



# 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 correspondence)  
**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_numb,numb_elem,elem2subdom)
```

#### DESCRIPTION

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

#### ARGUMENTS

<b>ni</b>	- integer
<b>nj</b>	- integer
<b>nk</b>	- integer
<b>nsdi</b>	- integer
<b>nsdj</b>	- integer
<b>nsdk</b>	- integer
<b>subdom_numb</b>	- integer
<b>numb_elem</b>	- integer
<b>elem2subdom</b>	- 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,button, &
&                                     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 ( $z > 0$ ), bottom ( $z < 0$ ).

## ARGUMENTS

**front** – integer  
**back** – integer  
**right** – integer  
**left** – integer  
**top** – integer  
**button** – 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  
**bottom** – 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 hexaedic 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,buttonR,      &
&                      frontN,backN,rightN,leftN,topN,buttonN)
```

## DESCRIPTION

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

## ARGUMENTS

<b>file_num</b>	- integer
<b>dom</b>	- mesh structure
<b>frequency</b>	- real
<b>theta</b>	- real
<b>phi</b>	- real
<b>frontR</b>	- integer
<b>backR</b>	- integer
<b>rightR</b>	- integer
<b>leftR</b>	- integer
<b>topR</b>	- integer
<b>buttonR</b>	- integer
<b>frontN</b>	- integer
<b>backN</b>	- integer
<b>rightN</b>	- integer
<b>leftN</b>	- integer
<b>topN</b>	- integer
<b>buttonN</b>	- 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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