

Surface Area of a Body of Revolution

How to compute the surface area of a body of revolution. This page is general and not restricted to the Sears-Haack body.

Since we are going to compute the integral numerically, we need a numerical integration routine. The routine Quanc8 included with the package of Computer Methods for Mathematical Computations will be used. The input arguments are as follows:

var	def	value
F	function to be integrated	Fint
a	lower limit of integration	0.0
b	upper limit of integration	1.0
abserr	absolute error tolerance	1E-8
relerr	relative error tolerance	1E-8

For this problem, we take $a=0$, $b=1$, and select something like $1E-8$ for both tolerances. We need a function that accepts one argument, the integration variable, and returns the integrand. The equation for the integrand requires an additional parameter, the maximum radius, that must be supplied. Since the function input to Quanc8 must have only one argument, the radius, and the value of maximum radius must get into the function somehow, this requires a bit of programming. The best way to write such a program in Fortran is to make a module that contains the function and includes the maximum radius as a module variable. Then, the main program can set the radius and the function can use this value. You will use this technique over and over when dealing with numerical procedures that use a function as an argument.

You may download the source code for the body of revolution program from <http://www.pdas.com/programs/areash.f90>

The results from running this program are at <http://www.pdas.com/programs/areash.out>

So there you have an example of a problem that looks overwhelming in analytic form, but can be solved quite simply with numerical methods. Of course, it was not easy developing Quanc8, but that is behind us. areash2.tex
Last modified 23 January 2003 by Ralph Carmichael (ralph@pdas.com)
Public Domain Aeronautical Software
P.O. Box 1438
Santa Cruz CA 95061