

NAG Toolbox for MATLAB

d06db

1 Purpose

d06db joins together (restitches) two adjacent, or overlapping, meshes.

2 Syntax

```
[nv3, nelt3, nedge3, coor3, edge3, conn3, reft3, ifail] = d06db(coor1,
edge1, conn1, reft1, coor2, edge2, conn2, reft2, itrace, 'eps', eps,
'nv1', nv1, 'nelt1', nelt1, 'nedge1', nedge1, 'nv2', nv2, 'nelt2',
nelt2, 'nedge2', nedge2)
```

3 Description

d06db joins together two adjacent, or overlapping, meshes. If the two meshes are adjacent then vertices belonging to the part of the boundary forming the common interface should coincide. If the two meshes overlap then vertices and triangles in the overlapping zone should coincide too.

This function is partly derived from material in the MODULEF package from INRIA (Institut National de Recherche en Informatique et Automatique).

4 References

None.

5 Parameters

5.1 Compulsory Input Parameters

1: **coor1(2,nv1)** – double array

coor1(1,*i*) contains the *x* co-ordinate of the *i*th vertex of the first input mesh, for *i* = 1, ..., **nv1**; while **coor1**(2,*i*) contains the corresponding *y* co-ordinate.

2: **edge1(3,nedge1)** – int32 array

The specification of the boundary edges of the first input mesh. **edge1**(1,*j*) and **edge1**(2,*j*) contain the vertex numbers of the two end points of the *j*th boundary edge. **edge1**(3,*j*) is a user-supplied tag for the *j*th boundary edge.

Constraint: $1 \leq \mathbf{edge1}(i, j) \leq \mathbf{nv1}$ and $\mathbf{edge1}(1, j) \neq \mathbf{edge1}(2, j)$, for $i = 1, 2$ and $j = 1, 2, \dots, \mathbf{nedge1}$.

3: **conn1(3,nelt1)** – int32 array

The connectivity between triangles and vertices of the first input mesh. For each triangle *j*, **conn1**(*i*,*j*) gives the indices of its three vertices (in anticlockwise order), for *i* = 1, 2, 3 and *j* = 1, ..., **nelt1**.

Constraints:

$$\begin{aligned} &1 \leq \mathbf{conn1}(i, j) \leq \mathbf{nv1}; \\ &\mathbf{conn1}(1, j) \neq \mathbf{conn1}(2, j); \\ &\mathbf{conn1}(1, j) \neq \mathbf{conn1}(3, j) \quad \text{and} \quad \mathbf{conn1}(2, j) \neq \mathbf{conn1}(3, j), \quad \text{for} \quad i = 1, 2, 3 \quad \text{and} \\ &j = 1, 2, \dots, \mathbf{nelt1}. \end{aligned}$$

4: **reft1(nelt1) – int32 array**

reft1(k) contains the user-supplied tag of the k th triangle from the first input mesh, for $k = 1, \dots, \mathbf{nelt1}$.

5: **coor2(2,nv2) – double array**

coor2(1, i) contains the x co-ordinate of the i th vertex of the second input mesh, for $i = 1, \dots, \mathbf{nv2}$; while **coor2**(2, i) contains the corresponding y co-ordinate.

6: **edge2(3,nedge2) – int32 array**

The specification of the boundary edges of the second input mesh. **edge2**(1, j) and **edge2**(2, j) contain the vertex numbers of the two end points of the j th boundary edge. **edge2**(3, j) is a user-supplied tag for the j th boundary edge.

Constraint: $1 \leq \mathbf{edge2}(i, j) \leq \mathbf{nv2}$ and $\mathbf{edge2}(1, j) \neq \mathbf{edge2}(2, j)$, for $i = 1, 2$ and $j = 1, 2, \dots, \mathbf{nedge2}$.

7: **conn2(3,nelt2) – int32 array**

The connectivity between triangles and vertices of the second input mesh. For each triangle j , **conn2**(i, j) gives the indices of its three vertices (in anticlockwise order), for $i = 1, 2, 3$ and $j = 1, \dots, \mathbf{nelt2}$.

