for inheritance: This keyword is used to designate the solver selected in the situation where the time scheme is an implicit scheme. solver is the name of the solver that allows equation diffusion and convection operators to be set as implicit terms. Keywords corresponding to this functionality are Simple (SIMPLE type algorithm), Simpler (SIMPLER type algorithm) for incompressible systems, Piso (Pressure Implicit with Split Operator), and Implicite (similar to PISO, but as it looks like a simplified solver, it will use fewer timesteps. But it may run faster because the pressure matrix is not re-assembled and thus provides CPU gains.
Advice: Since the 1.6.0 version, we recommend to use first the Implicite or Simple, then Piso, and at least Simpler. Because the two first give a fastest convergence (several times) than Piso and the Simpler has not been validated. It seems also than Implicite and Piso schemes give better results than the Simple scheme when the flow is not fully stationary. Thus, if the solution obtained with Simple is not stationary, it is recommended to switch to Piso or Implicite scheme.
- **tinit** *float* for inheritance: Value of initial calculation time (0 by default).
- **tmax** *float* for inheritance: Time during which the calculation will be stopped (1e30s by default).
- **tcpumax** *float* for inheritance: CPU time limit (must be specified in hours) for which the calculation is stopped (1e30s by default).
- **dt_min** *float* for inheritance: Minimum calculation time step (1e-16s by default).
- **dt_max** *float* for inheritance: Maximum calculation time step (1e30s by default).
- **facsec** *float* for inheritance: Value assigned to the safety factor for the time step (1. by default). The time step calculated is multiplied by the safety factor. The first thing to try when a calculation does not converge with an explicit time scheme is to reduce the facsec to 0.5.
Warning: Some schemes needs a facsec lower than 1 (0.5 is a good start), for example Schema_Adams_Bashforth_order_3
- **nb_pas_dt_max** *int* for inheritance: Maximum number of calculation time steps (1e9 by default).
- **dt_sauv** *float* for inheritance: Save time step value (1e30s by default). Every dt_sauv, fields are saved in the .sauv file. The file contains all the information saved over time. If this instruction is not entered, results are saved only upon calculation completion.
- **dt_impr** *float* for inheritance: Scheme parameter printing time step in time (1e30s by default). The time steps and the flux balances are printed (incorporated onto every side of processed domains) into the .out file.
- **dt_start** *dt_start* (9.5) for inheritance: dt_min : the first iteration is based on dt_min
dt_start dt_calc : the time step at first iteration is calculated in agreement with CFL condition.
dt_start dt_fixe value : the first time step is fixed by the user (recommended when restarting calculation with Crank Nicholson temporal scheme to ensure continuity).
By default, the first iteration is based on dt_calc.
- **seuil_statio** *float* for inheritance: Value of the convergence threshold (1e-12 by default). Problems using this type of time scheme converge when the derivatives dGi/dt of all the unknown transported values Gi have a combined absolute value less than this value. This is the keyword used to set the permanent rating threshold.
- **seuil_statio_relatif_deconseille** *int into [0, 1]* for inheritance
- **diffusion_implicite** *int into [0, 1]* for inheritance: Keyword to make the diffusion term in the Navier Stokes equation implicit (in this case, vrel should be set to 1). The stability time step is then only based on the convection time step (dt=facsec*dt_convection). Thus, in some circumstances, an important gain is achieved with respect to the time step (large diffusion with respect to convection

on tightened meshes). Caution: It is however recommended that the user should avoid exceeding the calculation convection time step by selecting a facsec that is too large. Start with a facsec of 1 and then increase this gradually if you wish to accelerate calculation. In addition, for a natural convection calculation with a zero initial speed, in the first time step, the convection time is infinite and therefore dt=facsec*dt_max.

- **niter_max_diffusion_implicite** *int* for inheritance: This keyword changes the default value (number of unknowns) of the maximal iterations number in the conjugate gradient method used for implicit diffusion.
- **seuil_diffusion_implicite** *float* for inheritance: This keyword changes the default value (1e-6) of convergency criteria for the resolution by conjugate gradient used for implicit diffusion.
- **impr_diffusion_implicite** *int into [0, 1]* for inheritance: Unactivate (default) or not the printing of the convergence during the resolution of the conjugate gradient.
- **precision_impr** *int* for inheritance: Optional keyword to define the digit number for flux values printed into .out files (by default 3).
- **no_error_if_not_converged_diffusion_implicite** *int into [0, 1]* for inheritance
- **no_conv_subiteration_diffusion_implicite** *int into [0, 1]* for inheritance
- **periode_sauvegarde_securite_en_heures** *int* for inheritance: To change the default period (23 hours) between the save of the fields in .sauv file.
- **no_check_disk_space** for inheritance: To disable the check of the available amount of disk space during the calculation.

25.15 schema_implicite_base

Description: Basic class for implicite time scheme.

See also: schema_temps_base (25) scheme_euler_implicit (25.14) schema_adams_moulton_order_2 (25.10) schema_adams_moulton_order_3 (25.11) schema_backward_differentiation_order_2 (25.12) schema_backward_differentiation_order_3 (25.13)

Usage:
schema_implicite_base obj Lire obj {

[**max_iter_implicite** *int*]
solveur *solveur_implicite_base*
[**tinit** *float*]
[**tmax** *float*]
[**tcpumax** *float*]
[**dt_min** *float*]
[**dt_max** *float*]
[**facsec** *float*]
[**nb_pas_dt_max** *int*]
[**dt_sauv** *float*]
[**dt_impr** *float*]
[**dt_start** *dt_start*]
[**seuil_statio** *float*]
[**seuil_statio_relatif_deconseille** *int into [0, 1]*]
[**diffusion_implicite** *int into [0, 1]*]
[**niter_max_diffusion_implicite** *int*]
[**seuil_diffusion_implicite** *float*]
[**impr_diffusion_implicite** *int into [0, 1]*]
[**precision_impr** *int*]
[**no_error_if_not_converged_diffusion_implicite** *int into [0, 1]*]
[**no_conv_subiteration_diffusion_implicite** *int into [0, 1]*]

[**periode_sauvegarde_securite_en_heures** *int*]
[**no_check_disk_space**]

