Parallel Computational Acoustics Library - Reference Manual

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Parallel Computational Acoustics Library Reference Manual*
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1 Modules

1.1 block_size

NAME

block_size

SYNOPSIS

```
MODULE block_size
```

DESCRIPTION

Block size for factorization of matrices used in the direct solver.

ARGUMENTS

n1 – integer
n2 – integer

1.2 direct_symmetric

NAME

direct_symmetric

SYNOPSIS

```
MODULE direct_symmetric
```

DESCRIPTION

Direct method module for symmetric complex matrix.

ARGUMENTS

ldu_Robin – factorized matrix structure
ldu_Dirichlet – factorized matrix structure

MODULES

USE factorized_matrix_struct

1.3 direct_unsymmetric

NAME

direct_unsymmetric

SYNOPSIS

```
MODULE direct_unsymmetric
```

DESCRIPTION

Direct method module for unsymmetric complex matrix.

ARGUMENTS

ldu_Robin – factorized matrix structure
ldu_Dirichlet – factorized matrix structure

MODULES

USE factorized_matrix_struct

1.4 facet_struct

NAME

facet_struct

SYNOPSIS

```
MODULE facet_struct
```

DESCRIPTION

Facet structure module.

ARGUMENTS

numb_facets – integer (= number of facets)
numb_quad – integer (= number of 4-node facets)
numb_tria – integer (= number of 3-node facets)
p_geometry – integer array (= pointer of facet connectivity per nodes)
geometry – integer array (= facet conectivity per nodes)
facet_id – integer array (= id of facet)
type_facet – integer array (= type of facet)
id_mat – integer array (= material associated with facet)
id_curve – integer array (= load curve associated with facet)
value – complex array (= average surface value)

1.5 factorized_matrix_struct

NAME

factorized_matrix_struct

SYNOPSIS

```
MODULE factorized_matrix_struct
```

DESCRIPTION

Block tridiagonal sparse matrix structure.

ARGUMENTS

neq – integer (dimension of the matrix)
sparse_size – integer (total number of non zero entries in sparse structure)
nfront – integer (= number of fronts of the tridiagonal structure)
nfront_clamp – integer (= number of last clamped fronts i.e. clamped degrees of freedom)
low_sparse_size – integer (= total size for storage of lower diagonal blocks)
upp_sparse_size – integer (= total size for storage of upper diagonal blocks)
profile_size – integer (= total size for storage of half dense diagonal blocks)
maxdim – integer (= maximum dimension of diagonal blocks)
bc_numb – integer
p_row – integer array (= pointer of first entry of each row)
p_diag – integer array (= pointer of first entry of each row in diagonal block)
p_upp – integer array (= pointer of first entry of each row in upper block)
p_ext – integer array (= pointer of first entry of each row in external block)
column_numb – integer array (= column number of non zero entry in sparse structure)
p_front – integer array (= pointer of fronts)
new2old – integer array (= equation number correspondance)
p_dia_bloc – integer array (= pointer of half dense diagonal blocks)
bc_mask – integer array
coef – complex array (= sparse matrix coefficients)
dia_blo – complex array (= half dense diagonal blocks)

1.6 feti_data

NAME

feti_data

SYNOPSIS

```
MODULE feti_data
```

DESCRIPTION

Data structures for complex FETI solver.

ARGUMENTS

subdom – mesh feti structure
Dirich – nodal list structure
interfine – interface descriptor structure
mesh_interfine – interface mesh structure
transp – sparse matrix structure
feti_rhs – complex array
feti_solution – complex array

MODULES

USE mesh_feti_struct
USE nodal_list_struct
USE interf_descriptor_struct
USE interf_mesh_struct
USE sparse_matrix_struct

1.7 feti_param

NAME

feti_param

SYNOPSIS

```
MODULE feti_param
```

DESCRIPTION

FETI parameters.

ARGUMENTS

typre – integer
feti_max_numb_it – integer
feti_numb_dir – integer
numb_restart – integer
feti_eps – real
eps_stagn – real

1.8 interf_descriptor_struct

NAME

interf_descriptor_struct

SYNOPSIS

```
MODULE interf_descriptor_struct
```

DESCRIPTION

Interface structure. The inner and outer data structures are for the case of non conforming grids or multi-level interface management. In case of conforming interfaces they are identical to the interface data structure.

ARGUMENTS

- **subdom_numb** – integer (= subdomain number)
- **numb_subdom** – integer (= number of subdomains)
- **subdom_neq** – integer (= number of equations in subdomain)
- **numb_neighb** – integer (= number of neighbouring subdomains)
- **list_neighb** – integer array (= list of neighbouring subdomains)
- **signe** – integer array (= sign of interface)
- **interf_nodes** – integer (= number of interface nodes in subdomain)
- **p_intf_nodes** – integer array (= pointer of interface nodes)
- **list_intf_nodes** – integer array (= list of interface nodes)
- **interf_neq** – integer (= number of interface equations in subdomain)
- **p_intf_eq** – integer array (= pointer of interface equations)
- **list_intf_eq** – integer array (= list of interface equations)
- **weight** – real array (= weighting factor)
- **weightd** – real array (= weighting factor)
- **inn_interf_neq** – integer (= number of inner interface equations)
- **p_list_inn** – integer array (= pointer of inner interface equations)
- **list_inn** – integer array (= list of inner interface equations)
- **buff_inn** – complex array (= sending buffer of values for inner interface equations)
- **out_interf_neq** – integer (= number of outer interface equations)
- **p_list_out** – integer array (= pointer of outer interface equations)
- **list_out** – integer array (= list of outer interface equations)
- **buff_out** – complex array (= sending buffer of values for outer interface equations)
- **global_numb_elements** – integer (= global number of element)
- **elem2dom** – integer array (= global element to subdomain allocation array)
- **local_numb_elements** – integer (= local number of element)
- **l2g_elem** – integer array (= local to global element number correspondance)

1.9 interf_mesh_struct

NAME

interf_mesh_struct

SYNOPSIS

```
MODULE interf_mesh_struct
```

DESCRIPTION

Interface mesh structure. The inner and outer data structures are for the case of non conforming grids or multi-level interface management. In case of conforming interfaces they are identical to the interface data structure.

ARGUMENTS

numb_nodes – integer (= number of nodes)
numb_neighb – integer (= number of neighbouring subdomains)
list_neighb – integer array (= list of neighbouring subdomains)
numb_elements – integer (= number of elements)
p_elem – integer array (= pointer of interface elements)
type_elem – integer array
elem_region – integer array
elem_signe – integer array
p_node_id – integer array (= pointer of interface nodes)
node_id – integer array (= list of interface nodes)
p_geometry – integer array (= pointer of nodes in each element)
geometry – integer array (= list of nodes in each element)
neq – integer (= number of
equations) – pointer of equations attached to each node + list
eq_id – integer array
eq_neighb – integer array
p_node_eq – integer array
node_eq – integer array
type_dof – integer array (= pointed list of types of dof)
p_topology – integer array (= pointer of interface equations)
topology – integer array (= list of interface equations)

1.10 load_curve_struct

NAME

load_curve_struct

SYNOPSIS

```
MODULE load_curve_struct
```

DESCRIPTION

Load curve structure.

ARGUMENTS

id_curve – integer
numb_points – integer
var – real array
factor – real array

1.11 mesh_feti_struct

NAME

mesh_feti_struct

SYNOPSIS

```
MODULE mesh_feti_struct
```

DESCRIPTION

Mesh structure.

ARGUMENTS

numb_elements – integer (= number of elements)
numb_nodes – integer (= number of nodes)
neq – integer (= number of equations)
p_node_eq – integer array (= pointer of node to equation correspondance)
node_eq – integer array (= list of equations associated with each node)
type_dof – integer array (= type of equations associated with each node)
l2g_elem – integer array (= local to global element number correspondance)
l2g_node – integer array (= local to global node number correspondance)

1.12 mesh_struct

NAME

mesh_struct

SYNOPSIS

```
MODULE mesh_struct
```

DESCRIPTION

Mesh structure.

ARGUMENTS

numb_connect – number of connected parts
numb_regions – number of elementary regions
numb_acou_regions – number of acoustic regions
numb_admit_regions – number of admittance regions
numb_infinite_regions – number of infinite regions
numb_nodes – number of nodes
space_dim – number of coordinates per node
node_id – external node id
coordinates – coordinates of nodes
tolerance – relative precision tolerance for coordinates
min_nodid – minimum node id
max_nodid – maximum node id
rev_node_id – internal node id
numb_elements – number of elements
numb_hexa – number of 8-node solid elements
numb_tetra – number of 4-node solid elements
numb_admit_quad – number of 4-node admittance elements
numb_admit_quad – number of 3-node admittance elements
numb_infinite_quad – number of 4-node infinite elements
numb_infinite_tria – number of 3-node infinite elements
geometry – pointed list of nodes in each element
p_geometry – pointer to geometry array
rev_geometry – pointed list of elements each node belongs to
p_rev_geometry – pointer to rev_geometry array
elem_id – id of element
elem_region – internal id of region of element
elem_region_id – external id of region of element
neighb_region – internal id of neighboring region
type_elem – type of element
neq – number of equations
node_eq – pointed list of equations attached to each node
type_dof – pointed list of types of dof attached to each node
p_node_eq – pointer to node_eq and type_dof arrays
topology – pointed list of equations in each element
p_topology – pointer of element connectivity per equations
primal_field – acoustic pressure
dual_field – normal velocity

1.13 model

NAME

model

SYNOPSIS

```
MODULE model
```

DESCRIPTION

Data structures used for model.

ARGUMENTS

see module

MODULES

USE mesh_struct
USE nodal_list_struct
USE facet_struct
USE sparse_matrix_struct
USE load_curve_struct
USE region_property_struct

1.14 mpif

NAME

mpif

SYNOPSIS

```
SUBROUTINE mpif
```

DESCRIPTION

FETI communicator declaration and mpif as a module

ARGUMENTS

max_count – parameter integer
FETI_COM – integer
COUPLE_COM – integer INCLUDES INCLUDE 'mpif.h'

1.15 nodal_list_struct

NAME

nodal_list_struct

SYNOPSIS

```
MODULE nodal_list_struct
```

DESCRIPTION

Nodal list structure.

ARGUMENTS

neq – integer (= dimension of problem)
numb – integer (= number of entries in the list)
list_id – integer (= external id of the list)
type_list – integer (= type of the list)
node_id – integer array (= list of nodes)
type_dof – integer array (= type of dof for each entry)
value – complex array (= values)
id_curve – integer array (= curve number associated to each entry)
id_mat – integer array (= material number)
eq_id – integer array (= list of listed equations)
mask – integer array (= mask array equal zero if not a listed equation)

1.16 outfil

NAME

outfil

SYNOPSIS

```
MODULE outfil
```

DESCRIPTION

Output unit structure.

ARGUMENTS

P6 – integer (= output unit)
print_matrix – integer
print_rhs – integer
print_solution – integer
print_mesh – integer

1.17 realloc

NAME

realloc

SYNOPSIS

```
MODULE realloc
```

DESCRIPTION

Functions for memory allocation.

ARGUMENTS

SUBROUTINE realloc_i1
SUBROUTINE extent_i1
SUBROUTINE realloc_r1
SUBROUTINE realloc_c1
SUBROUTINE realloc_i2
SUBROUTINE realloc_r2
SUBROUTINE extent_r2
SUBROUTINE realloc_c2

1.18 region_property_struct

NAME

region_property_struct

SYNOPSIS

```
MODULE region_property_struct
```

DESCRIPTION

Module of acoustic, admittance and infinite element material.

ARGUMENTS

density – real
id_curve_density – integer
celerity – complex
id_curve_celerity – integer
impedance – complex
id_curve_impedance – integer
origin – real array
axes – real array
adist – real
bdist – real
cdist – real
order – integer
tolerance – real

1.19 solver_param

NAME

solver_param

SYNOPSIS

```
MODULE solver_param
```

DESCRIPTION

Solver parameters module.

