Coil Design Studies for QOS

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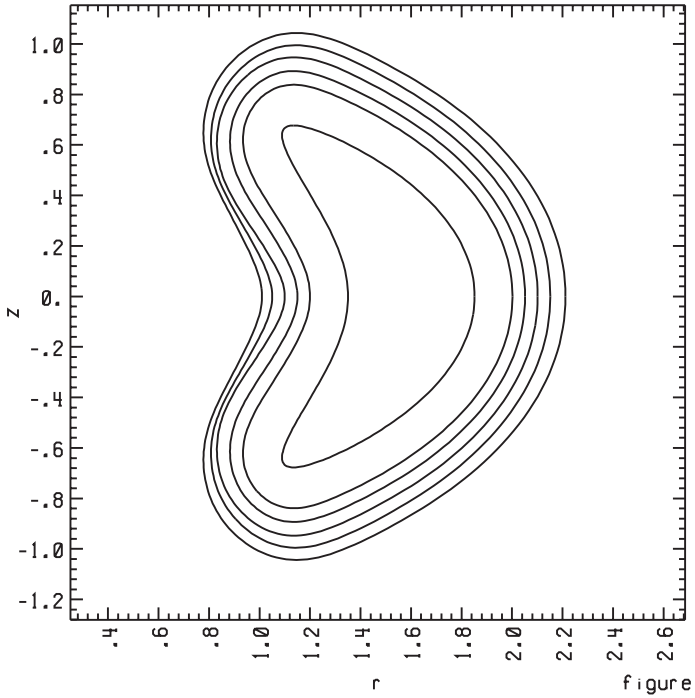
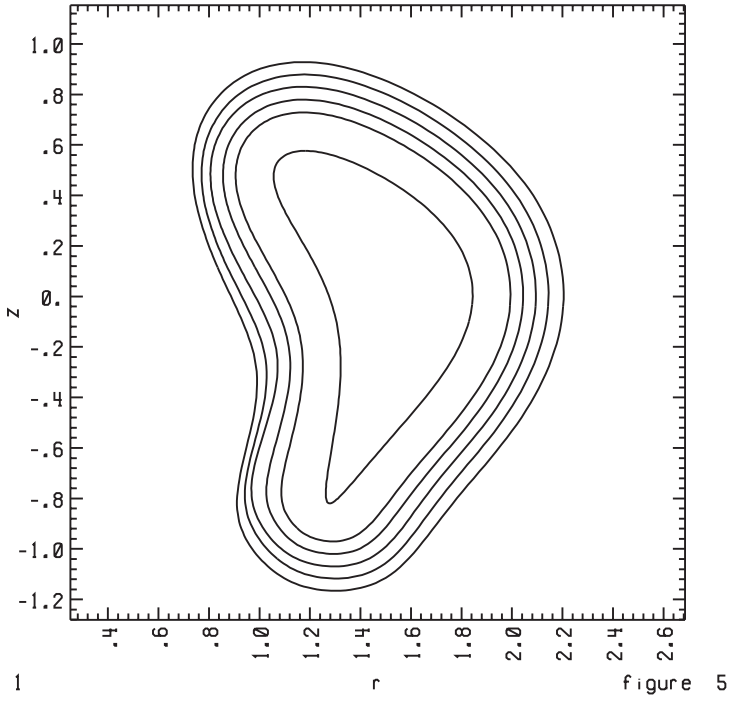
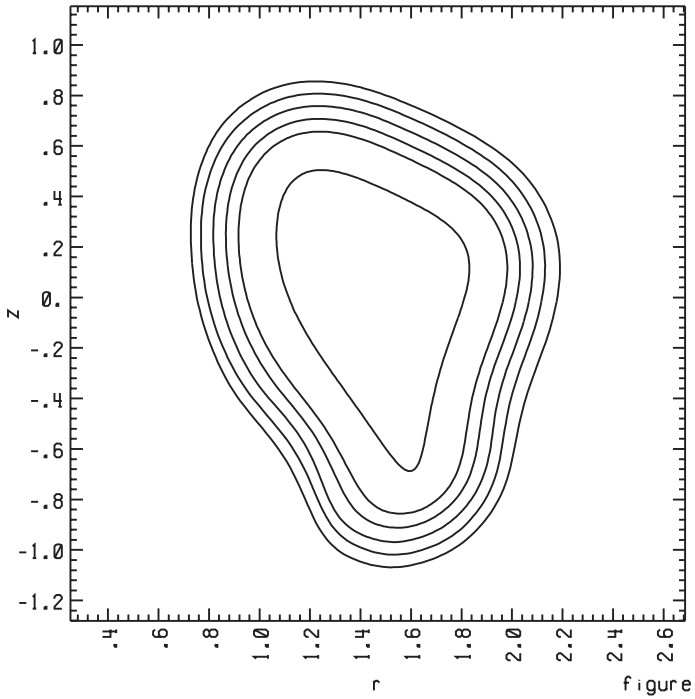
on behalf of the NCSX coil team

