



# Parallel Computational Acoustics Library - Mesh Generation Reference Manual

Frédéric Magoulès, François-Xavier Roux

► **To cite this version:**

Frédéric Magoulès, François-Xavier Roux. Parallel Computational Acoustics Library - Mesh Generation Reference Manual. [Intern report] A02-R-073 || magoules02b, 2002, 12 p. <inria-00099430>

**HAL Id: inria-00099430**

**<https://hal.inria.fr/inria-00099430>**

Submitted on 26 Sep 2006

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

---

# Parallel Computational Acoustics Library

## Mesh Generation Reference Manual\*

by F. Magoulès and F.-X. Roux

---

June 13, 2002

### Contents

<b>1</b>	<b>Modules</b>	<b>3</b>
1.1	mesh_struct . . . . .	3
<b>2</b>	<b>Functions</b>	<b>4</b>
2.1	split_mesh . . . . .	4
2.2	split_element . . . . .	4
2.3	split_facet . . . . .	5
2.4	build_glob_dirichlet . . . . .	5
2.5	build_glob_robin . . . . .	6
2.6	build_glob_neumann . . . . .	6
2.7	build_glob_mesh . . . . .	7
2.8	imove . . . . .	7
2.9	rmove . . . . .	8
2.10	echo_dirichlet . . . . .	8
2.11	echo_neumann . . . . .	9
2.12	echo_coor . . . . .	9
2.13	echo_geom . . . . .	10
2.14	echo_mesh . . . . .	10
2.15	echo_splitting . . . . .	11
2.16	inivec . . . . .	11

---

\* Generated by adoC, awk documenting C, June 13, 2002

## Index

### Alphabetical

- build\_glob\_dirichlet, 5
- build\_glob\_mesh, 7
- build\_glob\_neumann, 6
- build\_glob\_robin, 6
- echo\_coor, 9
- echo\_dirichlet, 8
- echo\_geom, 10
- echo\_mesh, 10
- echo\_neumann, 9
- echo\_splitting, 11
- imove, 7
- inivec, 11
- mesh\_struct, 3
- rmove , 8
- split\_element, 4
- split\_facet, 5
- split\_mesh, 4

- echo\_geom, 10
- echo\_mesh, 10
- echo\_neumann, 9
- echo\_splitting, 11
- imove, 7
- inivec, 11
- rmove , 8
- split\_element, 4
- split\_facet, 5
- split\_mesh, 4

Modules

- mesh\_struct, 3

### Files

- mesh\_struct.f90
  - mesh\_struct, 3
- splitmesh\_main.f90
  - split\_mesh, 4
- splitmesh\_routines.f90
  - build\_glob\_dirichlet, 5
  - build\_glob\_mesh, 7
  - build\_glob\_neumann, 6
  - build\_glob\_robin, 6
  - echo\_coor, 9
  - echo\_dirichlet, 8
  - echo\_geom, 10
  - echo\_mesh, 10
  - echo\_neumann, 9
  - echo\_splitting, 11
  - imove, 7
  - inivec, 11
  - rmove , 8
  - split\_element, 4
  - split\_facet, 5

### Sorted

#### Functions

- build\_glob\_dirichlet, 5
- build\_glob\_mesh, 7
- build\_glob\_neumann, 6
- build\_glob\_robin, 6
- echo\_coor, 9
- echo\_dirichlet, 8

# 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 correspon-  
    dance)  
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

## Acknowledgements

The authors acknowledge partial financial support by the European Community under the Enhancing Access to Research Infrastructure action of the Improving Human Potential programme, contract number HPRI-1999-CT-0026.