}
where

- **max_iter_implicite** *int*: Maximum number of iterations allowed for the solver (by default 200).
- **solveur** *solveur_implicite_base* (26): This keyword is used to designate the solver selected in the situation where the time scheme is an implicit scheme. solver is the name of the solver that allows equation diffusion and convection operators to be set as implicit terms. Keywords corresponding to this functionality are Simple (SIMPLE type algorithm), Simpler (SIMPLER type algorithm) for incompressible systems, Piso (Pressure Implicit with Split Operator), and Implicite (similar to PISO, but as it looks like a simplified solver, it will use fewer timesteps. But it may run faster because the pressure matrix is not re-assembled and thus provides CPU gains.
Advice: Since the 1.6.0 version, we recommend to use first the Implicite or Simple, then Piso, and at least Simpler. Because the two first give a fastest convergence (several times) than Piso and the Simpler has not been validated. It seems also than Implicite and Piso schemes give better results than the Simple scheme when the flow is not fully stationary. Thus, if the solution obtained with Simple is not stationary, it is recommended to switch to Piso or Implicite scheme.
- **tinit** *float* for inheritance: Value of initial calculation time (0 by default).
- **tmax** *float* for inheritance: Time during which the calculation will be stopped (1e30s by default).
- **tcpumax** *float* for inheritance: CPU time limit (must be specified in hours) for which the calculation is stopped (1e30s by default).
- **dt_min** *float* for inheritance: Minimum calculation time step (1e-16s by default).
- **dt_max** *float* for inheritance: Maximum calculation time step (1e30s by default).
- **facsec** *float* for inheritance: Value assigned to the safety factor for the time step (1. by default). The time step calculated is multiplied by the safety factor. The first thing to try when a calculation does not converge with an explicit time scheme is to reduce the facsec to 0.5.
Warning: Some schemes needs a facsec lower than 1 (0.5 is a good start), for example Schema_Adams_Bashforth_order_3
- **nb_pas_dt_max** *int* for inheritance: Maximum number of calculation time steps (1e9 by default).
- **dt_sauv** *float* for inheritance: Save time step value (1e30s by default). Every dt_sauv, fields are saved in the .sauv file. The file contains all the information saved over time. If this instruction is not entered, results are saved only upon calculation completion.
- **dt_impr** *float* for inheritance: Scheme parameter printing time step in time (1e30s by default). The time steps and the flux balances are printed (incorporated onto every side of processed domains) into the .out file.
- **dt_start** *dt_start* (9.5) for inheritance: dt_min : the first iteration is based on dt_min
dt_start dt_calc : the time step at first iteration is calculated in agreement with CFL condition.
dt_start dt_fixe value : the first time step is fixed by the user (recommended when restarting calculation with Crank Nicholson temporal scheme to ensure continuity).
By default, the first iteration is based on dt_calc.
- **seuil_statio** *float* for inheritance: Value of the convergence threshold (1e-12 by default). Problems using this type of time scheme converge when the derivatives dGi/dt of all the unknown transported values Gi have a combined absolute value less than this value. This is the keyword used to set the permanent rating threshold.
- **seuil_statio_relatif_deconseille** *int into [0, 1]* for inheritance
- **diffusion_implicite** *int into [0, 1]* for inheritance: Keyword to make the diffusion term in the Navier Stokes equation implicit (in this case, vrel should be set to 1). The stability time step is then only based on the convection time step (dt=facsec*dt_convection). Thus, in some circumstances, an important gain is achieved with respect to the time step (large diffusion with respect to convection on tightened meshes). Caution: It is however recommended that the user should avoid exceeding the calculation convection time step by selecting a facsec that is too large. Start with a facsec of 1 and then increase this gradually if you wish to accelerate calculation. In addition, for a natural convection

calculation with a zero initial speed, in the first time step, the convection time is infinite and therefore dt=facsec*dt_max.

- **niter_max_diffusion_implicite** *int* for inheritance: This keyword changes the default value (number of unknowns) of the maximal iterations number in the conjugate gradient method used for implicit diffusion.
- **seuil_diffusion_implicite** *float* for inheritance: This keyword changes the default value (1e-6) of convergency criteria for the resolution by conjugate gradient used for implicit diffusion.
- **impr_diffusion_implicite** *int into [0, 1]* for inheritance: Unactivate (default) or not the printing of the convergence during the resolution of the conjugate gradient.
- **precision_impr** *int* for inheritance: Optional keyword to define the digit number for flux values printed into .out files (by default 3).
- **no_error_if_not_converged_diffusion_implicite** *int into [0, 1]* for inheritance
- **no_conv_subiteration_diffusion_implicite** *int into [0, 1]* for inheritance
- **periode_sauvegarde_securite_en_heures** *int* for inheritance: To change the default period (23 hours) between the save of the fields in .sauv file.
- **no_check_disk_space** for inheritance: To disable the check of the available amount of disk space during the calculation.

25.16 schema_predictor_corrector

Description: This is the predictor-corrector scheme (second order). It is more accurate and economic than MacCormack scheme. It gives best results with a second ordre convective scheme like quick, centre (VDF).

See also: schema_temps_base (25)

Usage:
schema_predictor_corrector obj Lire obj {

[**tinit** *float*]
[**tmax** *float*]
[**tcpumax** *float*]
[**dt_min** *float*]
[**dt_max** *float*]
[**facsec** *float*]
[**nb_pas_dt_max** *int*]
[**dt_sauv** *float*]
[**dt_impr** *float*]
[**dt_start** *dt_start*]
[**seuil_statio** *float*]
[**seuil_statio_relatif_deconseille** *int into [0, 1]*]
[**diffusion_implicite** *int into [0, 1]*]
[**niter_max_diffusion_implicite** *int*]
[**seuil_diffusion_implicite** *float*]
[**impr_diffusion_implicite** *int into [0, 1]*]
[**precision_impr** *int*]
[**no_error_if_not_converged_diffusion_implicite** *int into [0, 1]*]
[**no_conv_subiteration_diffusion_implicite** *int into [0, 1]*]
[**periode_sauvegarde_securite_en_heures** *int*]
[**no_check_disk_space**]

}
where

- **tinit** *float* for inheritance: Value of initial calculation time (0 by default).

- **tmax** *float* for inheritance: Time during which the calculation will be stopped (1e30s by default).
- **tcpumax** *float* for inheritance: CPU time limit (must be specified in hours) for which the calculation is stopped (1e30s by default).
- **dt_min** *float* for inheritance: Minimum calculation time step (1e-16s by default).
- **dt_max** *float* for inheritance: Maximum calculation time step (1e30s by default).
- **facsec** *float* for inheritance: Value assigned to the safety factor for the time step (1. by default). The time step calculated is multiplied by the safety factor. The first thing to try when a calculation does not converge with an explicit time scheme is to reduce the facsec to 0.5.
  Warning: Some schemes needs a facsec lower than 1 (0.5 is a good start), for example Schema_Adams_Bashforth_order_3
- **nb_pas_dt_max** *int* for inheritance: Maximum number of calculation time steps (1e9 by default).
- **dt_sauv** *float* for inheritance: Save time step value (1e30s by default). Every dt_sauv, fields are saved in the .sauv file. The file contains all the information saved over time. If this instruction is not entered, results are saved only upon calculation completion.
- **dt_impr** *float* for inheritance: Scheme parameter printing time step in time (1e30s by default). The time steps and the flux balances are printed (incorporated onto every side of processed domains) into the .out file.
- **dt_start** *dt_start* (9.5) for inheritance: dt_min : the first iteration is based on dt_min
  dt_start dt_calc : the time step at first iteration is calculated in agreement with CFL condition.
  dt_start dt_fixe value : the first time step is fixed by the user (recommended when restarting calculation with Crank Nicholson temporal scheme to ensure continuity).
  By default, the first iteration is based on dt_calc.
- **seuil_statio** *float* for inheritance: Value of the convergence threshold (1e-12 by default). Problems using this type of time scheme converge when the derivatives dGi/dt of all the unknown transported values Gi have a combined absolute value less than this value. This is the keyword used to set the permanent rating threshold.
- **seuil_statio_relatif_deconseille** *int into [0, 1]* for inheritance
- **diffusion_implicite** *int into [0, 1]* for inheritance: Keyword to make the diffusion term in the Navier Stokes equation implicit (in this case, vrel should be set to 1). The stability time step is then only based on the convection time step (dt=facsec*dt_convection). Thus, in some circumstances, an important gain is achieved with respect to the time step (large diffusion with respect to convection on tightened meshes). Caution: It is however recommended that the user should avoid exceeding the calculation convection time step by selecting a facsec that is too large. Start with a facsec of 1 and then increase this gradually if you wish to accelerate calculation. In addition, for a natural convection calculation with a zero initial speed, in the first time step, the convection time is infinite and therefore dt=facsec*dt_max.
- **niter_max_diffusion_implicite** *int* for inheritance: This keyword changes the default value (number of unknowns) of the maximal iterations number in the conjugate gradient method used for implicit diffusion.
- **seuil_diffusion_implicite** *float* for inheritance: This keyword changes the default value (1e-6) of convergency criteria for the resolution by conjugate gradient used for implicit diffusion.
- **impr_diffusion_implicite** *int into [0, 1]* for inheritance: Unactivate (default) or not the printing of the convergence during the resolution of the conjugate gradient.
- **precision_impr** *int* for inheritance: Optional keyword to define the digit number for flux values printed into .out files (by default 3).
- **no_error_if_not_converged_diffusion_implicite** *int into [0, 1]* for inheritance
- **no_conv_subiteration_diffusion_implicite** *int into [0, 1]* for inheritance
- **periode_sauvegarde_securite_en_heures** *int* for inheritance: To change the default period (23 hours) between the save of the fields in .sauv file.
- **no_check_disk_space** for inheritance: To disable the check of the available amount of disk space during the calculation.

