



# Parallel Computational Acoustics Library - Mesh Generation Reference Manual

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# Parallel Computational Acoustics Library

## Mesh Generation Reference Manual\*

by F. Magoulès and F.-X. Roux

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June 13, 2002

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# 1 Modules

## 1.1 **mesh\_struct**

NAME

*mesh\_struct*

SYNOPSIS

```
MODULE mesh_struct
```

DESCRIPTION

Mesh structure for split\_mesh program.

ARGUMENTS

- nodes\_per\_element** – integer (= number of nodes per element)
- numb\_elements** – integer (= number of elements)
- geometry** – integer array (= geometry)
- space\_dim** – integer (= number of coordinates per node)
- numb\_nodes** – integer (= number of nodes)
- coordinates** – real array (coordinates)
- numb\_clamp\_nodes** – integer (= number of clamped nodes)
- clamp\_nodes** – integer array (= clamped nodes)
- nodes\_per\_facet** – integer (= number of nodes per facet)
- numb\_facets** – integer (= number of facets)
- facets** – integer array (= facets)
- facet2elem** – integer array (= facet to element correspondance)
- numb\_clamp\_facets** – integer
- clamp\_facets** – integer array (= clamped facets)

## 2 Functions

### 2.1 `split_mesh`

NAME

*split\_mesh*

SYNOPSIS

```
PROGRAM split_mesh
```

DESCRIPTION

Build subdomains from a global domain divided in grid and mesh with regular hexahedron with all the same material properties:  $\omega = 2\pi F/c$ , with  $c = 1$ . The variables  $\omega$ ,  $F$  and  $c$  denotes respectively the wavenumber, the frequency, and the celerity.

ARGUMENTS

None

MODULES

```
USE mesh_struct
```

### 2.2 `split_element`

NAME

*split\_element*

SYNOPSIS

```
SUBROUTINE split_element (ni,nj,nk,nsdi,nsdj,nsdk,           &
&                          subdom_num, num_elem, elem2subdom)
```

DESCRIPTION

Decompose regular hexaedric mesh of domain into subdomains and build elements to subdomain correspondance.

ARGUMENTS

**ni** – integer  
**nj** – integer  
**nk** – integer  
**nsdi** – integer  
**nsdj** – integer  
**nsdk** – integer  
**subdom\_num** – integer  
**num\_elem** – integer  
**elem2subdom** – integer array

**2.3 split\_facet**

NAME

*split\_facet*

SYNOPSIS

SUBROUTINE `split_facet` (`dom,elem2dom,facet2dom`)

DESCRIPTION

Detect facets on rear face of domain.

ARGUMENTS

**dom** – mesh structure  
**elem2dom** – integer array  
**facet2dom** – integer array

MODULES

USE `mesh_struct`**2.4 build\_glob\_dirichlet**

NAME

*build\_glob\_dirichlet*

SYNOPSIS

SUBROUTINE `build_glob_dirichlet` (`front,back,right,left,top,botton, &`  
& `dom`)

DESCRIPTION

Detect clamped nodes on face of domain with the convention front ( $x > 0$ ), back ( $x < 0$ ), right ( $y > 0$ ), left ( $y < 0$ ), top ( $z > 0$ ), botton ( $z < 0$ ).

ARGUMENTS

**front** – integer  
**back** – integer  
**right** – integer  
**left** – integer  
**top** – integer  
**botton** – integer  
**dom** – mesh structure

MODULES

USE `mesh_struct`

**2.5 build\_glob\_robin**

NAME

*build\_glob\_robin*

SYNOPSIS

```

SUBROUTINE build_glob_robin (front,back,right,left,top,botton,    &
&                               dom)

```

DESCRIPTION

Detect robin facet on face of domain with the convention front ( $x > 0$ ), back ( $x < 0$ ), right ( $y > 0$ ), left ( $y < 0$ ), top ( $z > 0$ ), botton ( $z < 0$ ).

ARGUMENTS

**front** – integer  
**back** – integer  
**right** – integer  
**left** – integer  
**top** – integer  
**botton** – integer  
**dom** – mesh structure

MODULES

```

USE mesh_struct

```

**2.6 build\_glob\_neumann**

NAME

*build\_glob\_neumann*

SYNOPSIS

```

SUBROUTINE build_glob_neumann (front,back,right,left,top,botton,  &
&                               dom)

```

DESCRIPTION

Detect clamped facet on face of block with the convention front ( $x > 0$ ), back ( $x < 0$ ), right ( $y > 0$ ), left ( $y < 0$ ), top ( $z > 0$ ), botton ( $z < 0$ ).