ARGUMENTS

type_galerkin – integer
symmetric_matrix – integer
type_solver – integer
type_precond – integer
max_numb_it – integer
numb_dir – integer
out_of_core – integer
type_opt – integer
nsd – integer
epsilon – real
numb_freq – integer
frequency – real array

1.20 sparse_matrix_struct

NAME

sparse_matrix_struct

SYNOPSIS

```
MODULE sparse_matrix_struct
```

DESCRIPTION

Sparse matrix structure.

ARGUMENTS

neq – integer (= dimension of the matrix)
sparse_size – integer (= total number of non zero entries)
p_row – integer array (= position of first entry of each row)
column_numb – integer array (= column number of each non zero entry)
coef – complex array (= non zero entries)
symmetric – integer (= symmetric matrix flag)

2 Functions

2.1 add_interf_matrix

NAME

add_interf_matrix

SYNOPSIS

```
SUBROUTINE add_interf_matrix
```

DESCRIPTION

Add interface sparse matrix to impedance sparse matrix.

ARGUMENTS

None

MODULES

USE model
USE feti_data
USE solver_param
USE outfil
USE direct_unsymmetric

2.2 add_interf_matrix_structure

NAME

add_interf_matrix_structure

SYNOPSIS

```
SUBROUTINE add_interf_matrix_structure
```

DESCRIPTION

Add interface sparse matrix data structure.

ARGUMENTS

None

MODULES

USE model
USE feti_data

2.3 add_sparse_sym_matrix

NAME

add_sparse_sym_matrix

SYNOPSIS

```
SUBROUTINE add_sparse_sym_matrix (a,b,b2a_eqid)
```

DESCRIPTION

Add symmetric interface sparse matrix to impedance matrix.

ARGUMENTS

a – sparse matrix structure
b – sparse matrix structure
b2a_eqid – integer array

MODULES

USE outfil
USE realloc
USE sparse_matrix_struct

2.4 add_sparse_sym_struct

NAME

add_sparse_sym_struct

SYNOPSIS

```
SUBROUTINE add_sparse_sym_struct (a,b,b2a_eqid)
```

DESCRIPTION

Add symmetric interface sparse matrix structure.

ARGUMENTS

a – sparse matrix structure
b – sparse matrix structure
b2a_eqid – integer array

MODULES

USE outfil
USE realloc
USE sparse_matrix_struct

2.5 add_sparse_unsym_matrix

NAME

add_sparse_unsym_matrix

SYNOPSIS

```
SUBROUTINE add_sparse_unsym_matrix (a,b,b2a_eqid)
```

DESCRIPTION

Add unsymmetric interface sparse matrix to impedance matrix.

ARGUMENTS

a – sparse matrix structure
b – sparse matrix structure
b2a_eqid – integer array

MODULES

USE outfil
USE realloc
USE sparse_matrix_struct

2.6 add_sparse_unsym_struct

NAME

add_sparse_unsym_struct

SYNOPSIS

```
SUBROUTINE add_sparse_unsym_struct (a,b,b2a_eqid)
```

DESCRIPTION

Add unsymmetric interface sparse matrix structure.

ARGUMENTS

a – sparse matrix structure
b – sparse matrix structure
b2a_eqid – integer array

MODULES

USE outfil
USE realloc
USE sparse_matrix_struct

2.7 assemble_bc

NAME

assemble_bc

SYNOPSIS

```
SUBROUTINE assemble_bc (dom,acou_mat,dim_neumann,Neumann,          &
&                       dim_fneumann,FNeumann,rhs,frequency,dim_lc,&
&                       LC)
```

DESCRIPTION

Assemble right hand side.

ARGUMENTS

dom – mesh structure
acout_mat – region property structure array
dim_neumann – integer
Neumann – nodal list structure array
dim_fneumann – integer
FNeumann – facet structure array
rhs – complex array
frequency – real
dim_lc – integer
LC – load curve structure array

MODULES

USE mesh_struct
USE nodal_list_struct
USE facet_struct
USE region_property_struct
USE load_curve_struct
USE outfil

2.8 assemble_facet_bc

NAME

assemble_facet_bc

SYNOPSIS

```
 SUBROUTINE assemble_facet_bc (dom,acou_mat,FNeumann,rhs,frequency,&
&                              dim_lc,LC)
```

DESCRIPTION

Assemble contribution of facet Neumann boundary conditions to right hand side.

ARGUMENTS

dom – mesh structure
acou_mat – region property structure array
FNeumann – facet structure
rhs – complex array
frequency – real
dim_lc – integer
LC – load curve structure array

MODULES

USE mesh_struct
USE facet_struct
USE region_property_struct
USE load_curve_struct
USE outfil

2.9 assemble_impedance

NAME

assemble_impedance

SYNOPSIS

```
  SUBROUTINE assemble_impedance (dom,a,frequency,acou_mat,admi_mat, &
 &                               inf_mat,typegalerkin)
```

DESCRIPTION

Assemble impedance sparse matrix on domain.

ARGUMENTS

dom – mesh structure
a – sparse matrix structure
frequency – real
acou_mat – region property structure array
admi_mat – region property structure array
inf_mat – region property structure array
typegalerkin – integer

MODULES

USE sparse_matrix_struct
USE mesh_struct
USE region_property_struct
USE outfil

2.10 assemble_interf_matrix

NAME

assemble_interf_matrix

SYNOPSIS

```
 SUBROUTINE assemble_interf_matrix (dom,mesh_intf,b,frequency,     &
&                                   acou_mat,type_sol,subdom_numb)
```

DESCRIPTION

Assemble interface sparse matrix

ARGUMENTS

dom – mesh structure
mesh_intf – interface mesh structure
b – sparse matrix structure
frequency – real
acou_mat – region property structure array
type_sol – integer
subdom_numb – integer

MODULES

USE sparse_matrix_struct
USE interf_mesh_struct
USE mesh_struct
USE region_property_struct
USE outfil

WARNINGS

The alpha and beta parameters are the parameters used in the continous relation $(\alpha u + \beta \partial^2 \tau u)$ which gives after discretization $(\alpha M - \beta K)$.

2.11 assemble_nodal_bc

NAME

assemble_nodal_bc

SYNOPSIS

```
 SUBROUTINE assemble_nodal_bc (dom,acou_mat,Neumann,rhs,frequency,  &
&                              dim_lc,LC)
```

DESCRIPTION

Assemble contribution of nodal Neumann boundary conditions to right hand side.

ARGUMENTS

dom – mesh structure
acou_mat – region property structure array
Neumann – nodal list structure
rhs – complex array
frequency – real
dim_lc – integer
lc – load curve structure array

MODULES

USE mesh_struct
USE nodal_list_struct
USE region_property_struct
USE load_curve_struct
USE outfil

2.12 bcast_acoustic_property

NAME

bcast_acoustic_property

SYNOPSIS

```
SUBROUTINE bcast_acoustic_property (mat)
```

DESCRIPTION

Broadcast acoustic region property to all processes.

ARGUMENTS

mat – region property structure

MODULES

USE region_property_struct
USE mpif

2.13 bcast_admittance_property

NAME

bcast_admittance_property

SYNOPSIS

```
SUBROUTINE bcast_admittance_property (mat)
```

DESCRIPTION

Broadcast admittance region property to all processes.

ARGUMENTS

mat – region property structure

MODULES

USE region_property_struct
USE mpif

2.14 bcast_facet

NAME

bcast_facet

SYNOPSIS

```
SUBROUTINE bcast_facet (bc,intf)
```

DESCRIPTION

Broadcast facet list to all processes and extract.

ARGUMENTS

bc – facet structure
intf – interface descriptor structure

MODULES

USE facet_struct
USE interf_descriptor_struct
USE outfil
USE mpif

2.15 bcast_infinite_property

NAME

bcast_infinite_property

SYNOPSIS

```
SUBROUTINE bcast_infinite_property (mat)
```

DESCRIPTION

Broadcast infinite element region property to all processes.

ARGUMENTS

mat – region property structure

MODULES

USE region_property_struct
USE mpif

2.16 bcast_load_curve

NAME

bcast_load_curve

SYNOPSIS

```
SUBROUTINE bcast_load_curve (lc)
```

DESCRIPTION

Broadcast load curve to all processes.

ARGUMENTS

lc – load curve structure

MODULES

USE load_curve_struct
USE outfil
USE mpif

2.17 bcast_model_attribute

NAME

bcast_model_attribute

SYNOPSIS

```
SUBROUTINE bcast_model_attribute (attribute)
```

DESCRIPTION

Broadcast model attribute to all processes.

ARGUMENTS

attribute – character string

MODULES

USE mpif

2.18 bcast_model_parameters

NAME

bcast_model_parameters

SYNOPSIS

```
SUBROUTINE bcast_model_parameters (n1,n2,n3,n4,n5)
```

DESCRIPTION

Broadcast model parameters to all processes.

ARGUMENTS

n1 – integer
n2 – integer
n3 – integer
n4 – integer
n5 – integer

MODULES

USE solver_param
USE outfil
USE mpif

2.19 bcast_nodal_list

NAME

bcast_nodal_list

SYNOPSIS

```
SUBROUTINE bcast_nodal_list (bc,intf,opt)
```

DESCRIPTION

Broadcast nodal list to all processes and extract.

ARGUMENTS

bc – nodal list structure
intf – interface desriptor structure
opt – integer

MODULES

USE nodal_list_struct
USE interf_descriptor_struct
USE outfil
USE mpif

2.20 bcast_solver_parameters

NAME

bcast_solver_parameters

SYNOPSIS

```
SUBROUTINE bcast_solver_parameters
```

DESCRIPTION

Broadcast solver parameters to all processes.

ARGUMENTS

None

MODULES

USE solver_param
USE block_size
USE outfil
USE mpif

2.21 build_diag

NAME

build_diag

SYNOPSIS

```
SUBROUTINE build_diag (neq,dim,p_row,column_numb,coef,diag)
```

DESCRIPTION

Define diagonal coefficients of sparse matrix

ARGUMENTS

neq – integer
dim – integer
p_row – integer array
column_numb – integer array
coef – complex array
diag – complex array

MODULES

USE outfil

2.22 build_dirich_aug

NAME

build_dirich_aug

SYNOPSIS

```
  SUBROUTINE build_dirich_aug (intf_mesh,Dirichlet,Dirich_aug,      &
 &                             listintf)
```

DESCRIPTION

Compute Schur complement matrix.

ARGUMENTS

intf_mesh – interface mesh structure
Dirichlet – factorized matrix structure
Dirich_aug – factorized matrix structure
listintf – nodal list structure

MODULES

USE solver_param
USE outfil
USE interf_mesh_struct
USE nodal_list_struct
USE realloc
USE factorized_matrix_struct

2.23 build_interf_matrix_structure

NAME

build_interf_matrix_structure

SYNOPSIS

```
  SUBROUTINE build_interf_matrix_structure
```

DESCRIPTION

Build interface sparse matrix data structure.

ARGUMENTS

None

MODULES

USE model
USE feti_data
USE solver_param
USE outfil

2.24 build_interface

NAME

build_interface

SYNOPSIS

```
SUBROUTINE build_interface
```

DESCRIPTION

Build subdomain interface.

ARGUMENTS

None

MODULES

USE outfil
USE mpif
USE feti_data
USE model
USE feti_param

2.25 build_matrix_structure

NAME

build_matrix_structure

SYNOPSIS

```
SUBROUTINE build_matrix_structure
```

DESCRIPTION

Build sparse matrix data structure.

ARGUMENTS

None

MODULES

USE model
USE solver_param

2.26 build_node_eq

NAME

build_node_eq

SYNOPSIS

```
SUBROUTINE build_node_eq (dom,inf_mat)
```

DESCRIPTION

Build correspondance between nodes and equations.

ARGUMENTS

dom – mesh structure
intf_mat – region property structure array

MODULES

USE mesh_struct
USE region_property_struct
USE realloc
USE outfil

2.27 build_rev_geometry

NAME

build_rev_geometry

SYNOPSIS

```
SUBROUTINE build_rev_geometry (dom)
```

DESCRIPTION

Build pointed list of elements each node belongs to.