26 solveur_implicite_base

Description: Class for solver in the situation where the time scheme is the implicit scheme. Solver allows equation diffusion and convection operators to be set as implicit terms.

See also: objet_u (33) solveur_lineaire_std (26.5) simpler (26.4)

Usage:

26.1 implicite

Description: similar to PISO, but as it looks like a simplified solver, it will use fewer timesteps. But it may run faster because the pressure matrix is not re-assembled and thus provides CPU gains.

See also: piso (26.2)

Usage:
implicite obj Lire obj {

> [**seuil_convergence_implicite** *float*]
> [**nb_corrections_max** *int*]
> [**seuil_convergence_solveur** *float*]
> [**seuil_generation_solveur** *float*]
> [**seuil_verification_solveur** *float*]
> [**seuil_test_preliminaire_solveur** *float*]
> [**solveur** *solveur_sys_base*]
> [**no_qdm**]
> [**nb_it_max** *int*]
> [**controle_residu**]

}
where

- **seuil_convergence_implicite** *float* for inheritance: Convergence criteria.
- **nb_corrections_max** *int* for inheritance: Maximum number of corrections performed by the PISO algorithm to achieve the projection of the velocity field. The algorithm may perform less corrections then nb_corrections_max if the accuracy of the projection is sufficient. (By default nb_corrections_max is set to 21).
- **seuil_convergence_solveur** *float* for inheritance: value of the convergence criteria for the resolution of the implicit system build by solving several times per time step the Navier_Stokes equation and the scalar equations if any. This value MUST be used when a coupling between problems is considered (should be set to a value typically of 0.1 or 0.01).
- **seuil_generation_solveur** *float* for inheritance: Option to create a GMRES solver and use vrel as the convergence threshold (implicit linear system Ax=B will be solved if residual error ||Ax-B|| is lesser than vrel).
- **seuil_verification_solveur** *float* for inheritance: Option to check if residual error ||Ax-B|| is lesser than vrel after the implicit linear system Ax=B has been solved.
- **seuil_test_preliminaire_solveur** *float* for inheritance: Option to decide if the implicit linear system Ax=B should be solved by checking if the residual error ||Ax-B|| is bigger than vrel.
- **solveur** *solveur_sys_base* (9.12) for inheritance: Method (different from the default one, Gmres with diagonal preconditioning) to solve the linear system.
- **no_qdm** for inheritance: Keyword to not solve qdm equation (and turbulence models of these equation).
- **nb_it_max** *int* for inheritance: Keyword to set the maximum iterations number for the Gmres.

- **controle_residu** for inheritance: Keyword of Boolean type (by default 0). If set to 1, the convergence occurs if the residu suddenly increases.

26.2 piso

Description: Piso (Pressure Implicit with Split Operator) - method to solve N_S.

See also: simpler (26.4) implicite (26.1) simple (26.3)

Usage:
piso obj Lire obj {

[**seuil_convergence_implicite** *float*]
[**nb_corrections_max** *int*]
[**seuil_convergence_solveur** *float*]
[**seuil_generation_solveur** *float*]
[**seuil_verification_solveur** *float*]
[**seuil_test_preliminaire_solveur** *float*]
[**solveur** *solveur_sys_base*]
[**no_qdm**]
[**nb_it_max** *int*]
[**controle_residu**]

}
where

- **seuil_convergence_implicite** *float*: Convergence criteria.
- **nb_corrections_max** *int*: Maximum number of corrections performed by the PISO algorithm to achieve the projection of the velocity field. The algorithm may perform less corrections then nb-_corrections_max if the accuracy of the projection is sufficient. (By default nb_corrections_max is set to 21).
- **seuil_convergence_solveur** *float* for inheritance: value of the convergence criteria for the resolution of the implicit system build by solving several times per time step the Navier_Stokes equation and the scalar equations if any. This value MUST be used when a coupling between problems is considered (should be set to a value typically of 0.1 or 0.01).
- **seuil_generation_solveur** *float* for inheritance: Option to create a GMRES solver and use vrel as the convergence threshold (implicit linear system Ax=B will be solved if residual error ||Ax-B|| is lesser than vrel).
- **seuil_verification_solveur** *float* for inheritance: Option to check if residual error ||Ax-B|| is lesser than vrel after the implicit linear system Ax=B has been solved.
- **seuil_test_preliminaire_solveur** *float* for inheritance: Option to decide if the implicit linear system Ax=B should be solved by checking if the residual error ||Ax-B|| is bigger than vrel.
- **solveur** *solveur_sys_base* (9.12) for inheritance: Method (different from the default one, Gmres with diagonal preconditioning) to solve the linear system.
- **no_qdm** for inheritance: Keyword to not solve qdm equation (and turbulence models of these equation).
- **nb_it_max** *int* for inheritance: Keyword to set the maximum iterations number for the Gmres.
- **controle_residu** for inheritance: Keyword of Boolean type (by default 0). If set to 1, the convergence occurs if the residu suddenly increases.

26.3 simple

Description: SIMPLE type algorithm

See also: piso (26.2)

Usage:
simple obj Lire obj {

> **relax_pression** *float*
> [**seuil_convergence_implicite** *float*]
> [**nb_corrections_max** *int*]
> [**seuil_convergence_solveur** *float*]
> [**seuil_generation_solveur** *float*]
> [**seuil_verification_solveur** *float*]
> [**seuil_test_preliminaire_solveur** *float*]
> [**solveur** *solveur_sys_base*]
> [**no_qdm**]
> [**nb_it_max** *int*]
> [**controle_residu**]

}
where

- **relax_pression** *float*: Value between 0 and 1 (by default 1), this keyword is used only by the SIMPLE algorithm for relaxing the increment of pressure.
- **seuil_convergence_implicite** *float* for inheritance: Convergence criteria.
- **nb_corrections_max** *int* for inheritance: Maximum number of corrections performed by the PISO algorithm to achieve the projection of the velocity field. The algorithm may perform less corrections then nb_corrections_max if the accuracy of the projection is sufficient. (By default nb_corrections_max is set to 21).
- **seuil_convergence_solveur** *float* for inheritance: value of the convergence criteria for the resolution of the implicit system build by solving several times per time step the Navier_Stokes equation and the scalar equations if any. This value MUST be used when a coupling between problems is considered (should be set to a value typically of 0.1 or 0.01).
- **seuil_generation_solveur** *float* for inheritance: Option to create a GMRES solver and use vrel as the convergence threshold (implicit linear system Ax=B will be solved if residual error ||Ax-B|| is lesser than vrel).
- **seuil_verification_solveur** *float* for inheritance: Option to check if residual error ||Ax-B|| is lesser than vrel after the implicit linear system Ax=B has been solved.
- **seuil_test_preliminaire_solveur** *float* for inheritance: Option to decide if the implicit linear system Ax=B should be solved by checking if the residual error ||Ax-B|| is bigger than vrel.
- **solveur** *solveur_sys_base* (9.12) for inheritance: Method (different from the default one, Gmres with diagonal preconditioning) to solve the linear system.
- **no_qdm** for inheritance: Keyword to not solve qdm equation (and turbulence models of these equation).
- **nb_it_max** *int* for inheritance: Keyword to set the maximum iterations number for the Gmres.
- **controle_residu** for inheritance: Keyword of Boolean type (by default 0). If set to 1, the convergence occurs if the residu suddenly increases.

26.4 simpler

Description: Simpler method for incompressible systems.

