
Subject: Re: mesh_volume and tetra_volume
Posted by [Karl Schultz](#) on Tue, 10 Aug 2004 16:19:12 GMT
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"Robert Schaefer" <robertschaefer@gmx.de> wrote in message
news:bffae64.0408100002.6f8cf5ef@posting.google.com...
> "Karl Schultz" <kschultz_no_spam@rsinc.com> wrote in message
news:<10hf9gscqmtjdj41@corp.supernews.com>...
>> "Robert Schaefer" <robertschaefer@gmx.de> wrote in message
>> news:bffae64.0408090124.5906ed23@posting.google.com...
>>> Hello, I want to get the volume out of a 3d object.
>>> First i tried with mesh_volume, but the returned values weren't
>>> similar to my calculated. I checked with mesh_issolid: return value:1,
>>> so it ios solid and should return the volume.
>>> When i check with tetra_volume the volume is similar to my calculated
>>> volume.
>>>
>>> Now my question: what is the difference between mesh_volume and
>>> tetra_volume?
>>
>> MESH_VOLUME works by summing:
>>
>> (a dot (b cross c)) / 6
>> for every triangle in the mesh where a, b, and c are the verts of each
>> triangle in the mesh. This effectively calculates the signed volume of
a
>> tetrahedron formed by the origin and the 3 triangle verts for each
triangle
>> and then adds them up.
>>
>> TETRA_VOLUME just adds up the volume of all the tets in the mesh using
the
>> same idea as above.
>>
>> How big a difference are you seeing? Is there anything strange about
your
>> mesh, like being self-intersecting? How did you generate both the
polygonal
>> mesh and the tetrahedral mesh?
>>
>> Karl
>
> My testobjekt is generated by dilatation of one point. I can not see
> any strange about the mesh.
> With computemesh i generate the triangles, like D.fanning in his
> example (http://www.dfanning.com/graphics_tips/mesh.html). I signed
> the calculated values between tetra_volume and mesh_volume are very
> differnt:

```
>  
> accord sphere formula : 4./3.*!pi*16.^3 = 17157.3  
> total (vol) : 17611.0  
> volume with tetra_volume: 16308.0  
> mesh_volume : 11988.0  
>  
> Any idea?  
>  
> Robert
```

Not really. I think I'd have to see your code to understand better what is going on.

Here is an example that might help.

It makes a volume where each sample value is the distance from the volume center.

I use that to create an isosurface where the isovalue is some arbitrary radius value.

I print out the ideal volume of the sphere and then the volume of the isosurface according to MESH_VOLUME.

I don't know how you are getting your tetrahedral mesh, but I use INTERVAL_VOLUME and then use TETRA_VOLUME to compute the volume that way. I also extract the surface of the tet mesh and compute the volume enclosed by that with MESH_VOLUME.

The results are printed below. Note that all of the values except the ideal volume are very close. The reason why the ideal volume is a bit different is because the volume is performing discrete sampling, and so there is sampling error. The volumes of the various meshes will approach the ideal volume as you increase sampling.

I hope this helps you solve your problem.

Karl

```
pro t  
  n = 40  
  mid = n / 2  
  radius = n / 3.5  
  vol = BYTARR(n,n,n)  
  for i=0, n-1 do begin  
    for j=0, n-1 do begin  
      for k=0, n-1 do begin
```

```

        vol[i,j,k] = SQRT( (i-mid)^2 + (j-mid)^2 + (k-mid)^2 ) + 0.5
    endfor
endfor
endfor

ISOSURFACE, vol, radius, v, c

print, "Ideal volume", 4./3.*!pi*radius^3
print, MESH_ISSOLID(c)
print, "Isosurface volume", MESH_VOLUME(v, c)

INTERVAL_VOLUME, vol, 0, radius, tet_verts, tet_conn
print, "Tetrahedral volume", TETRA_VOLUME(tet_verts, tet_conn)
surf_conn = TETRA_SURFACE(tet_verts, tet_conn)
print, MESH_ISSOLID(surf_conn)
print, "Tetrahedral volume by surface", MESH_VOLUME(tet_verts,
surf_conn)
end

IDL> t
Ideal volume 6252.66
1
Isosurface volume 6321.85
Tetrahedral volume 6321.87
1
Tetrahedral volume by surface 6321.85

```