Constraints:

$1 \leq \mathbf{conn2}(i, j) \leq \mathbf{nv2}$;
 $\mathbf{conn2}(1, j) \neq \mathbf{conn2}(2, j)$;
 $\mathbf{conn2}(1, j) \neq \mathbf{conn2}(3, j)$ and $\mathbf{conn2}(2, j) \neq \mathbf{conn2}(3, j)$, for $i = 1, 2, 3$ and $j = 1, 2, \dots, \mathbf{nelt2}$.

8: **reft2(nelt2) – int32 array**

reft2(k) contains the user-supplied tag of the k th triangle from the second input mesh, for $k = 1, \dots, \mathbf{nelt2}$.

9: **itrace – int32 scalar**

The level of trace information required from d06db.

itrace ≤ 0

No output is generated.

itrace ≥ 1

Details about the common vertices, edges and triangles to both meshes are printed on the current advisory message unit (see x04ab).

5.2 Optional Input Parameters

1: **eps – double scalar**

The relative precision of the restitching of the two input meshes (see Section 8).

Suggested value: 0.001.

Default: 0.001

Constraint: **eps** > 0.0 .

2: **nv1 – int32 scalar**

Default: The dimension of the array **coor1**.

the total number of vertices in the first input mesh.

Constraint: **nv1** ≥ 3 .

3: **nelt1 – int32 scalar**

Default: The dimension of the arrays **conn1**, **reft1**. (An error is raised if these dimensions are not equal.)

the number of triangular elements in the first input mesh.

Constraint: **nelt1** $\leq 2 \times \mathbf{nv1} - 1$.

4: **nedge1 – int32 scalar**

Default: The dimension of the array **edge1**.

the number of boundary edges in the first input mesh.

Constraint: **nedge1** ≥ 1 .

5: **nv2 – int32 scalar**

Default: The dimension of the array **coor2**.

the total number of vertices in the second input mesh.

Constraint: **nv2** ≥ 3 .

6: **nelt2 – int32 scalar**

Default: The dimension of the arrays **conn2**, **reft2**. (An error is raised if these dimensions are not equal.)

the number of triangular elements in the second input mesh.

Constraint: **nelt2** $\leq 2 \times \mathbf{nv2} - 1$.

7: **nedge2 – int32 scalar**

Default: The dimension of the array **edge2**.

the number of boundary edges in the second input mesh.

Constraint: **nedge2** ≥ 1 .

5.3 Input Parameters Omitted from the MATLAB Interface

iwork, liwork

5.4 Output Parameters

1: **nv3 – int32 scalar**

The total number of vertices in the resulting mesh.

2: **nelt3 – int32 scalar**

The number of triangular elements in the resulting mesh.

3: **nedge3 – int32 scalar**

The number of boundary edges in the resulting mesh.

4: **coor3(2,*) – double array**

The first dimension of the array **coor3** must be at least

The second dimension of the array must be at least **nv1** + **nv2**. This may be reduced to **nv3** once that value is known

coor3(1, *i*) will contain the *x* co-ordinate of the *i*th vertex of the resulting mesh, for *i* = 1, ..., **nv3**; while **coor3**(2, *i*) will contain the corresponding *y* co-ordinate.

5: **edge3**(3,*) – **int32** array

The first dimension of the array **edge3** must be at least

The second dimension of the array must be at least **nedge1** + **nedge2**. This may be reduced to **nedge3** once that value is known

The specification of the boundary edges of the resulting mesh. **edge3**(*i*, *j*) will contain the vertex number of the *i*th end point (*i* = 1, 2) of the *j*th boundary or interface edge.

If the two meshes overlap, **edge3**(3, *j*) will contain the same tag as the corresponding edge belonging to the first and/or the second input mesh.

If the two meshes are adjacent,

- (i) if the *j*th edge is part of the partition interface, then **edge3**(3, *j*) will contain the value $1000 \times k_1 + k_2$ where k_1 and k_2 are the tags for the same edge of the first and the second mesh respectively;
- (ii) otherwise, **edge3**(3, *j*) will contain the same tag as the corresponding edge belonging to the first and/or the second input mesh.