See also: solveur_implicite_base (26) piso (26.2)

Usage:
simpler obj Lire obj {

seuil_convergence_implicite *float*
[**seuil_convergence_solveur** *float*]
[**seuil_generation_solveur** *float*]
[**seuil_verification_solveur** *float*]
[**seuil_test_preliminaire_solveur** *float*]
[**solveur** *solveur_sys_base*]
[**no_qdm**]
[**nb_it_max** *int*]
[**controle_residu**]

}
where

- **seuil_convergence_implicite** *float*: Keyword to set the value of the convergence criteria for the resolution of the implicit system build to solve either the Navier_Stokes equation (only for Simple and Simpler algorithms) or a scalar equation. It is adviced to use the default value (1e6) to solve the implicit system only once by time step. This value must be decreased when a coupling between problems is considered.
- **seuil_convergence_solveur** *float*: value of the convergence criteria for the resolution of the implicit system build by solving several times per time step the Navier_Stokes equation and the scalar equations if any. This value MUST be used when a coupling between problems is considered (should be set to a value typically of 0.1 or 0.01).
- **seuil_generation_solveur** *float*: Option to create a GMRES solver and use vrel as the convergence threshold (implicit linear system Ax=B will be solved if residual error ||Ax-B|| is lesser than vrel).
- **seuil_verification_solveur** *float*: Option to check if residual error ||Ax-B|| is lesser than vrel after the implicit linear system Ax=B has been solved.
- **seuil_test_preliminaire_solveur** *float*: Option to decide if the implicit linear system Ax=B should be solved by checking if the residual error ||Ax-B|| is bigger than vrel.
- **solveur** *solveur_sys_base* (9.12): Method (different from the default one, Gmres with diagonal preconditioning) to solve the linear system.
- **no_qdm** : Keyword to not solve qdm equation (and turbulence models of these equation).
- **nb_it_max** *int*: Keyword to set the maximum iterations number for the Gmres.
- **controle_residu** : Keyword of Boolean type (by default 0). If set to 1, the convergence occurs if the residu suddenly increases.

26.5 solveur_lineaire_std

Description: not_set

See also: solveur_implicite_base (26)

Usage:
solveur_lineaire_std obj Lire obj {

[**solveur** *solveur_sys_base*]

}
where

- **solveur** *solveur_sys_base* (9.12)

27 source_base

Description: Basic class of source terms introduced in the equation.

See also: objet_u (33) source_generique (27.19) boussinesq_temperature (27.4) boussinesq_concentration (27.3) dirac (27.8) puissance_thermique (27.17) source_qdm_lambdaup (27.21) source_th_tdivu (27.25) source_robin (27.22) source_robin_scalaire (27.23) canal_perio (27.5) source_constituant (27.18) source-_transport_k_eps (27.26) acceleration (27.2) coriolis (27.6) source_qdm (27.20) perte_charge_singuliere (27.16) perte_charge_directionnelle (27.12) perte_charge_isotrope (27.13) perte_charge_anisotrope (27.10) perte_charge_circulaire (27.11) darcy (27.7) forchheimer (27.9) perte_charge_reguliere (27.14)

Usage:

27.1 Source_Transport_K_Eps_anisotherme

Description: Keywords to modify the source term constants in the anisotherm standard k-eps model epsilon transportation equation. By default, these constants are set to: C1_eps=1.44 C2_eps=1.92 C3_eps=1.0

See also: source_transport_k_eps (27.26)

Usage:
Source_Transport_K_Eps_anisotherme obj Lire obj {

[**c3_eps** *float*]
[**c1_eps** *float*]
[**c2_eps** *float*]

}
where

- **c3_eps** *float*: Third constant.
- **c1_eps** *float* for inheritance: First constant.
- **c2_eps** *float* for inheritance: Second constant.

27.2 acceleration

Description: Momentum source term to take in account the forces due to rotation or translation of a non Galilean referential R' (centre 0') into the Galilean referential R (centre 0).

See also: source_base (27)

Usage:
acceleration obj Lire obj {

[**vitesse** *champ_base*]
[**acceleration** *champ_base*]
[**omega** *champ_base*]
[**domegadt** *champ_base*]
[**centre_rotation** *champ_base*]
[**option** *str into ['terme_complet', 'coriolis_seul', 'entrainement_seul']*]

}
where

- **vitesse** *champ_base* (15.1): Keyword for the velocity of the referential R' into the R referential (dOO'/dt term [m.s-1]). The velocity is mandatory when you want to print the total cinetic energy into the non-mobile Galilean referential R (see Ec_dans_repere_fixe keyword).
- **acceleration** *champ_base* (15.1): Keyword for the acceleration of the referential R' into the R referential (d2OO'/dt2 term [m.s-2]). field_base is a time dependant field (eg: Champ_Fonc_t).

- **omega** *champ_base* (15.1): Keyword for a rotation of the referential R' into the R referential [rad.s-1]. field_base is a 3D time dependant field specified for example by a Champ_Fonc_t keyword. The time_field field should have 3 components even in 2D (In 2D: 0 0 omega).
- **domegadt** *champ_base* (15.1): Keyword to define the time derivative of the previous rotation [rad.s-2]. Should be zero if the rotation is constant. The time_field field should have 3 components even in 2D (In 2D: 0 0 domegadt).
- **centre_rotation** *champ_base* (15.1): Keyword to specify the centre of rotation (expressed in R' coordinates) of R' into R (if the domain rotates with the R' referential, the centre of rotation is 0'=(0,0,0)). The time_field should have 2 or 3 components according the dimension 2 or 3.
- **option** *str into ['terme_complet', 'coriolis_seul', 'entrainement_seul']*: Keyword to specify the kind of calculation: terme_complet (default option) will calculate both the Coriolis and centrifugal forces, coriolis_seul will calculate the first one only, entrainement_seul will calculate the second one only.

27.3 boussinesq_concentration

Description: Class to describe a source term that couples the movement quantity equation and constituent transportation equation with the Boussinesq hypothesis.

See also: source_base (27)

Usage:
boussinesq_concentration obj Lire obj {

c0 *n x1 x2 ... xn*
[**verif_boussinesq** *int*]

}
where

- **c0** *n x1 x2 ... xn*: Reference concentration field type. The only field type currently available is Champ_Uniforme (Uniform field).
- **verif_boussinesq** *int*: Keyword to check (1) or not (0) the reference concentration in comparison with the mean concentration value in the domain. It is set to 1 by default.

27.4 boussinesq_temperature

Description: Class to describe a source term that couples the movement quantity equation and energy equation with the Boussinesq hypothesis.

See also: source_base (27)

Usage:
boussinesq_temperature obj Lire obj {

t0 *str*
[**verif_boussinesq** *int*]

}
where

- **t0** *str*: Reference temperature value (oC or K). It can also be a time dependant function since the 1.6.6 version.
- **verif_boussinesq** *int*: Keyword to check (1) or not (0) the reference temperature in comparison with the mean temperature value in the domain. It is set to 1 by default.

27.5 canal_perio

Description: Momentum source term to maintain flow rate. The expression of the source term is:
S(t) = (2*(Q(0) - Q(t))-(Q(0)-Q(t-dt))/(coeff*dt*area)

Where:
coeff=damping coefficient
area=area of the periodic boundary
Q(t)=flow rate at time t
dt=time step

Three files will be created during calculation on a datafile named DataFile.data. The first file contains the flow rate evolution. The second file is useful for restarting a calculation with the flow rate of the previous stopped calculation, and the last one contains the pressure gradient evolution:
-DataFile_Channel_Flow_Rate_ProblemName_BoundaryName
-DataFile_Channel_Flow_Rate_repr_ProblemName_BoundaryName
-DataFile_Pressure_Gradient_ProblemName_BoundaryName

See also: source_base (27)

Usage:
canal_perio obj Lire obj {

> **bord** *str*
> [**h** *float*]
> [**coeff** *float*]
> [**debit_impose** *float*]

}
where

- **bord** *str*: The name of the (periodic) boundary normal to the flow direction.
- **h** *float*: Half heigth of the channel.
- **coeff** *float*: Damping coefficient (optional, default value is 10).
- **debit_impose** *float*: Optional option to specify the aimed flow rate Q(0). If not used, Q(0) is computed by the code after the projection phase, where velocity initial conditions are slighlty changed to verify incompressibility.