ARGUMENTS

dom – mesh structure

MODULES

USE outfil
USE realloc
USE mesh_struct

2.28 build_rev_nodid

NAME

build_rev_nodid

SYNOPSIS

```
SUBROUTINE build_rev_nodid (dom)
```

DESCRIPTION

Build external to internal node number correspondance and change list of nodes in each element accordingly.

ARGUMENTS

dom – mesh structure

MODULES

USE outfil
USE mesh_struct

2.29 build_sparse_sym_struct

NAME

build_sparse_sym_struct

SYNOPSIS

```
SUBROUTINE build_sparse_sym_struct (dom,a)
```

DESCRIPTION

Build sparse matrix structure.

ARGUMENTS

dom – mesh structure
a – sparse matrix structure

MODULES

USE outfil
USE realloc
USE mesh_struct
USE sparse_matrix_struct

2.30 build_sparse_unsym_struct

NAME

build_sparse_unsym_struct

SYNOPSIS

```
SUBROUTINE build_sparse_unsym_struct (dom,a)
```

DESCRIPTION

Build sparse matrix structure.

ARGUMENTS

dom – mesh structure
a – sparse matrix structure

MODULES

USE outfil
USE realloc
USE mesh_struct
USE sparse_matrix_struct

2.31 build_topology

NAME

build_topology

SYNOPSIS

```
SUBROUTINE build_topology (dom)
```

DESCRIPTION

Build list of equations in each element, i.e. .build topology of elements using list of nodes per element and list and type of equations per node.

ARGUMENTS

dom – mesh structure

MODULES

USE mesh_struct
USE outfil
USE realloc

2.32 calpd

NAME

calpd

SYNOPSIS

```
SUBROUTINE calpd (pl,pc,pd,n,nza)
```

DESCRIPTION

Determine the cpd pointer which point to the adress inside a of the diagonal coefficient of the matrix. The matrix has a general structure.

ARGUMENTS

pl – integer array
pc – integer array
pd – integer array
n – integer
nza – integer

2.33 cmk_number

NAME

cmk_number

SYNOPSIS

```
SUBROUTINE cmk_number (nodes,p_graph,graph,list)
```

DESCRIPTION

Renumber graph via reverse Cuthill-Mac Kee algorithm.

ARGUMENTS

nodes – integer
p_graph – integer array
graph – integer array
list – integer array

MODULES

USE outfil

2.34 condens_1

NAME

condens_1

SYNOPSIS

```
SUBROUTINE condens_1 (lda,dim1,dim2,a,d,e,f,ie0,if0,nop)
```

DESCRIPTION

Compute the Schur complement matrix $[D^{-1}U^{-t}F]^t$ with LDU the Gauss-Jordan factorisation of the matrix A.

ARGUMENTS

lda – integer
dim1 – integer
dim2 – integer
a – complex array
d – complex array
e – complex array
f – complex array
ie0 – integer array
if0 – integer array
nop – real

MODULES

USE block_size

2.35 condens_2

NAME

condens_2

SYNOPSIS

```
SUBROUTINE condens_2 (lda,dim1,dim2,a,e,ie0,nop)
```

DESCRIPTION

Compute $[L^{-1}E]$ matrix where LDU is the Gauss-Jordan factorisation of the matrix A.

ARGUMENTS

lda – integer
dim1 – integer
dim2 – integer
a – complex array
e – complex array
ie0 – integer array
nop – real

MODULES

USE block_size

2.36 condens_3

NAME

condens_3

SYNOPSIS

```
SUBROUTINE condens_3 (lda,dim1,dim2,e,f,c,ie0,if0,nop)
```

DESCRIPTION

Compute the Schur complement matrix $C = C - [FU^{-1}d^{-1}][L^{-1}E]$ where $[L^{-1}E]$ and $[FU^{-1}d^{-1}]$ have already been computed.

ARGUMENTS

lda – integer
dim1 – integer
dim2 – integer
e – complex array
f – complex array
c – complex array
ie0 – integer array
if0 – integer array
nop – real

MODULES

USE block_size

2.37 copy_block

NAME

copy_block

SYNOPSIS

```
SUBROUTINE copy_block (lda,dim1,dim2,a,b)
```

DESCRIPTION

Copy one block of a matrix.

ARGUMENTS

lda – integer
dim1 – integer
dim2 – integer
a – complex array
b – complex array

MODULES

USE outfil

2.38 dirichlet_bc

NAME

dirichlet_bc

SYNOPSIS

```
SUBROUTINE dirichlet_bc (frequency,dim_lc,lc,bc)
```

DESCRIPTION

Build Interpolate Dirichlet boundary condition.

ARGUMENTS

frequency – real
dim_lc – integer
lc – load curve structure array
bc – nodal list structure

MODULES

USE load_curve_struct
USE nodal_list_struct
USE outfil

2.39 distribute_model

NAME

distribute_model

SYNOPSIS

```
SUBROUTINE distribute_model
```

DESCRIPTION

Distribute domain decomposed model.

ARGUMENTS

None

MODULES

USE model
USE feti_data
USE outfil

2.40 echo_facet

NAME

echo_facet

SYNOPSIS

```
SUBROUTINE echo_facet (P6,bc)
```

DESCRIPTION

Print facets data structure.

ARGUMENTS

P6 – integer (= output unit)
bc – facet structure

MODULES

USE facet_struct

2.41 echo_mesh

NAME

echo_mesh

SYNOPSIS

```
SUBROUTINE echo_mesh (P6,dom,subdom_numb)
```

DESCRIPTION

Print mesh data structure.

ARGUMENTS

P6 – integer (output unit)
dom – mesh structure
subdom_numb – integer

MODULES

USE mesh_struct

2.42 echo_mesh_femview

NAME

echo_mesh_femview

SYNOPSIS

```
SUBROUTINE echo_mesh_femview (dom,subdom_numb,numb_subdom,elem2dom,&
&                             title,directory)
```

DESCRIPTION

Write mesh geometrical data in a FEMVIEW file.

ARGUMENTS

dom – mesh structure
subdom_numb – integer
numb_subdom – integer
elem2dom – integer array
title – character string
directory – character string

MODULES

USE mesh_struct

2.43 echo_model

NAME

echo_model

SYNOPSIS

```
SUBROUTINE echo_model (subdom_numb,numb_subdom)
```

DESCRIPTION

Print all model data structures.

ARGUMENTS

subdom_numb – integer
numb_subdom – integer

MODULES

USE model
USE outfil

2.44 echo_nodal_list

NAME

echo_nodal_list

SYNOPSIS

```
SUBROUTINE echo_nodal_list (P6,bc)
```

DESCRIPTION

Print nodal list structure.

ARGUMENTS

P6 – integer (= output unit)
bc – nodal list structure

MODULES

USE nodal_list_struct

2.45 equation_setup

NAME

equation_setup

SYNOPSIS

```
SUBROUTINE equation_setup
```

DESCRIPTION

Setup system of equations associated with model.

ARGUMENTS

None

MODULES

USE model
USE solver_param
USE outfil

2.46 extent_i1

NAME

extent_i1

SYNOPSIS

```
SUBROUTINE extent_i1 (tab,inc_dim1,ierr)
```

DESCRIPTION

Extension of multi-dimensional integer pointer.

ARGUMENTS

tab – integer array
inc_dim1 – integer
ierr – integer

2.47 extent_r2

NAME

extent_r2

SYNOPSIS

```
SUBROUTINE extent_r2 (tab,dim1,inc_dim2,ierr)
```

DESCRIPTION

Extension of multi-dimensional real pointer.

ARGUMENTS

tab – real array
dim1 – integer
inc_dim2 – integer
ierr – integer

2.48 extract_submesh

NAME

extract_submesh

SYNOPSIS

```
SUBROUTINE extract_submesh (dom,intf,target_subdom)
```

DESCRIPTION

Extract subdomain submesh and send it to associated process. Build topology of elements using list of nodes per element and list and type of equations per node.

ARGUMENTS

dom – mesh structure
intf – interface descriptor structure
target_subdom – integer

MODULES

USE mesh_struct
USE interf_descriptor_struct
USE outfil
USE mpif
USE realloc

2.49 facet_rhs

NAME

facet_rhs

SYNOPSIS

```
SUBROUTINE facet_rhs (dom,bc)
```

DESCRIPTION

Compute specific values for non homogeneous Robin conditions. $P1$ discretization is used at the nodes of facets.

ARGUMENTS

dom – mesh structure
bc – facet structure

MODULES

USE mesh_struct
USE facet_struct
USE outfil

2.50 factorize_numeric

NAME

factorize_numeric

SYNOPSIS

```
SUBROUTINE factorize_numeric
```

DESCRIPTION

Numerical factorization of local matrices.

ARGUMENTS

None

MODULES

USE outfil
USE solver_param

2.51 factorize_symbolic

NAME

factorize_symbolic

SYNOPSIS

```
SUBROUTINE factorize_symbolic
```

DESCRIPTION

Symbolic factorization of local matrices.

ARGUMENTS

None

MODULES

USE outfil
USE solver_param

2.52 feti_abort

NAME

feti_abort

SYNOPSIS

```
SUBROUTINE feti_abort
```

DESCRIPTION

Abort FETI.

ARGUMENTS

None

MODULES

USE mpif
USE outfil

2.53 feti_finalize

NAME

feti_finalize

SYNOPSIS

```
SUBROUTINE feti_finalize
```

DESCRIPTION

Close FETI communication space and output file.

ARGUMENTS

None

MODULES

USE mpif
USE outfil

2.54 feti_init

NAME

feti_init

SYNOPSIS

```
SUBROUTINE feti_init (subdom_numb,numb_subdom)
```

DESCRIPTION

Create FETI communication space, get subdomain number and number of subdomains and open output file.

ARGUMENTS

subdom_numb – integer
numb_subdom – integer

MODULES

USE model
USE outfil
USE mpif
USE feti_data
USE feti_param

2.55 fill_sym_sparse

NAME

fill_sym_sparse

SYNOPSIS

```
SUBROUTINE fill_sym_sparse (neq,sparse_size,rowp,col,inicoef,      &
&                           new2old,p_row,col_numb,coef)
```

DESCRIPTION

Filling of renumbered lower triangular part of the symmetric sparse structure stored row by row from the upper triangular symmetric one.

ARGUMENTS

- **rowp** – pointer of rows of the upper triangular part of the initial matrix
- **col** – list of column indices of rows of the initial matrix
- **inicoef** – list of entries of the initial matrix
- **new2old** – new to old correspondance
- **p_row** – pointer of rows of the lower triangular part of the symmetric matrix
- **col_numb** – list of column indices of rows of the renumbered matrix
- **coef** – list of entries of the renumbered matrix

MODULES

USE outfil

2.56 fill_unsym_sparse

NAME

fill_unsym_sparse

SYNOPSIS

```
SUBROUTINE fill_unsym_sparse(neq,sparse_size,rowp,col,inicoef,    &
&                            new2old,p_row,col_numb,coef)
```

DESCRIPTION

Filling of renumbered unsymmetric sparse structure stored by row

ARGUMENTS

rowp – pointer of rows of the initial matrix
col – list of column indices of rows of the initial matrix
inicoef – list of entries of the initial matrix
new2old – new to old correspondance
p_row – pointer of rows of the renumbered matrix
col_numb – list of column indices of rows of the renumbered matrix
coef – list of entries of the renumbered matrix

MODULES

USE outfil

2.57 frontal_numb

NAME

frontal_numb

SYNOPSIS

```
SUBROUTINE frontal_numb (nodes,p_graph,graph,i0,list,profile,indic,&
&                        connect)
```

DESCRIPTION

Frontal renumbering of graph.

ARGUMENTS

nodes – integer
p_graph – integer array
graph – integer array
i0 – integer
list – integer array
profile – real
indic – integer array
connect – integer array

2.58 full_schur_b

NAME

full_schur_b

SYNOPSIS

```
SUBROUTINE full_schur_b (lda,nrow,ncol,u,l,s,n2)
```

DESCRIPTION

Compute Schur complement: $S = A - LU$ using a block algorithm.