6: **conn3**(3,*) – **int32** array

The first dimension of the array **conn3** must be at least

The second dimension of the array must be at least **nelt1** + **nelt2**. This may be reduced to **nelt3** once that value is known

The connectivity between triangles and vertices of the resulting mesh. **conn3**(*i*, *j*) will give the indices of its three vertices (in anticlockwise order), for *i* = 1, 2, 3 and *j* = 1, ..., **nelt3**.

7: **reft3**(*) – **int32** array

Note: the dimension of the array **reft3** must be at least **nelt1** + **nelt2**. This may be reduced to **nelt3** once that value is known.

If the two meshes form a partition, **reft3**(*k*) will contain the same tag as the corresponding triangle belonging to the first or the second input mesh, for *k* = 1, ..., **nelt3**. If the two meshes overlap, then **reft3**(*k*) will contain the value $1000 \times k_1 + k_2$ where k_1 and k_2 are the user-supplied tags for the same triangle of the first and the second mesh respectively, for *k* = 1, ..., **nelt3**.

8: **ifail** – **int32** scalar

0 unless the function detects an error (see Section 6).

6 Error Indicators and Warnings

Errors or warnings detected by the function:

ifail = 1

On entry, **eps** ≤ 0.0,
or **nv1** < 3,
or **nelt1** > 2 × **nv1** – 1,
or **nedge1** < 1,
or **edge1**(*i*, *j*) < 1 or **edge1**(*i*, *j*) > **nv1** for some *i* = 1, 2 and *j* = 1, ..., **nedge1**,
or **edge1**(1, *j*) = **edge1**(2, *j*) for some *j* = 1, ..., **nedge1**,
or **conn1**(*i*, *j*) < 1 or **conn1**(*i*, *j*) > **nv1** for some *i* = 1, 2, 3 and *j* = 1, ..., **nelt1**,

or **conn1**(1,*j*) = **conn1**(2,*j*) or **conn1**(1,*j*) = **conn1**(3,*j*) or
conn1(2,*j*) = **conn1**(3,*j*) for some *j* = 1, ..., **nelt1**,
 or **nv2** < 3,
 or **nelt2** > 2 × **nv2** − 1,
 or **nedge2** < 1,
 or **edge2**(*i*,*j*) < 1 or **edge2**(*i*,*j*) > **nv2** for some *i* = 1, 2 and *j* = 1, ..., **nedge2**,
 or **edge2**(1,*j*) = **edge2**(2,*j*) for some *j* = 1, ..., **nedge2**,
 or **conn2**(*i*,*j*) < 1 or **conn2**(*i*,*j*) > **nv2** for some *i* = 1, 2, 3 and *j* = 1, ..., **nelt2**,
 or **conn2**(1,*j*) = **conn2**(2,*j*) or **conn2**(1,*j*) = **conn2**(3,*j*) or
conn2(2,*j*) = **conn2**(3,*j*) for some *j* = 1, ..., **nelt2**,
 or **liwork** < 2 × **nv1** + 3 × **nv2** + **nelt1** + **nelt2** + **nedge1** + **nedge2** + 1024.

ifail = 2

Using the input precision **eps**, the function has detected fewer than two coincident vertices between the two input meshes. You are advised to try another value of **eps**; if this error still occurs the two meshes are probably not stitchable.

ifail = 3

A serious error has occurred in an internal call to the restitching function. You should check the input of the two meshes, especially the edge/vertex and/or the triangle/vertex connectivities. If the problem persists, contact NAG.

ifail = 4

The function has detected a different number of coincident triangles from the two input meshes in the overlapping zone. You should check the input of the two meshes, especially the triangle/vertex connectivities.

ifail = 5

The function has detected a different number of coincident edges from the two meshes on the partition interface. You should check the input of the two meshes, especially the edge/vertex connectivities.

7 Accuracy

Not applicable.