27.6 coriolis

Description: Keyword for a Coriolis term in hydraulic equation. Warning: Only available in VDF.

See also: source_base (27)

Usage:
coriolis omega
where

- **omega** *str*: Value of omega.

27.7 darcy

Description: Class for calculation in a porius media with source term of Darcy -nu/K*V. This keyword must be used with a permeability model. For the moment there are two models : permeability constant or

Ergun's law. Darcy source term is available for quasi compressible calculation. A new keyword is aded for porosity (porosite).

See also: source_base (27)

Usage:
darcy bloc
where

- **bloc** *bloc_lecture* (3.39): Description.

27.8 dirac

Description: Class to define a source term corresponding to a volume power release in the energy equation.

See also: source_base (27)

Usage:
dirac position ch
where

- **position** *n x1 x2 ... xn*
- **ch** *champ_base* (15.1): Thermal power field type. To impose a volume power on a domain sub-area, the Champ_Uniforme_Morceaux (partly_uniform_field) type must be used.
  Warning : The volume thermal power is expressed in W.m-3.

27.9 forchheimer

Description: Class to add the source term of Forchheimer -Cf/sqrt(K)*V2 in the Navier Stokes equations. We must precise a permeability model : constant or Ergun's law. Moreover we can give the constant Cf : by default its value is 1. Forchheimer source term is available also for quasi compressible calculation. A new keyword is aded for porosity (porosite).

See also: source_base (27)

Usage:
forchheimer bloc
where

- **bloc** *bloc_lecture* (3.39): Description.

27.10 perte_charge_anisotrope

Description: Anisotropic pressure loss.

See also: source_base (27)

Usage:
perte_charge_anisotrope obj Lire obj {

> **lambda** *str*
> **lambda_ortho** *str*
> **diam_hydr** *champ_don_base*

direction *champ_don_base*
[**sous_zone** *str*]

}
where

- **lambda** *str*: Function for loss coefficient which may be Reynolds dependant (Ex: 64/Re).
- **lambda_ortho** *str*: Function for loss coefficient in transverse direction which may be Reynolds dependant (Ex: 64/Re).
- **diam_hydr** *champ_don_base* (15.2): Hydraulic diameter value.
- **direction** *champ_don_base* (15.2): Field which indicates the direction of the pressure loss.
- **sous_zone** *str*: Optional sub-area where pressure loss applies.

27.11 perte_charge_circulaire

Description: New pressure loss.

See also: source_base (27)

Usage:
perte_charge_circulaire obj Lire obj {

lambda *str*
lambda_ortho *str*
diam_hydr *champ_don_base*
diam_hydr_ortho *champ_don_base*
direction *champ_don_base*
[**sous_zone** *str*]

}
where

- **lambda** *str*: Function f(Re_tot, Re_long, t, x, y, z) for loss coefficient in the longitudinal direction
- **lambda_ortho** *str*: function: Function f(Re_tot, Re_ortho, t, x, y, z) for loss coefficient in transverse direction
- **diam_hydr** *champ_don_base* (15.2): Hydraulic diameter value.
- **diam_hydr_ortho** *champ_don_base* (15.2): Transverse hydraulic diameter value.
- **direction** *champ_don_base* (15.2): Field which indicates the direction of the pressure loss.
- **sous_zone** *str*: Optional sub-area where pressure loss applies.

27.12 perte_charge_directionnelle

Description: Directional pressure loss.

See also: source_base (27)

Usage:
perte_charge_directionnelle obj Lire obj {

lambda *str*
diam_hydr *champ_don_base*
direction *champ_don_base*
[**sous_zone** *str*]

}
where

- **lambda** *str*: Function for loss coefficient which may be Reynolds dependant (Ex: 64/Re).
- **diam_hydr** *champ_don_base* (15.2): Hydraulic diameter value.
- **direction** *champ_don_base* (15.2): Field which indicates the direction of the pressure loss.
- **sous_zone** *str*: Optional sub-area where pressure loss applies.

27.13 perte_charge_isotrope

Description: Isotropic pressure loss.

See also: source_base (27)

Usage:
perte_charge_isotrope obj Lire obj {

> **lambda** *str*
> **diam_hydr** *champ_don_base*
> [**sous_zone** *str*]

}
where

- **lambda** *str*: Function for loss coefficient which may be Reynolds dependant (Ex: 64/Re).
- **diam_hydr** *champ_don_base* (15.2): Hydraulic diameter value.
- **sous_zone** *str*: Optional sub-area where pressure loss applies.

27.14 perte_charge_reguliere

Description: Source term modelling the presence of a bundle of tubes in a flow.

See also: source_base (27)

Usage:
perte_charge_reguliere spec zone_name
where

- **spec** *spec_pdcr_base* (27.15): Description of longitudinale or transversale type.
- **zone_name** *str*: Name of the sub-area occupied by the tube bundle. A Sous_Zone (Sub-area) type object called zone_name should have been previously created.

27.15 spec_pdcr_base

Description: Class to read the source term modelling the presence of a bundle of tubes in a flow. Cf=A Re-B.

See also: objet_lecture (32) longitudinale (27.15.1) transversale (27.15.2)

Usage:
spec_pdcr_base ch_a a [**ch_b**] [**b**]
where

- **ch_a** *str into ['a', 'cf']*: Keyword to be used to set law coefficient values for the coefficient of regular pressure losses.
- **a** *float*: Value of a law coefficient for regular pressure losses.
- **ch_b** *str into ['b']*: Keyword to be used to set law coefficient values for regular pressure losses.
- **b** *float*: Value of a law coefficient for regular pressure losses.

27.15.1 longitudinale

Description: Class to define the pressure loss in the direction of the tube bundle.

See also: spec_pdcr_base (27.15)

Usage:
longitudinale dir dd ch_a a [**ch_b**] [**b**]
where

- **dir** *str into ['x', 'y', 'z']*: Direction.
- **dd** *float*: Tube bundle hydraulic diameter value. This value is expressed in m.
- **ch_a** *str into ['a', 'cf']*: Keyword to be used to set law coefficient values for the coefficient of regular pressure losses.
- **a** *float*: Value of a law coefficient for regular pressure losses.
- **ch_b** *str into ['b']*: Keyword to be used to set law coefficient values for regular pressure losses.
- **b** *float*: Value of a law coefficient for regular pressure losses.

27.15.2 transversale

Description: Class to define the pressure loss in the direction perpendicular to the tube bundle.

See also: spec_pdcr_base (27.15)

Usage:
transversale dir dd chaine_d d ch_a a [**ch_b**] [**b**]
where

- **dir** *str into ['x', 'y', 'z']*: Direction.
- **dd** *float*: Value of the tube bundle step.
- **chaine_d** *str into ['d']*: Keyword to be used to set the value of the tube external diameter.
- **d** *float*: Value of the tube external diameter.
- **ch_a** *str into ['a', 'cf']*: Keyword to be used to set law coefficient values for the coefficient of regular pressure losses.
- **a** *float*: Value of a law coefficient for regular pressure losses.
- **ch_b** *str into ['b']*: Keyword to be used to set law coefficient values for regular pressure losses.
- **b** *float*: Value of a law coefficient for regular pressure losses.

27.16 perte_charge_singuliere

Description: Source term that is used to model a pressure loss over a surface area (transition through a grid, sudden enlargement) defined by the faces of elements located on the intersection of a subzone named subzone_name and a X,Y, or Z plane located at X,Y or Z = location.