ARGUMENTS

lda – integer (= dimension of matrix A)
nrow – integer
ncol – integer
u(nrow,ncol) – complex array (= the upper band)
l(ncol,nrow) – complex array (= the lower band)
s(ncol,ncol) – complex array (= the Schur complement)
n2 – integer

2.59 full_blo

NAME

full_blo

SYNOPSIS

```
SUBROUTINE full_blo (lda,n,a,full_a)
```

DESCRIPTION

Store a dense diagonal block.

ARGUMENTS

lda – integer
n – integer
a – complex array
full_a – complex array

2.60 full_fwbw

NAME

full_fwbw

SYNOPSIS

```
SUBROUTINE full_fwbw (n,a,y,x)
```

DESCRIPTION

Compute dense matrix forward-backward substitution for a dense unsymmetric complex matrix.

ARGUMENTS

n – integer
a – complex array
y – complex array
x – complex array

2.61 full_ldlt

NAME

full_ldlt

SYNOPSIS

```
SUBROUTINE full_ldlt (lda,n,a,d)
```

DESCRIPTION

Compute symmetric Gauss Jordan factorization of dense matrix. The lower triangular part only is computed.

ARGUMENTS

lda – integer
n – integer
a – complex array
d – complex array

MODULES

USE block_size

2.62 full_ldlt_b

NAME

full_ldlt_b

SYNOPSIS

```
SUBROUTINE full_ldlt_b (lda,n,a,d)
```

DESCRIPTION

Compute symmetric Gauss Jordan factorization of symmetric dense matrix.

ARGUMENTS

lda – integer
n – integer
a – complex array
d – complex array

2.63 full_ldu

NAME

full_ldu

SYNOPSIS

```
SUBROUTINE full_ldu (lda,n,a,d)
```

DESCRIPTION

Compute Gauss-Jordan factorization of dense matrix.

ARGUMENTS

lda – integer
n – integer
a – complex array
d – complex array

MODULES

USE block_size

2.64 full_ldu_b

NAME

full_ldu_b

SYNOPSIS

```
SUBROUTINE full_ldu_b (lda,n,a,d)
```

DESCRIPTION

Compute Gauss-Jordan factorization of dense matrix.

ARGUMENTS

lda – integer
n – integer
a – complex array
d – complex array

MODULES

USE block_size

2.65 full_schur_b_sparse

NAME

full_schur_b_sparse

SYNOPSIS

```
SUBROUTINE full_schur_b_sparse (nrow,ncol,iu0,u,jl0,l,s,lda,n1,n2)
```

DESCRIPTION

Compute Schur complement: $S = A - LU$ using a block algorithm.

ARGUMENTS

nrow – integer
ncol – integer
iu0 – integer
u – complex array
jl0 – integer array
l – complex array
s – complex array
lda – integer
n1 – integer
n2 – integer

2.66 full_sto

NAME

full_sto

SYNOPSIS

```
SUBROUTINE full_sto (lda,n,mat,nblo)
```

DESCRIPTION

Store a full block.

ARGUMENTS

lda – integer
n – integer
mat – complex array
nblo – integer

2.67 full_unsto

NAME

full_unsto

SYNOPSIS

```
SUBROUTINE full_unsto (n,mat,nblo)
```

DESCRIPTION

Un-store a dense block.

ARGUMENTS

n – integer
mat – complex array
nblo – integer

2.68 galerkin_error

NAME

galerkin_error

SYNOPSIS

```
SUBROUTINE galerkin_error (subdom_numb,frequency)
```

DESCRIPTION

Compute the finite element error analysis.

ARGUMENTS

subdom_numb – integer
frequency – real

MODULES

USE model
USE outfil
USE realloc
USE feti_data
USE feti_param
USE mpif

2.69 galerkin_meshsize

NAME

galerkin_meshsize

SYNOPSIS

```
SUBROUTINE galerkin_meshsize (dom,x,h)
```

DESCRIPTION

Compute the Galerkin meshsize-value.

ARGUMENTS

dom – mesh structure
x – real (= hexaedrom nodes coordinates)
h – real (= mesh size)

MODULES

USE mesh_struct
USE outfil

2.70 galerkin_tau

NAME

galerkin_tau

SYNOPSIS

```
SUBROUTINE galerkin_tau (k,h,tau)
```

DESCRIPTION

Compute Galerkin tau-value.

ARGUMENTS

k – real (= wavenumber of the Helmholtz equation)
h – real (= mesh size)
tau – real (= tauk2-GLS or tauk4-GGLS coefficient)

MODULES

USE outfil

2.71 gather_nodid

NAME

gather_nodid

SYNOPSIS

```
SUBROUTINE gather_nodid (numb_nodes,l2g_node,node_id,              &
&                          glob_numb_nodes,glob_node_id)
```

DESCRIPTION

Gather subdomain node ids.

ARGUMENTS

numb_nodes – integer
l2g_node – integer array
node_id – integer array
glob_numb_nodes – integer
glob_node_id – integer array

2.72 gather_sol

NAME

gather_sol

SYNOPSIS

```
SUBROUTINE gather_sol (numb_nodes,l2g_node,p_node_eq,type_dof,     &
&                      node_eq,min_dof,max_dof,glob_numb_nodes,dof,&
&                      neq,v,glob_neq,glob_v)
```

DESCRIPTION

Gather subdomain solutions.

ARGUMENTS

numb_nodes – integer
l2g_node – integer array
p_node_eq – integer array
type_dof – integer array
node_eq – integer array
min_dof – integer
max_dof – integer
glob_numb_nodes – integer
dof – integer array
neq – integer
v – complex array
glob_neq – integer
glob_v – complex array

2.73 global_eq_mask

NAME

global_eq_mask

SYNOPSIS

```
SUBROUTINE global_eq_mask(numb_nodes,l2g_node,p_node_eq,type_dof, &
&                         min_dof,max_dof,glob_numb_nodes,dof)
```

DESCRIPTION

Build mask of equations in subdomain.

ARGUMENTS

numb_nodes – integer
l2g_node – integer array
p_node_eq – integer array
type_dof – integer array
min_dof – integer
max_dof – integer
glob_numb_nodes – integer
dof – integer array

2.74 global_solution

NAME

global_solution

SYNOPSIS

```
SUBROUTINE global_solution (intf,dom,glob_dom,v,glob_v)
```

DESCRIPTION

Gather global mesh and solution field.

ARGUMENTS

intf – interface descriptor structure
dom – mesh structure
glob_dom – mesh structure
v – complex array
glob_v – complex array

MODULES

USE mesh_struct
USE interf_descriptor_struct
USE outfil
USE mpif
USE realloc

2.75 globaldotproduct

NAME

globaldotproduct

SYNOPSIS

```
SUBROUTINE globaldotproduct (uv,u,v,intf)
```

DESCRIPTION

Global dot-product.

ARGUMENTS

uv – complex
u – complex array
v – complex array
intf – interface descriptor structure

MODULES

USE mpif
USE interf_descriptor_struct
USE outfil

2.76 globalsum

NAME

globalsum

SYNOPSIS

```
SUBROUTINE globalsum (buf,n)
```

DESCRIPTION

Sum the vector buf(n) accross the network.

ARGUMENTS

buff – real array
n – integer

MODULES

USE mpif

2.77 globalsumc

NAME

globalsumc

SYNOPSIS

```
SUBROUTINE globalsumc (buf,n)
```

DESCRIPTION

Sum the vector buf(n) accross the network.

ARGUMENTS

buff – complex array
n – integer

MODULES

USE mpif
USE outfil

2.78 globalsumi

NAME

globalsumi

SYNOPSIS

```
SUBROUTINE globalsumi (buf,n)
```

DESCRIPTION

Sum the vector buf(n) accross the network.

ARGUMENTS

buf – integer array
n – integer

MODULES

USE mpif

2.79 half_schur_b

NAME

half_schur_b

SYNOPSIS

```
SUBROUTINE half_schur_b (lda,nrow,ncol,u,l,s,n2)
```

DESCRIPTION

Compute upper triangular part of Schur complement matrix $S = A - LU$ using a block algorithm.

ARGUMENTS

lda – integer
nrow – integer
ncol – integer
u – complex array
l – complex array
s – complex array
n2 – integer

2.80 half_blo

NAME

half_blo

SYNOPSIS

```
SUBROUTINE half_blo (lda,n,a,half_a)
```

DESCRIPTION

Store the lower triangular part of matrix A row by row.

ARGUMENTS

lda – integer
n – integer
a – complex array
half_a – complex array

2.81 half_fwbw

NAME

half_fwbw

SYNOPSIS

```
SUBROUTINE half_fwbw (n,a,y,x)
```

DESCRIPTION

Compute dense matrix forward-backward substitution in the case of only the upper triangular part of symmetric matrix A is stored column by colum.

ARGUMENTS

n – integer
a – complex array
y – complex array
x – complex array

2.82 half_mm_b

NAME

half_mm_b

SYNOPSIS

```
SUBROUTINE half_mm_b (ncol,nrow,l,ldl,u,ldu,s,lds)
```

DESCRIPTION

Compute upper triangular part of Schur complement matrix $S = A - LU$.

ARGUMENTS

ncol – integer
nrow – integer
l(ncol,nrow) – complex array (= the lower band)
ldl – integer
u(nrow,ncol) – complex array (= the upper band)
ldu – integer
s(ncol,ncol) – complex array (= the Schur complement)
lds – integer (= the dimension of matrix A)

2.83 half_schur_b_sparse

NAME

half_schur_b_sparse

SYNOPSIS

```
SUBROUTINE half_schur_b_sparse (nrow,ncol,i0,u,l,s,lda,n1,n2)
```

DESCRIPTION

Compute upper triangular part of Schur complement matrix $S = A - LU$ using a block algorithm.

ARGUMENTS

nrow – integer
ncol – integer
i0(ncol) – integer array (= the position of the last non zero entry in columns of u and rows of l)
u(nrow,ncol) – complex array (= the upper band)
l(ncol,nrow) – complex array (= the lower band)
s(lda,ncol) – complex array (= the Schur complement)
lda – integer
n1 – integer
n2 – integer

2.84 half_sto

NAME

half_sto

SYNOPSIS

```
SUBROUTINE half_sto (lda,n,mat,nblo)
```

DESCRIPTION

Store the lower triangular part of matrix A row by row.

ARGUMENTS

lda – integer
n – integer
mat – complex array
nblo – integer

2.85 half_unsto

NAME

half_unsto

SYNOPSIS

```
SUBROUTINE half_unsto (n,half_mat,nblo)
```

DESCRIPTION

Un-store the upper triangular part of matrix A column by column.

ARGUMENTS

n – integer
half_mat – complex array
nblo – integer

2.86 ilu_0

NAME

ilu_0

SYNOPSIS

```
SUBROUTINE ilu_0 (neq,sparse_size,p_row,column_numb,coef,lu,p_diag)
```

DESCRIPTION

Preconditioner of a general matrix with ilu(0).

ARGUMENTS

neq – integer
sparse_size – integer
p_row – integer array
column_numb – integer array
coef – complex array
lu – sparse matrix structure
p_diag – integer array

MODULES

USE sparse_matrix_struct
USE outfil

2.87 ilu_preconditioner

NAME

ilu_preconditioner

SYNOPSIS

```
SUBROUTINE ilu_preconditioner (coef,pl,pc,pd,n,nza,ierr)
```

DESCRIPTION

ilu(0) preconditioner.

ARGUMENTS

coef – complex array
pl – integer array
pc – integer array
pd – integer array
n – integer
nza – integer
ierr – integer

2.88 imprim

NAME

imprim

SYNOPSIS

```
SUBROUTINE imprim (frequency,subdom_numb,numb_subdom)
```

DESCRIPTION

Print the matrix of domain.

ARGUMENTS

frequency – real
subdom_numb – integer
numb_subdom – integer

MODULES

USE model
USE outfil

2.89 imprim2

NAME

imprim2

SYNOPSIS

```
SUBROUTINE imprim2 (frequency,subdom_numb,numb_subdom)
```

DESCRIPTION

Print the matrix of interface.