8 Further Comments

d06db finds all the common vertices between the two input meshes using the relative precision of the restitching parameter **eps**. You are advised to vary the value of **eps** in the neighbourhood of 0.001 with **itrace** ≥ 1 to get the optimal value for the meshes under consideration.

9 Example

```

coor1 = zeros(2,400);
coor1(1, 1:400) = [0,
0.0526316,
0.105263,
0.157895,
0.210526,
0.263158,
0.315789,
0.368421,
0.421053,
0.473684,
0.526316,
```

```
0.578947,  
0.631579,  
0.684211,  
0.736842,  
0.789474,  
0.842105,  
0.894737,  
0.947368,  
1,  
0,  
0.053004,  
0.106007,  
0.15915,  
0.209592,  
0.260599,  
0.313038,  
0.366919,  
0.420609,  
0.47352,  
0.5263370000000001,  
0.579088,  
0.631888,  
0.684651,  
0.737256,  
0.78943,  
0.841553,  
0.894133,  
0.947067,  
1,  
0,  
0.0534333,  
0.106235,  
0.159956,  
0.209996,  
0.259977,  
0.311401,  
0.365802,  
0.420642,  
0.47341,  
0.526068,  
0.5786750000000001,  
0.631648,  
0.684596,  
0.737448,  
0.78982,  
0.84178,  
0.893995,  
0.946852,  
1,  
0,  
0.0538039,  
0.106545,  
0.158858,  
0.210128,  
0.260398,  
0.310943,  
0.3636,  
0.419451,  
0.472928,  
0.525577,  
0.578223,  
0.6310750000000001,  
0.683956,  
0.7368749999999999,  
0.78972,  
0.8420800000000001,  
0.894374,  
0.946955,  
1,  
0,
```

```
0.053751499999999999,  
0.106776,  
0.158931,  
0.210208,  
0.260742,  
0.311521,  
0.363876,  
0.418145,  
0.47223,  
0.525111,  
0.577985,  
0.630736,  
0.68337,  
0.735968,  
0.788992,  
0.841819,  
0.894612,  
0.947184,  
1,  
0,  
0.0536725,  
0.106635,  
0.158876,  
0.210666,  
0.261283,  
0.312324,  
0.36466,  
0.418511,  
0.471999,  
0.524845,  
0.577755,  
0.63064,  
0.683254,  
0.735891,  
0.788569,  
0.841356,  
0.894369,  
0.947225,  
1,  
0,  
0.054516,  
0.107159,  
0.158994,  
0.210434,  
0.261605,  
0.313007,  
0.365417,  
0.419192,  
0.473235,  
0.525468,  
0.577946,  
0.630796,  
0.683633,  
0.736328,  
0.78894,  
0.84111,  
0.894159,  
0.947129,  
1,  
0,  
0.056204,  
0.108298,  
0.159916,  
0.210824,  
0.261646,  
0.313118,  
0.365457,  
0.418953,  
0.473433,  
0.526137,
```

```
0.57868,  
0.63134,  
0.684293,  
0.737208,  
0.78962,  
0.842011,  
0.8946,  
0.947268,  
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0,  
0.0548594,  
0.108224,  
0.160449,  
0.211961,  
0.262781,  
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0.365485,  
0.418574,  
0.472328,  
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0.579114,  
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0.737445,  
0.790017,  
0.842418,  
0.895069,  
0.947591,  
1,  
0,  
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0.106492,  
0.159501,  
0.211988,  
0.263778,  
0.315022,  
0.36643,  
0.418881,  
0.471646,  
0.52457,  
0.578628,  
0.63217,  
0.684783,  
0.736978,  
0.789629,  
0.842153,  
0.894842,  
0.94759,  
1,  
0,  
0.0514925,  
0.104211,  
0.157661,  
0.2111,  
0.26372,  
0.316379,  
0.368652,  
0.420519,  
0.472412,  
0.524455,  
0.57796,  
0.631985,  
0.684635,  
0.736406,  
0.788965,  
0.8417519999999999,  
0.894427,  
0.947283,  
1,  
0,
```



```
0.0508223,  
0.10295,  
0.156261,  
0.209694,  
0.262775,  
0.316044,  
0.370283,  
0.423492,  
0.474535,  
0.526077,  
0.578169,  
0.631393,  
0.684214,  
0.736055,  
0.788503,  
0.841652,  
0.894472,  
0.947193,  
1,  
0,  
0.0515621,  
0.103835,  
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0.209397,  
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0,  
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0.369671,  
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0.475555,  
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0.682963,  
0.734669,  
0.78656,  
0.840591,  
0.894361,  
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1,  
0,  
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0.105929,  
0.159138,  
0.211875,  
0.264131,  
0.315782,  
0.368611,  
0.421782,  
0.47416,  
0.527515,
```

```
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0.8934260000000001,  
0.9469959999999999,  
1,  
0,  
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0.159138,  
0.21224,  
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0.368556,  
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0.473635,  
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0.421163,  
0.473189,  
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0.685273,  
0.7361839999999999,  
0.786892,  
0.838821,  
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0.9461540000000001,  
1,  
0,  
0.0519324,  
0.105695,  
0.159166,  
0.211854,  
0.264323,  
0.317522,  
0.369989,  
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0.6849460000000001,  
0.73676,  
0.7877420000000001,  
0.83928,  
0.892136,  
0.945949,  
1,  
0,
```