See also: source_base (27)

Usage:

perte_charge_singuliere dir coeff bloc_definition_surface
where

- **dir** *str into ['kx', 'ky', 'kz']*: KX, KY or KZ designate directional pressure loss coefficients for respectively X, Y or Z direction.
- **coeff** *float*: Value of friction coefficient (KX, KY, KZ).
- **bloc_definition_surface** *bloc_lecture* (3.39): Surface definition block : In VDF, the surface area definition syntax is identical to that used to define sides (edges) in the Block, for example { X = x0 y0 <= Y <= y1 } for a line perpendicular to the Ox axis in a two-dimensional domain, or { Y = y0 x0 <= X <= x1 z0 <= Z <= z1 } for a surface perpendicular to the Oy axis in a 3D domain.
example : sources { Perte_Charge_Singuliere KX 0.5 { X = 1. 0. <= Y <= 1. } }

  VEF : the surface area definition syntax relies on sub-areas definition (see 4.3.22). First value (X=0.35 in the example below, in regard to KX keyword) allows to determine the faces of elements in sub-area for which the pressure loss is applied.
example : sources { Perte_Charge_Singuliere KX 0.5 { 0.35 sous_zone_toto } }
Observations :
- If the surface area is not included in the calculation domain or if (in VDF) it is not perpendicular to the space direction in accordance with which the pressure loss is being calculated, Trio-U exists in error.
- The surface area may be diminished at only one side if a sudden shrinking or widening occurs.

27.17 puissance_thermique

Description: Class to define a source term corresponding to a volume power release in the energy equation.

See also: source_base (27)

Usage:
puissance_thermique ch
where

- **ch** *champ_base* (15.1): Thermal power field type. To impose a volume power on a domain sub-area, the Champ_Uniforme_Morceaux (partly_uniform_field) type must be used.
Warning : The volume thermal power is expressed in W.m-3 in 3D. It is a power per volume unit (in a porous media, it is a power per fluid volume unit).

27.18 source_constituant

Description: Keyword to specify source rates, in [[C]/s], for each one of the nb constituents. [C] is the concentration unit.

See also: source_base (27)

Usage:
source_constituant ch
where

- **ch** *champ_base* (15.1): Field type.

27.19 source_generique

Description: to define a source term depending on some discrete fields of the problem and (or) analytic expression. It is expressed by the way of a generic field usually used for post-processing.

See also: source_base (27)

Usage:
source_generique champ
where

- **champ** *champ_generique_base* (7): the source field

27.20 source_qdm

Description: Momentum source term in the Navier Stokes equation.

See also: source_base (27)

Usage:
source_qdm ch
where

- **ch** *champ_base* (15.1): Field type.

27.21 source_qdm_lambdaup

Description: This source term is a dissipative term which is intended to minimise the energy associated to non-conformscales u' (responsible for spurious oscillations in some cases). The equation for these scales can be seen as: du'/dt= -lambda. u' + grad P' where -lambda. u' represents the dissipative term, with lambda = a/Delta t For Crank-Nicholson temporal scheme, recommended value for a is 2.
Remark : This method requires to define a filtering operator.

See also: source_base (27)

Usage:
source_qdm_lambdaup obj Lire obj {

> **lambda** *float*
> [**lambda_min** *float*]
> [**lambda_max** *float*]
> [**ubar_umprim_cible** *float*]

}
where

- **lambda** *float*: value of lambda
- **lambda_min** *float*: value of lambda_min
- **lambda_max** *float*: value of lambda_max
- **ubar_umprim_cible** *float*: value of ubar_umprim_cible

27.22 source_robin

Description: This source term should be used when a Paroi_decalee_Robin boundary condition is set in a hydraulic equation. The source term will be applied on the N specified boundaries. To post-process the values of tauw, u_tau and Reynolds_tau into the files tauw_robin.dat, reynolds_tau_robin.dat and u_tau-_robin.dat, you must add a block Traitement_particulier { canal { } }

See also: source_base (27)

Usage:
source_robin bords
where

- **bords** *vect_nom* (3.102)

27.23 source_robin_scalaire

Description: This source term should be used when a Paroi_decalee_Robin boundary condition is set in a an energy equation. The source term will be applied on the N specified boundaries. The values temp_wall-_valueI are the temperature specified on the Ith boundary. The last value dt_impr is a printing period which is mandatory to specify in the data file but has no effect yet.

See also: source_base (27)

Usage:
source_robin_scalaire bords
where

- **bords** *listdeuxmots_sacc* (27.24)

27.24 listdeuxmots_sacc

Description: List of groups of two words (without accodances).

See also: listobj (31.3)

Usage:
n object1 object2 ....
list of *deuxmots* (5.20)

27.25 source_th_tdivu

Description: This term source is dedicated for any scalar (called T) transportation. Coupled with upwind (amont) or muscl scheme, this term gives for final expression of convection : div(U.T)-T.div (U)=U.grad(T) This ensures, in incompressible flow when divergence free is badly resolved, to stay in a better way in the physical boundaries.
Warning: Only available in VEF discretization.

See also: source_base (27)

Usage:
source_th_tdivu

27.26 source_transport_k_eps

Description: Keyword to alter the source term constants in the standard k-eps model epsilon transportation equation. By default, these constants are set to: C1_eps=1.44 C2_eps=1.92

See also: source_base (27) Source_Transport_K_Eps_anisotherme (27.1) source_transport_k_eps_aniso-_concen (27.27) source_transport_k_eps_aniso_therm_concen (27.28)

Usage:
source_transport_k_eps obj Lire obj {

[**c1_eps** *float*]
[**c2_eps** *float*]

}
where

- **c1_eps** *float*: First constant.
- **c2_eps** *float*: Second constant.

27.27 source_transport_k_eps_aniso_concen

Description: Keywords to modify the source term constants in the anisotherm standard k-eps model epsilon transportation equation. By default, these constants are set to: C1_eps=1.44 C2_eps=1.92 C3_eps=1.0

See also: source_transport_k_eps (27.26)

Usage:
source_transport_k_eps_aniso_concen obj Lire obj {

[**c3_eps** *float*]
[**c1_eps** *float*]
[**c2_eps** *float*]

}
where

- **c3_eps** *float*: Third constant.
- **c1_eps** *float* for inheritance: First constant.
- **c2_eps** *float* for inheritance: Second constant.

27.28 source_transport_k_eps_aniso_therm_concen

Description: Keywords to modify the source term constants in the anisotherm standard k-eps model epsilon transportation equation. By default, these constants are set to: C1_eps=1.44 C2_eps=1.92 C3_eps=1.0

See also: source_transport_k_eps (27.26)

Usage:
source_transport_k_eps_aniso_therm_concen obj Lire obj {

[**c3_eps** *float*]
[**c1_eps** *float*]
[**c2_eps** *float*]

}
where

- **c3_eps** *float*: Third constant.
- **c1_eps** *float* for inheritance: First constant.
- **c2_eps** *float* for inheritance: Second constant.

28 sous_zone

Description: It is an object type describing a domain sub-set.
A Sous_Zone (Sub-area) type object must be associated with a Domaine type object. The Lire (Read) interpretor is used to define the items comprising the sub-area.
Caution: The Domain type object nom_domaine must have been meshed (and triangulated or tetrahedralised in VEF) prior to carrying out the Associer (Associate) nom_sous_zone nom_domaine instruction; this instruction must always be preceded by the read instruction.