ARGUMENTS

frequency – real
subdom_numb – integer
numb_subdom – integer

MODULES

USE model
USE feti_data
USE outfil

2.90 init_model

NAME

init_model

SYNOPSIS

```
SUBROUTINE init_model (subdom_numb)
```

DESCRIPTION

Initialize domain data.

ARGUMENTS

subdom_numb – integer

MODULES

USE model

2.91 initialize

NAME

initialize

SYNOPSIS

```
SUBROUTINE initialize
```

DESCRIPTION

Initialize all model nodal data structures.

ARGUMENTS

None

MODULES

USE model
USE solver_param
USE outfil

2.92 inivec

NAME

inivec

SYNOPSIS

```
SUBROUTINE inivec (lx,x)
```

DESCRIPTION

Pseudo random initialization.

ARGUMENTS

lx – integer
x – complex array

2.93 input_data

NAME

input_data

SYNOPSIS

```
SUBROUTINE input_data
```

DESCRIPTION

Input domain data.

ARGUMENTS

None

MODULES

USE model
USE solver_param
USE block_size
USE outfil

2.94 interf_full_sym_struct

NAME

interf_full_sym_struct

SYNOPSIS

```
SUBROUTINE interf_full_sym_struct (intf_mesh,a)
```

DESCRIPTION

Build symmetric interface full matrix structure.

ARGUMENTS

intf_mesh – interface mesh structure
a – sparse matrix structure

MODULES

USE outfil
USE realloc
USE interf_mesh_struct
USE sparse_matrix_struct

2.95 interf_full_unsym_struct

NAME

interf_full_unsym_struct

SYNOPSIS

```
SUBROUTINE interf_full_unsym_struct (intf_mesh,a)
```

DESCRIPTION

Build symmetric interface full matrix structure.

ARGUMENTS

intf_mesh – interface mesh structure
a – sparse matrix structure

MODULES

USE outfil
USE realloc
USE interf_mesh_struct
USE sparse_matrix_struct

2.96 interf_sparse_sym_struct

NAME

interf_sparse_sym_struct

SYNOPSIS

```
SUBROUTINE interf_sparse_sym_struct (intf_mesh,a)
```

DESCRIPTION

Build symmetric interface sparse matrix structure.

ARGUMENTS

intf_mesh – interface mesh structure
a – sparse matrix structure

MODULES

USE outfil
USE realloc
USE interf_mesh_struct
USE sparse_matrix_struct

2.97 interf_sparse_unsym_struct

NAME

interf_sparse_unsym_struct

SYNOPSIS

```
SUBROUTINE interf_sparse_unsym_struct (intf_mesh,a)
```

DESCRIPTION

Build unsymmetric interface sparse matrix structure.

ARGUMENTS

intf_mesh – interface mesh structure
a – sparse matrix structure

MODULES

USE outfil
USE realloc
USE interf_mesh_struct
USE sparse_matrix_struct

2.98 interface_assemb

NAME

interface_assemb

SYNOPSIS

```
SUBROUTINE interface_assemb (intf,unassemb,assemb)
```

DESCRIPTION

Assemble a field along the interface.

ARGUMENTS

intf – interface descriptor structure
unassemb – complex array
assemb – complex array

MODULES

USE interf_descriptor_struct
USE outfil

2.99 interface_average

NAME

interface_average

SYNOPSIS

```
SUBROUTINE interface_average (intf,unassemb,assemb)
```

DESCRIPTION

Average a field along the interface

ARGUMENTS

intf – interface descriptor structure
unassemb – complex array (= unassembled field as input)
assemb – complex array (= averaged field along the interface as output)

MODULES

USE interf_descriptor_struct

2.100 interface_equation

NAME

interface_equation

SYNOPSIS

```
SUBROUTINE interface_equation (dom,intf)
```

DESCRIPTION

Detect interface equations.

ARGUMENTS

dom – mesh structure
intf – interface descriptor structure

MODULES

USE outfil
USE mesh_struct
USE interf_descriptor_struct
USE mpif
USE realloc

2.101 interface_exchange

NAME

interface_exchange

SYNOPSIS

```
SUBROUTINE interface_exchange (intf)
```

DESCRIPTION

Exchange interface data with neighbouring subdomains.

ARGUMENTS

intf – interface descriptor structure

MODULES

USE mpif
USE interf_descriptor_struct
USE outfil

2.102 interface_init

NAME

interface_init

SYNOPSIS

```
SUBROUTINE interface_init (intf)
```

DESCRIPTION

Initialize interface structure.

ARGUMENTS

intf – interface descriptor structure

MODULES

USE interf_descriptor_struct
USE realloc
USE outfil

2.103 interface_jump

NAME

interface_jump

SYNOPSIS

```
SUBROUTINE interface_jump (intf,v,w)
```

DESCRIPTION

Compute the jump of a field along the interface.

ARGUMENTS

intf – interface descriptor structure
v – complex array (= local field as input)
w – complex array (= jump of v as output)

MODULES

USE interf_descriptor_struct

2.104 interface_jump2

NAME

interface_jump2

SYNOPSIS

```
SUBROUTINE interface_jump2 (intf,k,v,lambda,g)
```

DESCRIPTION

Compute interface gradient.

ARGUMENTS

intf – interface descriptor structure
k – sparse matrix structure
v – complex array
lambda – complex array
g – complex array

MODULES

USE interf_descriptor_struct
USE sparse_matrix_struct
USE outfil

SEE ALSO

interface_jump.f90

2.105 interface_mesh_equation

NAME

interface_mesh_equation

SYNOPSIS

```
SUBROUTINE interface_mesh_equation (dom,intf,mesh_intf)
```

DESCRIPTION

Build interface equation per node.

ARGUMENTS

dom – mesh structure
intf – interface descriptor structure
mesh_intf – interface mesh structure

MODULES

USE outfil
USE interf_descriptor_struct
USE interf_mesh_struct
USE facet_struct
USE mesh_struct
USE mpif
USE realloc

2.106 interface_mesh_geometry

NAME

interface_mesh_geometry

SYNOPSIS

```
SUBROUTINE interface_mesh_geometry (dom,intf,mesh_intf)
```

DESCRIPTION

Detect interface facets.

ARGUMENTS

dom – mesh structure
intf – interface descriptor structure
mesh_intf – interface mesh structure

MODULES

USE outfil
USE interf_descriptor_struct
USE facet_struct
USE mesh_struct
USE interf_mesh_struct
USE mpif
USE realloc

2.107 interface_mesh_topology

NAME

interface_mesh_topology

SYNOPSIS

```
SUBROUTINE interface_mesh_topology (mesh_intf)
```

DESCRIPTION

Build list of equations in each element.

ARGUMENTS

mesh_intf – interface mesh structure

MODULES

USE interf_mesh_struct
USE outfil
USE realloc

2.108 interface_node

NAME

interface_node

SYNOPSIS

```
SUBROUTINE interface_node (intf)
```

DESCRIPTION

Detect interface nodes.

ARGUMENTS

intf – interface descriptor structure

MODULES

USE outfil
USE interf_descriptor_struct
USE mpif
USE realloc

2.109 interface_signe

NAME

interface_signe

SYNOPSIS

```
SUBROUTINE interface_signe (intf)
```

DESCRIPTION

Sign sub-domains and interfaces.

ARGUMENTS

intf – interface descriptor structure

MODULES

USE interf_descriptor_struct
USE outfil
USE mpif

2.110 invD_times_U

NAME

invD_times_U

SYNOPSIS

```
SUBROUTINE invD_times_U (lda,nrow,d,ncol,u)
```

DESCRIPTION

Compute $[D]^{-1}U$.

ARGUMENTS

lda – integer
nrow – integer
d – complex array
ncol – integer
u – complex array

2.111 invL_times_U

NAME

invL_times_U

SYNOPSIS

```
SUBROUTINE invL_times_U (lda,nrow,ldlt,ncol,u)
```

DESCRIPTION

Compute $[L]^{-1}U$.

ARGUMENTS

lda – integer
nrow – integer
ldlt – complex array
ncol – integer
u – complex array

2.112 invL_times_sparsU

NAME

invL_times_sparsU

SYNOPSIS

```
SUBROUTINE invL_times_sparsU (n,ldlt,lda,ncol_u,i0,u,n1,n2)
```

DESCRIPTION

Compute $[L]^{-1}U$

ARGUMENTS

n – integer
ldlt – complex array
lda – integer
ncol_u – integer
i0 – integer array
u – complex array
n1 – integer
n2 – integer

2.113 invUt_times_sparsU

NAME

invUt_times_sparsU

SYNOPSIS

```
SUBROUTINE invUt_times_sparsU (n,ldu,lda,ncol_u,i0,u,n1,n2)
```

DESCRIPTION

Compute $[U]^{-t}U$.

ARGUMENTS

n – integer
ldu – complex array
lda – integer
ncol_u – integer
i0 – integer array
u – complex array
n1 – integer
n2 – integer

2.114 jacobi_convergence

NAME

jacobi_convergence

SYNOPSIS

```
SUBROUTINE jacobi_convergence (omega,omega_moins,omega_plus,k_max,&
&                              p1,q1,p2,q2,rho_max)
```

DESCRIPTION

Compute maximum value of convergence rate of jacobi algorithm.

ARGUMENTS

omega – real
omega_moins – real
omega_plus – real
k_max – real
p1 – real
q1 – real
p2 – real
q2 – real
rho_max – real

MODULES

USE outfil

2.115 jacobi_optimized

NAME

jacobi_optimized

SYNOPSIS

```
SUBROUTINE jacobi_optimized (type_optimized,omega,h,L,            &
&                            alpha_left,alpha_right,              &
&                            beta_left,beta_right)
```

DESCRIPTION

Compute optimized coefficient of jacobi algorithm.

ARGUMENTS

type_optimized – integer
omega – real
h – real
L – real
alpha_left – complex
alpha_right – complex
beta_left – complex
beta_right – complex

MODULES

USE mesh_struct
USE outfil

2.116 L_times_invD

NAME

L_times_invD

SYNOPSIS

```
SUBROUTINE L_times_invD (lda,nrow,d,ncol,u)
```

DESCRIPTION

Compute $L[D]^{-1}$.

ARGUMENTS

lda – integer
nrow – integer
d – complex array
ncol – integer
u – complex array

2.117 L_times_invU

NAME

L_times_invU

SYNOPSIS

```
SUBROUTINE L_times_invU (lda,nrow,ldu,ncol,l)
```

DESCRIPTION

Compute $L[U]^{-1}$.

ARGUMENTS

lda – integer (= the dimension of matrix A)
nrow – integer
ldu – complex array (= the ldu factorization of diagonal block)
ncol – integer
l – complex array (= the lower band)

2.118 LdLt_tri_block_numeric

NAME

LdLt_tri_block_numeric

SYNOPSIS

```
SUBROUTINE LdLt_tri_block_numeric
```

DESCRIPTION

Numerical factorization using tridiagonal block LdLt algorithm.

ARGUMENTS

None

MODULES

USE solver_param
USE feti_data
USE model
USE outfil
USE direct_symmetric

2.119 LdLt_tri_block_symbolic

NAME

LdLt_tri_block_symbolic

SYNOPSIS

```
SUBROUTINE LdLt_tri_block_symbolic
```

DESCRIPTION

Symbolic factorization for block tridiagonal LDL^t algorithm.

ARGUMENTS

None

MODULES

USE model
USE outfil
USE solver_param
USE feti_data
USE direct_symmetric

2.120 Ldlt_tri_dirich

NAME

Ldlt_tri_dirich

SYNOPSIS

```
SUBROUTINE Ldlt_tri_dirich (nop,ldu)
```

DESCRIPTION

Block tridiagonal factorization of a sparse symmetric matrix with reverse Cuthill Mac Kee numbering. Case of Dirichlet conditions for the last block.

ARGUMENTS

nop – real
ldu – factorized matrix structure

MODULES

USE solver_param
USE outfil
USE factorized_matrix_struct

2.121 LdU_tri_block_numeric

NAME

LdU_tri_block_numeric

SYNOPSIS

```
SUBROUTINE LdU_tri_block_numeric
```

DESCRIPTION

Numerical factorization using tridiagonal block *LDU* algorithm.