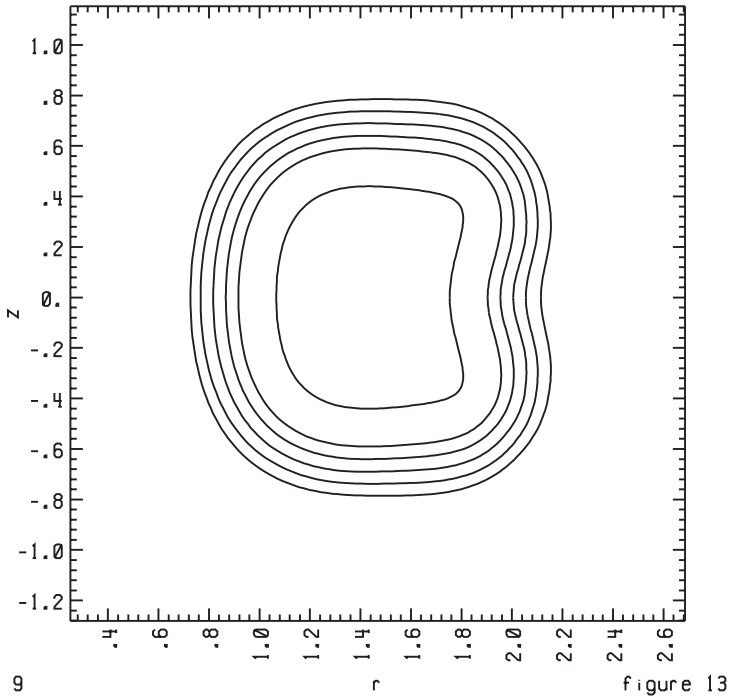
US-Japan Stellarator Workshop
Sept. 22 - Sept. 24, 1999
Oak Ridge, Tennessee