See also: objet_u (33)

Usage:
sous_zone obj Lire obj {

[**restriction** *str*]
[**rectangle** *bloc_origine_cotes*]
[**segment** *bloc_origine_cotes*]
[**boite** *bloc_origine_cotes*]
[**liste** *n n1 n2 ... nn*]
[**fichier** *str*]
[**intervalle** *deuxentiers*]
[**polynomes** *bloc_lecture*]
[**couronne** *bloc_couronne*]
[**tube** *bloc_tube*]
[**fonction_sous_zone** *str*]
[**union** *str*]

}
where

- **restriction** *str*: The elements of the sub-area nom_sous_zone must be included into the other sub-area named nom_sous_zone2. This keyword should be used first in the Lire keyword.
- **rectangle** *bloc_origine_cotes* (28.1): The sub-area will include all the domain elements whose centre of gravity is within the Rectangle (in dimension 2).
- **segment** *bloc_origine_cotes* (28.1)
- **boite** *bloc_origine_cotes* (28.1): The sub-area will include all the domain elements whose centre of gravity is within the Box (in dimension 3).
- **liste** *n n1 n2 ... nn*: The sub-area will include n domain items, numbers No. 1 No. i No. n.
- **fichier** *str*: The sub-area is read into the file filename.
- **intervalle** *deuxentiers* (28.2): The sub-area will include domain items whose number is between n1 and n2 (where n1<=n2).
- **polynomes** *bloc_lecture* (3.39): A REPRENDRE
- **couronne** *bloc_couronne* (28.3): In 2D case, to create a couronne.
- **tube** *bloc_tube* (28.4): In 3D case, to create a tube.
- **fonction_sous_zone** *str*: Keyword to build a sub-area with the the elements included into the area defined by fonction>0.
- **union** *str*: The elements of the sub-area nom_sous_zone3 will be added to the sub-area nom_sous_zone. This keyword should be used last in the Lire keyword.

28.1 bloc_origine_cotes

Description: Class to create a rectangle (or a box).

See also: objet_lecture (32)

Usage:
name origin name2 cotes
where

- **name** *str into ['Origine']*: Keyword to define the origin of the rectangle (or the box).
- **origin** *x1 x2 (x3)*: Co-ordinates of the origin of the rectangle (or the box).
- **name2** *str into ['Cotes']*: Keyword to define the length along the axes.
- **cotes** *x1 x2 (x3)*: Length along the axes.

28.2 deuxentiers

Description: Two integers.

See also: objet_lecture (32)

Usage:
int1 int2
where

- **int1** *int*: First integer.
- **int2** *int*: Second integer.

28.3 bloc_couronne

Description: Class to create a couronne (2D).

See also: objet_lecture (32)

Usage:
name origin name3 ri name4 re
where

- **name** *str into ['Origine']*: Keyword to define the center of the circle.
- **origin** *x1 x2 (x3)*: Center of the circle.
- **name3** *str into ['ri']*: Keyword to define the interior radius.
- **ri** *float*: Interior radius.
- **name4** *str into ['re']*: Keyword to define the exterior radius.
- **re** *float*: Exterior radius.

28.4 bloc_tube

Description: Class to create a tube (3D).

See also: objet_lecture (32)

Usage:
name origin name2 direction name3 ri name4 re name5 h
where

- **name** *str into ['Origine']*: Keyword to define the center of the tube.
- **origin** *x1 x2 (x3)*: Center of the tube.
- **name2** *str into ['dir']*: Keyword to define the direction of the main axis.
- **direction** *str into ['X', 'Y', 'Z']*: direction of the main axis X, Y or Z
- **name3** *str into ['ri']*: Keyword to define the interior radius.
- **ri** *float*: Interior radius.
- **name4** *str into ['re']*: Keyword to define the exterior radius.
- **re** *float*: Exterior radius.
- **name5** *str into ['hauteur']*: Keyword to define the heigth of the tube.
- **h** *float*: Heigth of the tube.

29 turbulence_paroi_base

Description: Basic class for wall laws for NAVIER STOKES equations.

See also: objet_u (33) loi_standard_hydr_old (29.3) loi_standard_hydr (29.2) paroi_tble (29.5) negligeable (29.4) utau_imp (29.9)

Usage:

29.1 loi_expert_hydr

Description: This keyword is similar to the previous keyword Loi_standard_hydr but has several additional options into brackets.

See also: loi_standard_hydr (29.2)

Usage:
loi_expert_hydr obj Lire obj {

[**u_star_impose** *float*]
[**methode_calcul_face_keps_impose** *str into ['toutes_les_faces_accrochees', 'que_les_faces_des-_elts_dirichlet']*]
[**kappa** *float*]
[**Erugu** *float*]
[**A_plus** *float*]

}
where

- **u_star_impose** *float*: The value of the friction velocity (u*) is not calculated but given by the user.
- **methode_calcul_face_keps_impose** *str into ['toutes_les_faces_accrochees', 'que_les_faces_des-_elts_dirichlet']*: The available options select the algorithm to apply K and Eps boundaries condition (the algorithms differ according to the faces).
  toutes_les_faces_accrochees : Default option in 2D (the algorithm is the same than the algorithm used in Loi_standard_hydr)
  que_les_faces_des_elts_dirichlet : Default option in 3D (another algorithm where less faces are concerned when applying K-Eps boundary condition).
- **kappa** *float*: The value can be changed from the default one (0.415)
- **Erugu** *float*: The value of E can be changed from the default one for a smooth wall (9.11). It is also possible to change the value for one boundary wall only with paroi_rugueuse keyword/
- **A_plus** *float*: The value can can be changed from the default one (26.0)

29.2 loi_standard_hydr

Description: Keyword for the logarithmic wall law for a hydraulic problem. Loi_standard_hydr refers to first cell rank eddy-viscosity defined from continuous analytical functions, whereas Loi_standard_hydr-_3couches from functions separataly defined for each sub-layer

See also: turbulence_paroi_base (29) loi_expert_hydr (29.1)

Usage:
loi_standard_hydr

29.3 loi_standard_hydr_old

Description: not_set

See also: turbulence_paroi_base (29)

Usage:
loi_standard_hydr_old

29.4 negligeable

Description: Keyword to suppress the calculation of a law of the wall with a turbulence model. The wall stress is directly calculated with the derivative of the velocity, in the direction perpendicular to the wall (tau_tan /rho= nu dU/dy).
Warning: This keyword is not available for k-epsilon models. In that case you must choose a wall law.

See also: turbulence_paroi_base (29)

Usage:
negligeable

29.5 paroi_tble

Description: Keyword for the Thin Boundary Layer Equation wall-model (a more complete description of the model can be found into this PDF file). The wall shear stress is evaluated thanks to boundary layer equations applied in a one-dimensional fine grid in the near-wall region.

See also: turbulence_paroi_base (29)

Usage:
paroi_tble obj Lire obj {

[**n** *int*]
[**facteur** *float*]
[**modele_visco** *str*]
[**stats** *twofloat*]
[**sonde_tble** *liste_sonde_tble*]
[**restart**]
[**stationnaire** *entierfloat*]
[**lambda** *str*]
[**mu** *str*]
[**sans_source_boussinesq**]
[**alpha** *float*]
[**kappa** *float*]

}
where

- **n** *int*: Number of nodes in the TBLE grid (mandatory option).
- **facteur** *float*: Stretching ratio for the TBLE grid (to refine, the TBLE facteur must be greater than 1).
- **modele_visco** *str*: File name containing the description of the eddy viscosity model.
- **stats** *twofloat* (29.6): Statistics of the TBLE velocity and turbulent viscosity profiles. 2 values are required : the starting time and ending time of the statistics computation.
- **sonde_tble** *liste_sonde_tble* (29.7)
- **restart**
- **stationnaire** *entierfloat* (29.8)
- **lambda** *str*
- **mu** *str*
- **sans_source_boussinesq**
- **alpha** *float*
- **kappa** *float*

29.6 twofloat

Description: two reals.

See also: objet_lecture (32)

Usage:
a b
where

- **a** *float*: First real.
- **b** *float*: Second real.