ARGUMENTS

None

MODULES

USE solver_param
USE feti_data
USE model
USE outfil
USE direct_unsymmetric

2.122 LdU_tri_block_symbolic

NAME

LdU_tri_block_symbolic

SYNOPSIS

```
SUBROUTINE LdU_tri_block_symbolic
```

DESCRIPTION

Symbolic factorization for block tridiagonal LdU algorithm.

ARGUMENTS

None

MODULES

USE model
USE outfil
USE solver_param
USE feti_data
USE direct_unsymmetric

2.123 LdU_tri_dirich

NAME

LdU_tri_dirich

SYNOPSIS

```
SUBROUTINE LdU_tri_dirich (nop,ldu)
```

DESCRIPTION

Block tridiagonal factorization of a sparse symmetric matrix with reverse Cuthill Mac Kee numbering.

ARGUMENTS

nop – real
ldu – factorized matrix structure

MODULES

USE solver_param
USE outfil
USE factorized_matrix_struct

2.124 mask_to_list

NAME

mask_to_list

SYNOPSIS

```
SUBROUTINE mask_to_list (dim,mask,ntrue,list,P6)
```

DESCRIPTION

Build concatened list from a mask array.

ARGUMENTS

dim – integer
mask – integer array
ntrue – integer
list – integer array
P6 – integer

2.125 merge_nodal_list

NAME

merge_nodal_list

SYNOPSIS

```
SUBROUTINE merge_nodal_list (neq,dim_bc,bc,tot)
```

DESCRIPTION

Build concatenated boundary condition.

ARGUMENTS

neq – integer
dim_bc – integer
bc – nodal list structure array
tot – nodal list structure

MODULES

USE ...

2.126 mtxv

NAME

mtxv

SYNOPSIS

```
SUBROUTINE mtxv (n,m,a,x,y)
```

DESCRIPTION

Conjugate matrix-vector product: $y = A^*x$.

ARGUMENTS

n – integer
m – integer
a – complex array
x – complex array
y – complex array

2.127 mtxv_par

NAME

mtxv_par

SYNOPSIS

```
SUBROUTINE mtxv_par (n,m,a,x,y,intf)
```

DESCRIPTION

Parallel conjugate matrix-vector product: $y = A^*x$.

ARGUMENTS

n – integer
m – integer
a – complex array
x – complex array
y – complex array
intf – interface descriptor structure

MODULES

USE interf_descriptor_struct
USE outfil

2.128 mxvadd

NAME

mxvadd

SYNOPSIS

```
SUBROUTINE mxvadd (n,m,a,x,y)
```

DESCRIPTION

Add matrix-vector product: $y = y + Ax$.

ARGUMENTS

n – integer
m – integer
a – complex array
x – complex array
y – complex array

2.129 nodal_list_equation

NAME

nodal_list_equation

SYNOPSIS

```
SUBROUTINE nodal_list_equation (dom,bc)
```

DESCRIPTION

Build list and mask of boundary equations.

ARGUMENTS

dom – mesh structure
bc – nodal list structure

MODULES

USE mesh_struct
USE nodal_list_struct
USE realloc
USE outfil

2.130 opti_number

NAME

opti_number

SYNOPSIS

```
SUBROUTINE opti_number (nodes,p_graph,graph,list_opt)
```

DESCRIPTION

Renumber subgraph via Cuthill-Mac Kee algorithm.

ARGUMENTS

nodes – integer
p_graph – integer array
graph – integer array
list_opt – integer array

MODULES

USE outfil

2.131 output_results

NAME

output_results

SYNOPSIS

```
SUBROUTINE output_results (frequency,freq_numb)
```

DESCRIPTION

Print results.

ARGUMENTS

frequency – real
freq_numb – integer

MODULES

USE outfil
USE model
USE feti_data
USE mpif

2.132 point_front

NAME

point_front

SYNOPSIS

```
SUBROUTINE point_front (neq,p_row,sparse_size,col_numb,new2old,    &
&                       nfront,p_front,nclamp,nfront_clamp)
```

DESCRIPTION

Build pointer of fronts of block tridiagonal sparse matrix.

ARGUMENTS

neq – integer
p_row – integer array (= pointer of rows of unsymmetric matrix)
sparse_size – integer
col_numb – integer array (= list of column indices of rows of unsymmetric matrix)
new2old – integer array (= new to old correspondance)
nfront – integer
p_front – integer array (= pointer of fronts)
nclamp – integer
nfront_clamp – integer

MODULES

USE outfil

2.133 post_process

NAME

post_process

SYNOPSIS

```
SUBROUTINE post_process
```

DESCRIPTION

Post process results.

ARGUMENTS

None

MODULES

USE solver_param
USE model

2.134 print_vector

NAME

print_vector

SYNOPSIS

```
SUBROUTINE print_vector (n,v)
```

DESCRIPTION

Print vector.

ARGUMENTS

n – integer
v – complex array

MODULES

USE outfil

2.135 proband

NAME

proband

SYNOPSIS

```
SUBROUTINE proband (n,i1,i2,prow1,prow2,lmorse,ncol,a,x,y)
```

DESCRIPTION

Compute product by a rectangular sub-block of a symmetric sparse matrix.

ARGUMENTS

n – integer
i1 – integer
i2 – integer
prow1 – integer array
prow2 – integer array
lmorse – integer
ncol – integer array
a – complex array
x – complex array
y – complex array

2.136 probit

NAME

probit

SYNOPSIS

```
SUBROUTINE probit (intf,w,bitw)
```

DESCRIPTION

Compute the local right-hand-side associated with a Neumann boundary condition on the interface.

ARGUMENTS

intf – interface descriptor structure
w – complex array
bitw – complex array

MODULES

USE interf_descriptor_struct
USE outfil

2.137 problem_form

NAME

problem_form

SYNOPSIS

```
SUBROUTINE problem_form (frequency,subdom_numb,numb_subdom,typesol,&
&                        symm,k_opt,typegalerkin)
```

DESCRIPTION

Form the matrix of domain.

ARGUMENTS

frequency – real
subdom_numb – integer
numb_subdom – integer
typesol – integer
symm – integer
k_opt – integer
typegalerkin – integer

MODULES

USE model
USE outfil
USE feti_data

2.138 problo

NAME

problo

SYNOPSIS

```
SUBROUTINE problo (n,i1,i2,prow1,prow2,lmorse,ncol,a,x,y)
```

DESCRIPTION

Compute product by a sub-block of a sparse matrix.

ARGUMENTS

n – integer
i1 – integer
i2 – integer
prow1 – integer array
prow2 – integer array
lmorse – integer
ncol – integer array
a – complex array
x – complex array
y – complex array

2.139 problot

NAME

problot

SYNOPSIS

```
SUBROUTINE problot (n,i1,i2,prow1,prow2,lmorse,ncol,a,x,y)
```

DESCRIPTION

Compute product by a transposed sub-block of a sparse matrix.

ARGUMENTS

n – integer
i1 – integer
i2 – integer
prow1 – integer array
prow2 – integer array
lmorse – integer
ncol – integer array
a – complex array
x – complex array
y – complex array

2.140 pt_extract

NAME

pt_extract

SYNOPSIS

```
SUBROUTINE pt_extract (n,i1,i2,j0,prow1,prow2,lmorse,ncol,a,dim2,  &
&                      dim1,blo)
```

DESCRIPTION

Extract transposed renumbered block associated to rows i1 to i2 and delimited by pointers prow1 et prow2 from sparse matrix stored by row.

ARGUMENTS

n – integer
i1 – integer
i2 – integer
j0 – integer
prow1 – integer array
prow2 – integer array
lmorse – integer
ncol – integer array
a – complex array
dim2 – integer
dim1 – integer
blo – complex array

2.141 read_mesh

NAME

read_mesh

SYNOPSIS

```
SUBROUTINE read_mesh (file_num,dom,max_numb_f,numb_f,f)
```

DESCRIPTION

Input mesh in free format.

ARGUMENTS

file_num – integer
dom – mesh structure
max_numb_f – integer
numb_f – integer
f – facet structure array

MODULES

USE mesh_struct
USE facet_struct
USE realloc
USE outfil

2.142 realloc_c1

NAME

realloc_c1

SYNOPSIS

```
SUBROUTINE realloc_c1 (tab,dim1,ierr)
```

DESCRIPTION

Reallocation of multi-dimensional complex pointer in the case where the pointer has been allocated.

ARGUMENTS

tab – complex array
dim1 – integer
ierr – integer

2.143 realloc_c2

NAME

realloc_c2

SYNOPSIS

```
SUBROUTINE realloc_c2 (tab,dim1,dim2,ierr)
```

DESCRIPTION

Reallocation of multi-dimensional complex pointer in the case where the pointer has been allocated.

ARGUMENTS

tab – complex array
dim1 – integer
dim2 – integer
ierr – integer

2.144 realloc_i1

NAME

realloc_i1

SYNOPSIS

```
SUBROUTINE realloc_i1 (tab,dim1,ierr)
```

DESCRIPTION

Reallocation of multi-dimensional integer pointer in the case where the pointer has been allocated.

ARGUMENTS

tab – integer array
dim1 – integer
ierr – integer

2.145 realloc_i2

NAME

realloc_i2

SYNOPSIS

```
SUBROUTINE realloc_i2 (tab,dim1,dim2,ierr)
```

DESCRIPTION

Reallocation of multi-dimensional integer pointer in the case where the pointer has been allocated.

ARGUMENTS

tab – integer array
dim1 – integer
dim2 – integer
ierr – integer

2.146 realloc_r1

NAME

realloc_r1

SYNOPSIS

```
SUBROUTINE realloc_r1 (tab,dim1,ierr)
```

DESCRIPTION

Reallocation of multi-dimensional real pointer in the case where the pointer has been allocated.

ARGUMENTS

tab – real array
dim1 – integer
ierr – integer

2.147 realloc_r2

NAME

realloc_r2

SYNOPSIS

```
SUBROUTINE realloc_r2 (tab,dim1,dim2,ierr)
```

DESCRIPTION

Reallocation of multi-dimensional real pointer in the case where the pointer has been allocated.

ARGUMENTS

tab – real array
dim1 – integer
dim2 – integer
ierr – integer

2.148 ren_sym_sparse

NAME

ren_sym_sparse

SYNOPSIS

```
SUBROUTINE ren_sym_sparse (neq,sparse_size,rowp,col,new2old,p_row, &
&                          col_numb)
```

DESCRIPTION

Construction of renumbered lower triangular part of the symmetric sparse structure stored row by row from the upper triangular symmetric one.

ARGUMENTS

rowp – pointer of rows of the upper triangular part of the initial matrix
col – list of column indices of rows of the initial matrix
new2old – new to old correspondance
p_row – pointer of rows of the lower triangular part of the symmetric matrix
col_numb – list of column indices of rows of the renumbered matrix
... – ...

MODULES

USE outfil

2.149 ren_unsym_sparse

NAME

ren_unsym_sparse

SYNOPSIS

```
SUBROUTINE ren_unsym_sparse (neq,sparse_size,rowp,col,new2old,     &
&                             p_row,col_numb)
```

DESCRIPTION

Construction of renumbered unsymmetric sparse structure stored row by row.

ARGUMENTS

rowp – pointer of rows of the initial matrix
col – list of column indices of rows of the initial matrix
new2old – new to old correspondance
p_row – pointer of rows of the unsymmetric matrix
col_numb – list of column indices of rows of the renumbered matrix

MODULES

USE outfil

2.150 renum_eq_mpc

NAME

renum_eq_mpc

SYNOPSIS

```
SUBROUTINE renum_eq_mpc (dom,dim_mpc,mpc)
```

DESCRIPTION

Change equation numbering to take into account multi-point constraints.

ARGUMENTS

dom – mesh structure
dim_mpc – integer
mpc – nodal list structure array

MODULES

USE outfil
USE mesh_struct
USE Nodal_List_struct

2.151 renum_facet

NAME

renum_facet

SYNOPSIS

```
SUBROUTINE renum_facet (dom,bc)
```

DESCRIPTION

Replace external to internal node number in list of nodes of facet.