## ARGUMENTS

**front** – integer  
**back** – integer  
**right** – integer  
**left** – integer  
**top** – integer  
**botton** – integer  
**dom** – mesh structure

## MODULES

USE mesh\_struct

2.7 **build\_glob\_mesh**

## NAME

*build\_glob\_mesh*

## SYNOPSIS

SUBROUTINE build\_glob\_mesh (ni,nj,nk,dx,dy,dz,dom)

## DESCRIPTION

Compute geometry and coordinates of regular hexaedric mesh.

## ARGUMENTS

**ni** – integer  
**nj** – integer  
**nk** – integer  
**dx** – real  
**dy** – real  
**dz** – real  
**dom** – mesh structure

## MODULES

USE mesh\_struct

2.8 **imove**

## NAME

*imove*

## SYNOPSIS

SUBROUTINE imove (dim,x,y)



## DESCRIPTION

Move integer array.

## ARGUMENTS

**dim** – integer  
**x** – integer array  
**y** – integer array

2.9 **rmove**

## NAME

*rmove*

## SYNOPSIS

SUBROUTINE `rmove` (`dim,x,y`)

## DESCRIPTION

Move real array.

## ARGUMENTS

**dim** – integer  
**x** – real array  
**y** – real array

2.10 **echo\_dirichlet**

## NAME

*echo\_dirichlet*

## SYNOPSIS

SUBROUTINE `echo_dirichlet` (`file_num,dom,frequency,theta,phi`)

## DESCRIPTION

Write list of clamped nodes with Dirichlet boundary conditions.

## ARGUMENTS

**file\_num** – integer  
**dom** – mesh structure  
**frequency** – real  
**theta** – real  
**phi** – real

## MODULES

USE mesh\_struct

**2.11** **echo\_neumann**

## NAME

*echo\_neumann*

## SYNOPSIS

```

SUBROUTINE echo_neumann (file_num,dom,frequency,theta,phi,      &
&                        frontR,backR,rightR,leftR,topR,bottonR, &
&                        frontN,backN,rightN,leftN,topN,bottonN)

```

## DESCRIPTION

Write rhs associated to Robin and/or Neumann boundary conditions.

## ARGUMENTS

```

file_num – integer
dom – mesh structure
frequency – real
theta – real
phi – real
frontR – integer
backR – integer
rightR – integer
leftR – integer
topR – integer
bottonR – integer
frontN – integer
backN – integer
rightN – integer
leftN – integer
topN – integer
bottonN – integer

```

## MODULES

USE mesh\_struct

**2.12** **echo\_coor**

## NAME

*echo\_coor*

## SYNOPSIS

```

SUBROUTINE echo_coor (file_num,space_dim,numb_nodes,coordinates)

```

## DESCRIPTION

Write coordinates of nodes.

## ARGUMENTS

**file\_num** – integer  
**space\_dim** – integer  
**numb\_nodes** – integer  
**coordinates** – real array

2.13 **echo\_geom**

## NAME

*echo\_geom*

## SYNOPSIS

```
SUBROUTINE echo_geom (file_num,nodes_per_element,numb_elements,    &
&                      geometry,region,type_elem)
```

## DESCRIPTION

Write topology.

## ARGUMENTS

**file\_num** – integer  
**nodes\_per\_element** – integer  
**numb\_elements** – integer  
**geometry** – integer array  
**region** – integer  
**type\_elem** – integer

2.14 **echo\_mesh**

## NAME

*echo\_mesh*

## SYNOPSIS

```
SUBROUTINE echo_mesh (file_num,dom)
```

## DESCRIPTION

Write mesh.

## ARGUMENTS

**file\_num** – integer  
**dom** – mesh structure

## MODULES

USE mesh\_struct

**2.15** **echo\_splitting**

## NAME

*echo\_splitting*

## SYNOPSIS

```

SUBROUTINE echo_splitting (file_num,numb_elem,elem2subdom,      &
&                          numb_facet,facet2subdom)

```

## DESCRIPTION

Write element to subdomain correspondance including facet element.

## ARGUMENTS

**file\_num** – integer  
**numb\_elem** – integer  
**elem2subdom** – integer array  
**numb\_facet** – integer  
**facet2subdom** – integer array

**2.16** **inivec**

## NAME

*inivec*

## SYNOPSIS

```

SUBROUTINE inivec (lx,x)

```

## DESCRIPTION

Pseudo random number generator.

## ARGUMENTS

**lx** – integer  
**x** – complex array

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