29.7 liste_sonde_tble

Description: not_set

See also: listobj (31.3)

Usage:
n object1 object2 ....
list of *sonde_tble* (29.7.1)

29.7.1 sonde_tble

Description: not_set

See also: objet_lecture (32)

Usage:
name point
where

- **name** *str*
- **point** *un_point* (3.8.3)

29.8 entierfloat

Description: An integer and a real.

See also: objet_lecture (32)

Usage:
the_int the_float
where

- **the_int** *int*: Integer.
- **the_float** *float*: Real.

29.9 utau_imp

Description: Keyword to impose the friction velocity on the wall with a turbulence model for thermohydraulic problems. There are two possibilities to use this keyword :
1 - we can impose directly the value of the friction velocity u_star.
2 - we can also give the friction coefficient and hydraulic diameter. So, TRUST determines the friction velocity by : u_star = U*sqrt(lambda_c/8).

See also: turbulence_paroi_base (29)

Usage:
utau_imp obj Lire obj {

[**u_tau** *champ_base*]
[**lambda_c** *str*]
[**diam_hydr** *champ_base*]

}
where

- **u_tau** *champ_base* (15.1): Field type.
- **lambda_c** *str*: The friction coefficient. It can be function of the spatial coordinates x,y,z, the Reynolds number Re, and the hydraulic diameter.
- **diam_hydr** *champ_base* (15.1): The hydraulic diameter.

30 turbulence_paroi_scalaire_base

Description: Basic class for wall laws for energy equation.

See also: objet_u (33) loi_standard_hydr_scalaire (30.4) loi_analytique_scalaire (30.1) paroi_tble_scal (30.6) loi_paroi_nu_impose (30.3) negligeable_scalaire (30.5)

Usage:

30.1 loi_analytique_scalaire

Description: not_set

See also: turbulence_paroi_scalaire_base (30)

Usage:
loi_analytique_scalaire

30.2 loi_expert_scalaire

Description: Keyword similar to keyword Loi_standard_hydr_scalaire but with additional option.

See also: loi_standard_hydr_scalaire (30.4)

Usage:
loi_expert_scalaire obj Lire obj {

[**prdt_sur_kappa** *float*]
[**calcul_ldp_en_flux_impose** *int into [0, 1]*]

}
where

- **prdt_sur_kappa** *float*: This option is to change the default value of 2.12 in the scalable wall function.
- **calcul_ldp_en_flux_impose** *int into [0, 1]*: By default (value set to 0), the law of the wall is not applied for a wall with a Neumann condition. With value set to 1, the law is applied even on a wall with Neumann condition.

30.3 loi_paroi_nu_impose

Description: Keyword to impose Nusselt numbers on the wall for the thermohydraulic problems. To use this option, it is necessary to give in the data file the value of the hydraulic diameter and the expression of the Nusselt number.

See also: turbulence_paroi_scalaire_base (30)

Usage:
loi_paroi_nu_impose obj Lire obj {

nusselt *str*
diam_hydr *champ_base*

}
where

- **nusselt** *str*: The Nusselt number. This expression can be a function of x, y, z, Re (Reynolds number), Pr (Prandtl number).
- **diam_hydr** *champ_base* (15.1): The hydraulic diameter.

30.4 loi_standard_hydr_scalaire

Description: Keyword for the law of the wall.

See also: turbulence_paroi_scalaire_base (30) loi_expert_scalaire (30.2)

Usage:
loi_standard_hydr_scalaire

30.5 negligeable_scalaire

Description: Keyword to suppress the calculation of a law of the wall with a turbulence model for thermohydraulic problems. The wall stress is directly calculated with the derivative of the velocity, in the direction perpendicular to the wall.

See also: turbulence_paroi_scalaire_base (30)

Usage:
negligeable_scalaire

30.6 paroi_tble_scal

Description: Keyword for the Thin Boundary Layer Equation thermal wall-model.

See also: turbulence_paroi_scalaire_base (30)

Usage:
paroi_tble_scal obj Lire obj {

[**n** *int*]
[**facteur** *float*]
[**modele_visco** *str*]
[**nb_comp** *int*]
[**stats** *fourfloat*]
[**sonde_tble** *liste_sonde_tble*]
[**prandtl** *float*]

}
where

- **n** *int*: Number of nodes in the TBLE grid (mandatory option).
- **facteur** *float*: Stretching ratio for the TBLE grid (to refine, the TBLE facteur must be greater than 1).
- **modele_visco** *str*: File name containing the description of the eddy viscosity model.
- **nb_comp** *int*: Number of component to solve in the fine grid (1 if 2D simulation (2D not available yet), 2 if 3D simulation).
- **stats** *fourfloat* (30.7): Statistics of the TBLE velocity and turbulent viscosity profiles. 4 values are required : the starting time of velocity averaging, the starting time of the RMS fluctuations, the ending time of the statistics computation and finally the print time period for the statistics.
- **sonde_tble** *liste_sonde_tble* (29.7)
- **prandtl** *float*

30.7 fourfloat

Description: Four reals.

See also: objet_lecture (32)

Usage:
a b c d
where

- **a** *float*: First real.
- **b** *float*: Second real.
- **c** *float*: Third real.
- **d** *float*: Fourth real.

31 listobj_impl

Description: not_set

See also: objet_u (33) listobj (31.3)

Usage:

31.1 list_un_pb

Description: pour les groupes

See also: listobj (31.3)

Usage:
{ object1 , object2 .... }
list of *un_pb* (31.2) separeted with ,

31.2 un_pb

Description: pour les groupes

See also: objet_lecture (32)

Usage:
mot
where

- **mot** *str*: la chaine

31.3 listobj

Description: List of objects.

See also: listobj_impl (31) champs_a_post (4.2.18) list_stat_post (4.2.21) listpoints (4.2.7) sondes (4.2.3) listchamp_generique (7.3) list_nom_virgule (7.2) definition_champs (4.2.1) post_processings (4.3) liste_post (4.5) liste_post_ok (4.4) condlims (5.4) sources (5.5) vect_nom (3.102) list_nom (3.87) list_bord (3.48.4) list_bloc_mailler (3.48) list_un_pb (31.1) list_list_nom (4.8) ecrire_fichier_xyz_valeur_param (5.6) pp (5.16) listdeuxmots_sacc (27.24) liste_sonde_tble (29.7) listeqn (4.10) list_info_med (4.32) listsous_zone_valeur (5.9.12) reactions (8.1)

Usage:

32 objet_lecture

Description: Auxiliary class for reading.

See also: objet_u (33) bloc_lecture (3.39) deuxmots (5.20) format_file (4.6) deuxentiers (28.2) floatfloat (5.21) entierfloat (29.8) champ_a_post (4.2.19) champs_posts (4.2.17) stat_post_deriv (4.2.22) stats_posts (4.2.20) stats_serie_posts (4.2.28) sonde_base (4.2.5) un_point (3.8.3) sonde (4.2.4) definition_champ (4.2.2) postraitement_base (4.4.2) un_postraitement (4.3.1) type_un_post (4.5.2) type_postraitement_ft_lata (4.5.3) un_postraitement_spec (4.5.1) nom_postraitement (4.4.1) condinit (5.3.1) condinits (5.3) condlimlu

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Usage:

32.1 paroi_ft_disc_deriv

Description: not_set

See also: objet_lecture (32) symetrie (32.1.1)

Usage:
paroi_ft_disc_deriv

32.1.1 symetrie

Description: Symetrie condition in the case of two-phase flows

See also: paroi_ft_disc_deriv (32.1)

Usage:
symetrie

32.2 methode_transport_deriv

Description: Basic class for method of transport of interface.

See also: objet_lecture (32) loi_horaire (32.2.1)

Usage:
methode_transport_deriv

32.2.1 loi_horaire

Description: not_set

See also: methode_transport_deriv (32.2)

Usage:
loi_horaire nom_loi
where

- **nom_loi** *str*

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