[illegible]

```
0.0529351,  
0.0527519,  
0.052523200000000001,  
0.0521887,  
0.0514365,  
0.0511852,  
0.0513826,  
0.0520693,  
0.0526316,  
0.105263,  
0.105629,  
0.106414,  
0.107543,  
0.107282,  
0.106009,  
0.105685,  
0.10625,  
0.106115,  
0.105494,  
0.105215,  
0.105602,  
0.105363,  
0.104955,  
0.104762,  
0.104321,  
0.103634,  
0.103504,  
0.104258,  
0.105263,  
0.157895,  
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0.158585,  
0.160703,  
0.161508,  
0.160854,  
0.159774,  
0.159143,  
0.159396,  
0.158225,  
0.157661,  
0.157998,  
0.158158,  
0.157847,  
0.157691,  
0.157682,  
0.157078,  
0.156562,  
0.156934,  
0.157895,  
0.210526,  
0.209851,  
0.209921,  
0.211672,  
0.214046,  
0.214868,  
0.214591,  
0.214038,  
0.212959,  
0.211629,  
0.210427,  
0.210469,  
0.21082,  
0.210792,  
0.210731,  
0.210732,  
0.210398,  
0.20989,  
0.209907,  
0.210526,  
0.263158,
```

```
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0.262359,  
0.264518,  
0.266476,  
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0.262874,  
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0.316165,  
0.316445,  
0.316505,  
0.316034,  
0.315338,  
0.315112,  
0.315404,  
0.3159,  
0.315842,  
0.315789,  
0.368421,  
0.36991,  
0.368859,  
0.367246,  
0.365954,  
0.365335,  
0.366449,  
0.367228,  
0.367797,  
0.368303,  
0.368453,  
0.369026,  
0.369213,  
0.368774,  
0.368247,  
0.368658,  
0.369427,  
0.369468,  
0.368954,  
0.368421,  
0.421053,  
0.423169,  
0.423363,  
0.421555,  
0.419389,  
0.417386,  
0.415919,  
0.416287,  
0.417343,  
0.418262,  
0.420205,
```

```
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0.42146,  
0.421103,  
0.420855,  
0.421458,  
0.422405,  
0.422629,  
0.421965,  
0.421053,  
0.473684,  
0.475673,  
0.477027,  
0.476105,  
0.474016,  
0.471957,  
0.470082,  
0.46891,  
0.469108,  
0.46938,  
0.471703,  
0.473569,  
0.473634,  
0.473058,  
0.472478,  
0.472845,  
0.473917,  
0.474621,  
0.474445,  
0.473684,  
0.526316,  
0.527735,  
0.529574,  
0.52977,  
0.528675,  
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reft3 =
        array elided
ifail =
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