
Subject: Re: Volume by four vectors

Posted by [Sander Roosendaal](#) on Thu, 14 Oct 2004 19:11:08 GMT

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Dear Ed,

I appreciate your help.

For my problem:

"Given four 3D vectors $a=[a_1,a_2,a_3]$ $b=[b_1,b_2,b_3]$ $c=[c_1,c_2,c_3]$ and $d=[d_1,d_2,d_3]$, I want to calculate the volume defined by $i*a + j*b + k*c + l*d$ with i,j,k,l between 0 and 1."

You responded:

- > Interesting geometry problem. The volume you're talking about is an
- > irregular polyhedron--the generalization of a cube. You can dissect
- > the volume into
- > irregular tetrahedra, each bounded by 4 triangles, two triangles on
- > each face.
- > Pick an origin inside of the hexahedron, and since there are 6 faces,

There are more than 6 faces.

I calculate a 16 points. Only some of them define the polyhedron.

O(rigin), $a,b,c,d,a+b,a+c,a+d,b+c,b+d,c+d, a+b+c,a+b+d,a+c+d,b+c+d, a+b+c+d$

Example:

If $a=[1,0,0]$; $b=[0,1,0]$; $c=[0,0,1]$, $d=[0.01,0.01,0]$

The resulting volume will be very close to 1. Actually, the 16 points are

- *1: (0,0,0)
- *2: (1,0,0)
- *3: (0,1,0)
- *4: (0,0,1)
- 5: (0.01,0.01,0)
- 6: (1,1,0)
- *7: (1,0,1)
- *8: (1.01,0.01,0)
- *9: (0,1,1)
- *10: (0.01,1.01,0)
- 11: (0.01,0.01,1)
- 12: (1,1,1)
- *13: (1.01,1.01,0)
- *14: (1.01,0.01,1)
- *15: (0.01,1.01,1)
- *16: (1.01,1.01,1)

The ones marked with * are on the outside (12 in total). This polyhedron has 8 faces.

--

hartelijke groeten,

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