ARGUMENTS

dom – mesh structure
bc – facet structure

MODULES

USE mesh_struct
USE facet_struct

2.152 renum_nodal_list

NAME

renum_nodal_list

SYNOPSIS

```
SUBROUTINE renum_nodal_list (dom,bc)
```

DESCRIPTION

Replace external to internal node number in nodal list.

ARGUMENTS

dom – mesh structure
bc – nodal list structure

MODULES

USE mesh_struct
USE nodal_list_struct

2.153 solve_rhs

NAME

solve_rhs

SYNOPSIS

```
SUBROUTINE solve_rhs (subdom_numb)
```

DESCRIPTION

Solve problem for a single right hand side.

ARGUMENTS

subdom_numb – integer

MODULES

USE solver_param
USE model
USE outfil
USE realloc
USE feti_data
USE feti_param
USE mpif

2.154 son_3d

NAME

son_3d

SYNOPSIS

```
PROGRAM son_3d
```

DESCRIPTION

FETI demonstration code.

ARGUMENTS

None

MODULES

USE solver_param

2.155 sort_list

NAME

sort_list

SYNOPSIS

```
SUBROUTINE sort_list (dim,list)
```

DESCRIPTION

Sort list of interger in increasing ordering.

ARGUMENTS

dim – integer
list – integer array

2.156 sparse_fwbw

NAME

sparse_fwbw

SYNOPSIS

```
SUBROUTINE sparse_fwbw (neq,sparse_size,p_row,column_numb,a,       &
&                        p_diag,b,z)
```

DESCRIPTION

Sparse forward-backward solution of $Ax = b$ with $A = LU$.

ARGUMENTS

neq – integer
sparse_size – integer
p_row – integer array
column_numb – integer array
a – complex array
p_diag – integer array
b – complex array
z – complex array

2.157 sparse_matrix_equalization

NAME

sparse_matrix_equalization

SYNOPSIS

```
SUBROUTINE sparse_matrix_equalization (b,a)
```

DESCRIPTION

Equalize sparse matrix.

ARGUMENTS

b – sparse matrix structure
a – sparse matrix structure

MODULES

USE sparse_matrix_struct
USE realloc
USE outfil

2.158 sparse_matrix_equalization2

NAME

sparse_matrix_equalization2

SYNOPSIS

```
SUBROUTINE sparse_matrix_equalization2 (b,a)
```

DESCRIPTION

Equalize sparse matrix.

ARGUMENTS

b – sparse matrix structure
a – sparse matrix structure

MODULES

USE sparse_matrix_struct

2.159 sparse_prod

NAME

sparse_prod

SYNOPSIS

```
SUBROUTINE sparse_prod (a,x,y)
```

DESCRIPTION

Compute sparse matrix vector product in the case of a symmetric matrix with upper triangular part stored by rows.

ARGUMENTS

a – sparse matrix structure
x – complex array
y – complex array

MODULES

USE sparse_matrix_struct

2.160 split_mesh

NAME

split_mesh

SYNOPSIS

```
SUBROUTINE split_mesh (numb_subdom)
```

DESCRIPTION

Build elements to subdomain correspondance.

ARGUMENTS

numb_subdom – integer

MODULES

USE model
USE feti_data
USE outfil

2.161 stoprun

NAME

stoprun

SYNOPSIS

```
SUBROUTINE stoprun
```

DESCRIPTION

Abort run.

ARGUMENTS

None

MODULES

USE outfil

2.162 sym_approx_schur_cpmt

NAME

sym_approx_schur_cpmt

SYNOPSIS

```
SUBROUTINE sym_approx_schur_cpmt (a,ainit,reg,intf,intf_mesh,Diri, &
&                                 Dir)
```

DESCRIPTION

Compute Schur complement.

ARGUMENTS

a – sparse matrix structure
ainit – sparse matrix structure
reg – sparse matrix structure
intf – interface descriptor structure
intf_mesh – interface mesh structure
Diri – nodal list structure
Dir – nodal list structure

MODULES

USE mpif
USE solver_param
USE feti_data
USE sparse_matrix_struct
USE direct_symmetric
USE interf_mesh_struct
USE interf_descriptor_struct
USE nodal_list_struct
USE outfil
USE realloc

2.163 sym_build_schur_cpmt

NAME

sym_build_schur_cpmt

SYNOPSIS

```
SUBROUTINE sym_build_schur_cpmt (ainit,reg,intf,intf_mesh,Diri,    &
&                                 Dir)
```

DESCRIPTION

Compute Schur complement.

ARGUMENTS

ainit – sparse matrix structure
reg – sparse matrix structure
intf – interface descriptor structure
intf_mesh – interface mesh structure
Diri – nodal list structure
Dir – nodal list structure

MODULES

USE mpif
USE solver_param
USE feti_data
USE sparse_matrix_struct
USE direct_symmetric
USE interf_mesh_struct
USE interf_descriptor_struct
USE nodal_list_struct
USE outfil

2.164 sym_condens

NAME

sym_condens

SYNOPSIS

```
SUBROUTINE sym_condens (lda,dim1,dim2,a,d,b,c,bt,i0,nop)
```

DESCRIPTION

Compute the Schur complement: $C = C - [L^{-1}B]^t[L^{-1}B]$ where L is the lower triangular part of the Choleski factorisation of A.

ARGUMENTS

lda – integer
dim1 – integer
dim2 – integer
a – complex array
d – complex array
b – complex array
c – complex array
bt – complex array
i0 – integer array
nop – real

MODULES

USE block_size

2.165 sym_direct_solve

NAME

sym_direct_solve

SYNOPSIS

```
SUBROUTINE sym_direct_solve (y,x)
```

DESCRIPTION

Forward-backward substitution using tridiagonal block LdU factorization.

ARGUMENTS

y – complex array
x – complex array

MODULES

USE model
USE direct_symmetric

2.166 sym_extract

NAME

sym_extract

SYNOPSIS

```
SUBROUTINE sym_extract (n,i1,i2,j0,prow1,prow2,lmorse,ncol,a,lda,  &
&                       dim2,blo)
```

DESCRIPTION

Extract block associated to rows i1 to i2 and delimited by pointers prow1 et prow2 from sparse matrix stored by row.

ARGUMENTS

n – integer
i1 – integer
i2 – integer
j0 – integer
prow1 – integer array
prow2 – integer array
lmorse – integer
ncol – integer
a – complex array
lda – integer
dim2 – integer
blo – complex array

2.167 sym_fill_tridiag_sparse

NAME

sym_fill_tridiag_sparse

SYNOPSIS

```
SUBROUTINE sym_fill_tridiag_sparse (a,ldu)
```

DESCRIPTION

Fill renumbered matrix with storage of lower triangular part.

ARGUMENTS

a – sparse matrix structure
ldu – factorized matrix structure

MODULES

USE sparse_matrix_struct
USE factorized_matrix_struct

2.168 sym_fwbw_tri_dirichlet

NAME

sym_fwbw_tri_dirichlet

SYNOPSIS

```
SUBROUTINE sym_fwbw_tri_dirichlet (y,x)
```

DESCRIPTION

Forward-backward substitution using tridiagonal block LDU factorization.

ARGUMENTS

y – complex array
x – complex array

MODULES

USE model
USE direct_symmetric

2.169 sym_multi_level1_feti

NAME

sym_multi_level1_feti

SYNOPSIS

```
SUBROUTINE sym_multi_level1_feti (rhs,solution,a,a_init,           &
&                              Dirichlet,interfine,typre,numb_dir,  &
&                              max_numb_it,numb_restart,epsilon,    &
&                              epstagn,multi_rhs)
```

DESCRIPTION

Level-1 FETI solution with multi-Krylov projection.

ARGUMENTS

rhs – complex array
solution – complex array
a – sparse matrix structure
a_init – sparse matrix structure
Dirichlet – nodal list structure
interfine – interface descriptor structure
typre – integer
numb_dir – integer
max_numb_it – integer
numb_restart – integer
epsilon – real
epstagn – real
multi_rhs – integer

MODULES

USE mpif
USE direct_symmetric
USE factorized_matrix_struct
USE sparse_matrix_struct
USE interf_descriptor_struct
USE nodal_list_struct
USE outfil

2.170 sym_multi_level2_feti

NAME

sym_multi_level2_feti

SYNOPSIS

```
SUBROUTINE sym_multi_level2_feti (rhs,solution,a,a_init,b,         &
&                                 Dirichlet,interfineP,typre,      &
&                                 numb_dir,max_numb_it,numb_restart,   &
&                                 epsilon,epstagn,multi_rhs)
```

DESCRIPTION

Solution of interface problem using a Jacobi algorithm.

ARGUMENTS

rhs – complex array
solution – complex array
a – sparse matrix structure
a_init – sparse matrix structure
Dirichlet – nodal list structure
interfineP – interface descriptor structure
typre – integer
numb_dir – integer
max_numb_it – integer
numb_restart – integer
epsilon – real
epstagn – real
multi_rhs – integer

MODULES

USE mpif
USE direct_symmetric
USE factorized_matrix_struct
USE sparse_matrix_struct
USE interf_descriptor_struct
USE nodal_list_struct
USE feti_data
USE outfil

2.171 sym_proax

NAME

sym_proax

SYNOPSIS

```
SUBROUTINE sym_proax (neq,p_row,sparse_size,column_numb,coef,x,y)
```

DESCRIPTION

Compute sparse matrix vector product in the case of a symmetric matrix with upper triangular part stored by rows.

ARGUMENTS

neq – integer
p_row – integer array
sparse_size – integer
column_numb – integer array
coef – complex array
x – complex array
y – complex array

2.172 sym_renumb_matrix_bc

NAME

sym_renumb_matrix_bc

SYNOPSIS

```
SUBROUTINE sym_renumb_matrix_bc (a,ldu)
```

DESCRIPTION

Build renumbered matrix with storage of lower triangular part.

ARGUMENTS

a – sparse matrix structure
ldu – factorized matrix structure

MODULES

USE sparse_matrix_struct
USE nodal_list_struct
USE outfil
USE realloc
USE factorized_matrix_struct

2.173 sym_tridiag_struct

NAME

sym_tridiag_struct

SYNOPSIS

```
SUBROUTINE sym_tridiag_struct (ldu)
```

DESCRIPTION

Build block tridiagonal sparse matrix structure of symmetric matrix renumbered via Cuthill Mac Kee.

ARGUMENTS

ldu – factorized matrix structure

MODULES

USE solver_param
USE outfil
USE realloc
USE factorized_matrix_struct

2.174 symfwbw_tri_dirichlet

NAME

symfwbw_tri_dirichlet

SYNOPSIS

```
SUBROUTINE symfwbw_tri_dirichlet (y,x,ldu)
```

DESCRIPTION

Forward-backward substitution with tridiagonal block sparse matrix. Case of Dirichlet conditions for the last block.

ARGUMENTS

y – complex array
x – complex array
ldu – factorized matrix structure

MODULES

USE solver_param
USE outfil

2.175 symunsym_sparse_mask

NAME

symunsym_sparse_mask

SYNOPSIS

```
SUBROUTINE symunsym_sparse_mask (neq,rowp,lcol,col,p_row,          &
&                               sparse_size,col_numb,mask)
```

DESCRIPTION

Construction of the un-symmetric sparse structure from the upper triangular part of the symmetric one stored row by row.

ARGUMENTS

rowp – pointer of rows of upper triangular part of symmetric matrix
col – list of column indices of rows of upper triangular part
p_row – pointer of rows of unsymmetric matrix
col_numb – list of column indices of rows of unsymmetric matrix
mask – mask of eliminated equations

MODULES

USE outfil

2.176 un_condens

NAME

un_condens

SYNOPSIS

```
SUBROUTINE un_condens (lda,dim1,dim2,a,d,e,f,c,v,ie0,if0,nop)
```

DESCRIPTION

Compute the Schur complement $C = C - [U^{-t}F]^t d^{-1} [L^{-1}E]$ LDU is the Gauss-Jordan factorisation of A.

ARGUMENTS

lda – integer
dim1 – integer
dim2 – integer
a – complex array
d – complex array
e – complex array
f – complex array
c – complex array
v – complex array
ie0 – integer array
if0 – integer array
nop – real

2.177 un_extract

NAME

un_extract

SYNOPSIS

```
SUBROUTINE un_extract(n,i1,i2,j0,prow1,prow2,lmorse,ncol,a,lda,   &
&                       dim2,blo)
```

DESCRIPTION

Extract block associated to rows i1 to i2 and delimited by pointers prow1 et prow2 from sparse matrix stored by row

ARGUMENTS

n – integer
i1 – integer
i2 – integer
j0 – integer
prow1 – integer array
prow2 – integer array
lmorse – integer
ncol – integer array
a – complex array
lda – integer
dim2 – integer
blo – complex array

2.178 unsym_approx_schur_cpmt

NAME

unsym_approx_schur_cpmt

SYNOPSIS

```
SUBROUTINE unsym_approx_schur_cpmt(a,ainit,reg,intf,intf_mesh,    &
&                                    Diri,Dir)
```

DESCRIPTION

Compute Schur complement.

ARGUMENTS

a – sparse matrix structure
ainit – sparse matrix structure
reg – sparse matrix structure
intf – interface descriptor structure
intf_mesh – interface mesh structure
Diri – nodal list structure
Dir – nodal list structure

MODULES

USE mpif
USE solver_param
USE feti_data
USE sparse_matrix_struct
USE direct_unsymmetric
USE interf_mesh_struct
USE interf_descriptor_struct
USE nodal_list_struct
USE outfil
USE realloc

2.179 unsym_build_schur_cpmt

NAME

unsym_build_schur_cpmt

SYNOPSIS

```
SUBROUTINE unsym_build_schur_cpmt (ainit,reg,intf,intf_mesh,Diri,  &
&                                  Dir)
```

DESCRIPTION

Compute Schur complement

ARGUMENTS

ainit – sparse matrix structure
reg – sparse matrix structure
intf – interface descriptor structure
intf_mesh – interface mesh structure
Diri – nodal list structure
Dir – modal list structure

MODULES

USE mpif
USE solver_param
USE feti_data
USE sparse_matrix_struct
USE direct_unsymmetric
USE interf_mesh_struct
USE interf_descriptor_struct
USE nodal_list_struct
USE outfil
USE realloc

2.180 unsym_direct_solve

NAME

unsym_direct_solve

SYNOPSIS

```
SUBROUTINE unsym_direct_solve (y,x)
```

DESCRIPTION

Forward-backward substitution using tridiagonal block LdU factorization

ARGUMENTS

y – complex array
x – complex array

MODULES

USE model
USE direct_unsymmetric

2.181 unsym_fill_tridiag_sparse

NAME

unsym_fill_tridiag_sparse

SYNOPSIS

```
SUBROUTINE unsym_fill_tridiag_sparse (a,ldu)
```

DESCRIPTION

Fill renumbered matrix

ARGUMENTS

a – sparse matrix structure
ldu – factorized matrix structure

MODULES

USE sparse_matrix_struct
USE factorized_matrix_struct

2.182 unsym_fwbw_tri_dirichlet

NAME

unsym_fwbw_tri_dirichlet

SYNOPSIS

```
SUBROUTINE unsym_fwbw_tri_dirichlet(y,x)
```

DESCRIPTION

Forward-backward substitution using tridiagonal block LdU factorization.

ARGUMENTS

y – complex array
x – complex array

MODULES

USE model
USE direct_unsymmetric

2.183 unsym_multi_level1_feti

NAME

unsym_multi_level1_feti

SYNOPSIS

```
SUBROUTINE unsym_multi_level1_feti(rhs,solution,a,a_init,         &
&                              Dirichlet, interfine,typre,         &
&                              numb_dir,max_numb_it,numb_restart,   &
&                              epsilon,epstagn,multi_rhs)
```

DESCRIPTION

Level-1 FETI solution with multi-Krylov projection

ARGUMENTS

rhs – complex array
solution – complex array
a – sparse matrix structure
a_init – sparse matrix structure
Dirichlet – nodal list structure
interfine – interface descriptor structure
typre – integer
numb_dir – integer
max_numb_it – integer
numb_restart – integer
epsilon – real
epstagn – real
multi_rhs – integer

MODULES

USE mpif
USE direct_unsymmetric
USE factorized_matrix_struct
USE sparse_matrix_struct
USE interf_descriptor_struct
USE nodal_list_struct
USE outfil

2.184 unsym_multi_level2_feti

NAME

unsym_multi_level2_feti

SYNOPSIS

```
SUBROUTINE unsym_multi_level2_feti (rhs,solution,a,a_init,b,      &
&                            Dirichlet,interfine,     typre,      &
&                            numb_dir,max_numb_it,numb_restart,   &
&                            epsilon,epstagn,multi_rhs)
```

DESCRIPTION

Level-2 FETI solution with multi-Krylov projection.

ARGUMENTS

rhs – complex array
solution – complex array
a – sparse matrix structure
a_init – sparse matrix structure
Dirichlet – nodal list structure
interfineP – interface descriptor structure
typre – integer
numb_dir – integer
max_numb_it – integer
numb_restart – integer
epsilon – real
epstagn – real
multi_rhs – integer

MODULES

USE mpif
USE direct_unsymmetric
USE factorized_matrix_struct
USE sparse_matrix_struct
USE interf_descriptor_struct
USE interf_mesh_struct
USE nodal_list_struct
USE outfil

2.185 unsym_proax

NAME

unsym_proax

SYNOPSIS

```
SUBROUTINE unsym_proax (neq,p_row,sparse_size,column_numb,coef,x,y)
```

DESCRIPTION

Compute sparse matrix vector product in the case of an unsymmetric matrix stored by rows.

ARGUMENTS

neq – integer
p_row – integer array
sparse_size – integer
column_numb – integer array
coef – complex array
x – complex array
y – complex array

2.186 unsym_renumb_matrix_bc

NAME

unsym_renumb_matrix_bc

SYNOPSIS

```
SUBROUTINE unsym_renumb_matrix_bc (a,ldu)
```

DESCRIPTION

Build renumbered matrix.

ARGUMENTS

a – sparse matrix structure
nrow – factorized matrix structure

MODULES

USE sparse_matrix_struct
USE nodal_list_struct
USE outfil
USE realloc
USE factorized_matrix_struct

2.187 unsym_tridiag_struct

NAME

unsym_tridiag_struct

SYNOPSIS

```
SUBROUTINE unsym_tridiag_struct(ldu)
```

DESCRIPTION

Build block tridiagonal sparse matrix structure of unsymmetric matrix renumbered via Cuthill Mac Kee.

ARGUMENTS

ldu – factorized matrix struct

MODULES

USE solver_param
USE outfil
USE realloc
USE factorized_matrix_struct

2.188 unsymfwbw_tri_dirichlet

NAME

unsymfwbw_tri_dirichlet

SYNOPSIS

```
SUBROUTINE unsymfwbw_tri_dirichlet (y,x,ldu)
```

DESCRIPTION

Forward-backward substitution with tridiagonal block sparse matrix. Case of Dirichlet conditions for the last block.

ARGUMENTS

y – complex array
x – complex array
ldu – factorized matrix structure

MODULES

USE solver_param
USE outfil
USE factorized_matrix_struct

2.189 unsymunsym_sparse_mask

NAME

unsymunsym_sparse_mask

SYNOPSIS

```
SUBROUTINE unsymunsym_sparse_mask(neq,rowp,lcol,col,p_row,        &
&                                  sparse_size,col_numb,mask)
```

DESCRIPTION

Construction of the non-symmetric sparse structure with elimination of non diagonal entries of clamped rows and columns.

ARGUMENTS

rowp – pointer of rows of non symmetric matrix
col – list of column indices of rows
p_row – pointer of rows of compressed matrix
col_numb – list of column indices of rows of compressed matrix
mask – mask of eliminated equations

MODULES

USE outfil

2.190 update_facet

NAME

update_facet

SYNOPSIS

```
SUBROUTINE update_facet (dom,bc)
```

DESCRIPTION

Find facets material number.

ARGUMENTS

dom – mesh structure
bc – facet structure

MODULES

USE mesh_struct
USE facet_struct
USE outfil

2.191 Update_Nodal_List

NAME

Update_Nodal_List

SYNOPSIS

```
SUBROUTINE Update_Nodal_List (dom,bc)
```

DESCRIPTION

Find neighboring elements of boundary nodes

ARGUMENTS

dom – mesh structure
bc – nodal list structure

MODULES

USE mesh_struct
USE nodal_list_struct
USE realloc
USE outfil

2.192 update_region

NAME

update_region

SYNOPSIS

```
SUBROUTINE update_region (dom,acou_mat,admi_mat,inf_mat)
```

DESCRIPTION

Change region id to internal region number for elements and build internal region number of adjacent element.

ARGUMENTS

dom – mesh structure
acou_mat – region property structure array
admi_mat – region property structure array
inf_mat – region property structure array

MODULES

USE mesh_struct
USE region_property_struct
USE outfil

2.193 write_field

NAME

write_field

SYNOPSIS

```
SUBROUTINE write_field (file_num,dom,field)
```

DESCRIPTION

Print field entries node by node

ARGUMENTS

file_num – integer
dom – mesh structure
field – complex array

MODULES

USE outfil
USE mesh_struct

2.194 write_field_femview

NAME

write_field_femview

SYNOPSIS

```
SUBROUTINE write_field_femview (file_num,dom,field)
```

DESCRIPTION

Write the complex components of pressure in a FEMVIEW file

ARGUMENTS

file_num – integer
dom – mesh structure
field – complex array

MODULES

USE outfil
USE mesh_struct

2.195 write_matrix

NAME

write_matrix

SYNOPSIS

```
SUBROUTINE write_matrix (a,frequency,subdom_numb,numb_subdom,     &
&                         directory)
```

DESCRIPTION

Print complex sparse matrix.

ARGUMENTS

a – sparse matrix structure
frequency – real
subdom_numb – integer
numb_subdom – integer
directory – character string

MODULES

USE outfil
USE sparse_matrix_struct

2.196 write_meshfield_femvtk

NAME

write_meshfield_femvtk

SYNOPSIS

```
SUBROUTINE write_meshfield_femvtk (file_num,dom,field)
```

DESCRIPTION

Write the complex components of pressure in a VTK file

ARGUMENTS

file_num – integer
dom – mesh structure
field – complex array

MODULES

USE outfil
USE mesh_struct

2.197 zorthodir_solver

NAME

zorthodir_solver

SYNOPSIS

```
SUBROUTINE zorthodir_solver (rhs,x,a,Dirichlet,type_precond,       &
&                             numb_dir,max_numb_it,epsilon,         &
&                             subdom_numb)
```

DESCRIPTION

Iterative solution of complex problem by Orthodir algorithm with restarts.

ARGUMENTS

rhs – complex array
x – complex array
a – sparse matrix structure
Dirichlet – nodal list structure
type_precond – integer
numb_dir – integer
max_numb_it – integer
epsilon – real
subdom_numb – integer

MODULES

USE sparse_matrix_struct
USE nodal_list_struct
USE outfil

2.198 zorthodir_solver_par

NAME

zorthodir_solver_par

SYNOPSIS

```
SUBROUTINE zorthodir_solver_par (rhs,x,a,Dirichlet,intf,           &
&                        type_precond,numb_dir,max_numb_it,epsilon,&
&                        subdom_numb)
```

DESCRIPTION

Parallel Iterative solution of complex problem by Orthodir algorithm with restarts.

ARGUMENTS

rhs – complex array
x – complex array
a – sparse matrix structure
Dirichlet – nodal list structure
intf – interface descriptor structure
type_precond – integer
numb_dir – integer
max_numb_it – integer
epsilon – real
subdom_numb – integer

MODULES

USE sparse_matrix_struct
USE nodal_list_struct
USE interf_descriptor_struct
USE outfil

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