QAS









QOS

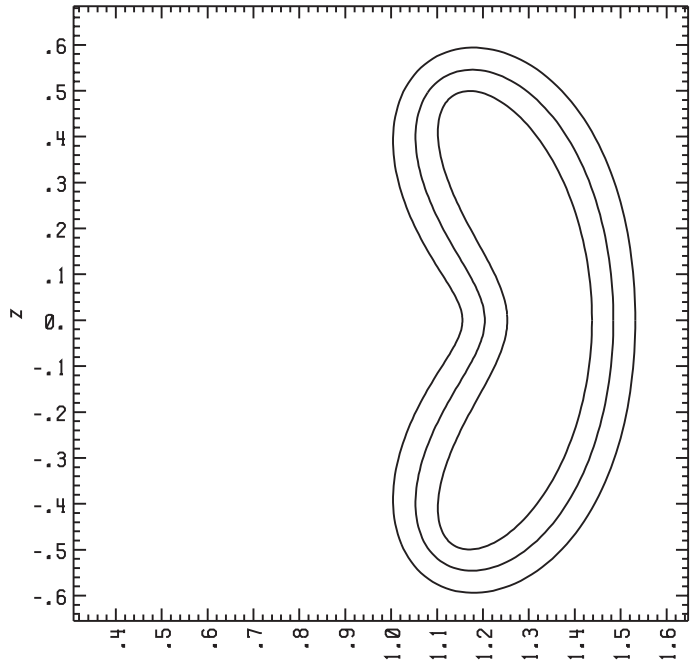


figure 1

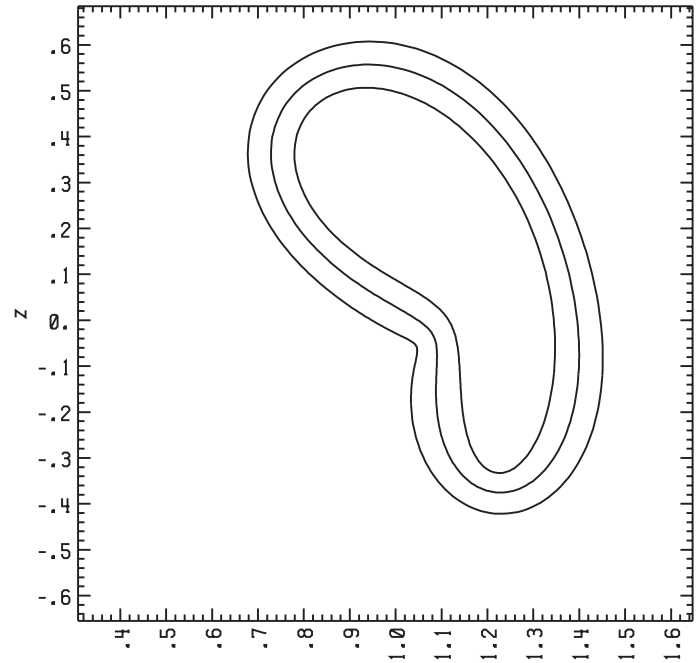


figure 5

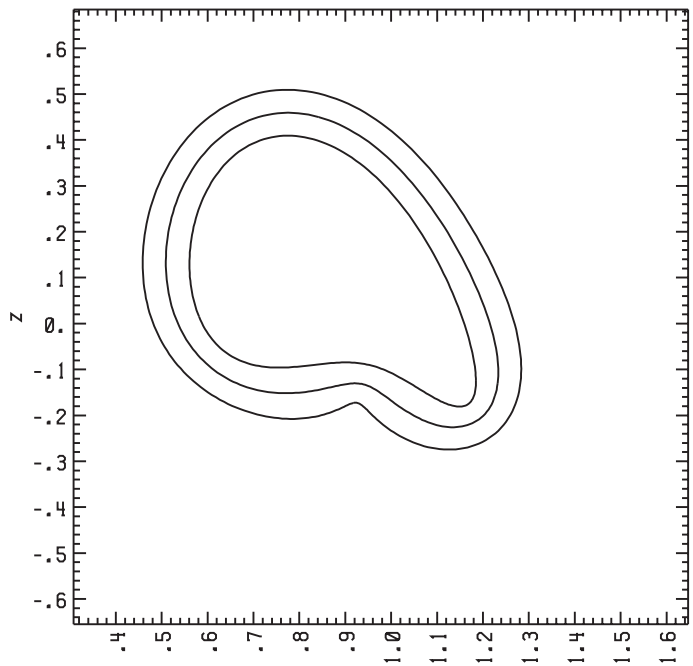


figure 9

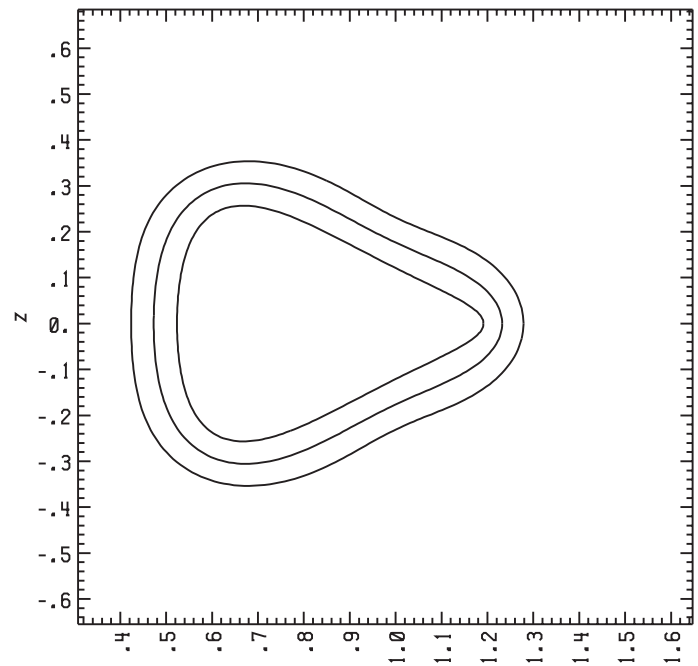
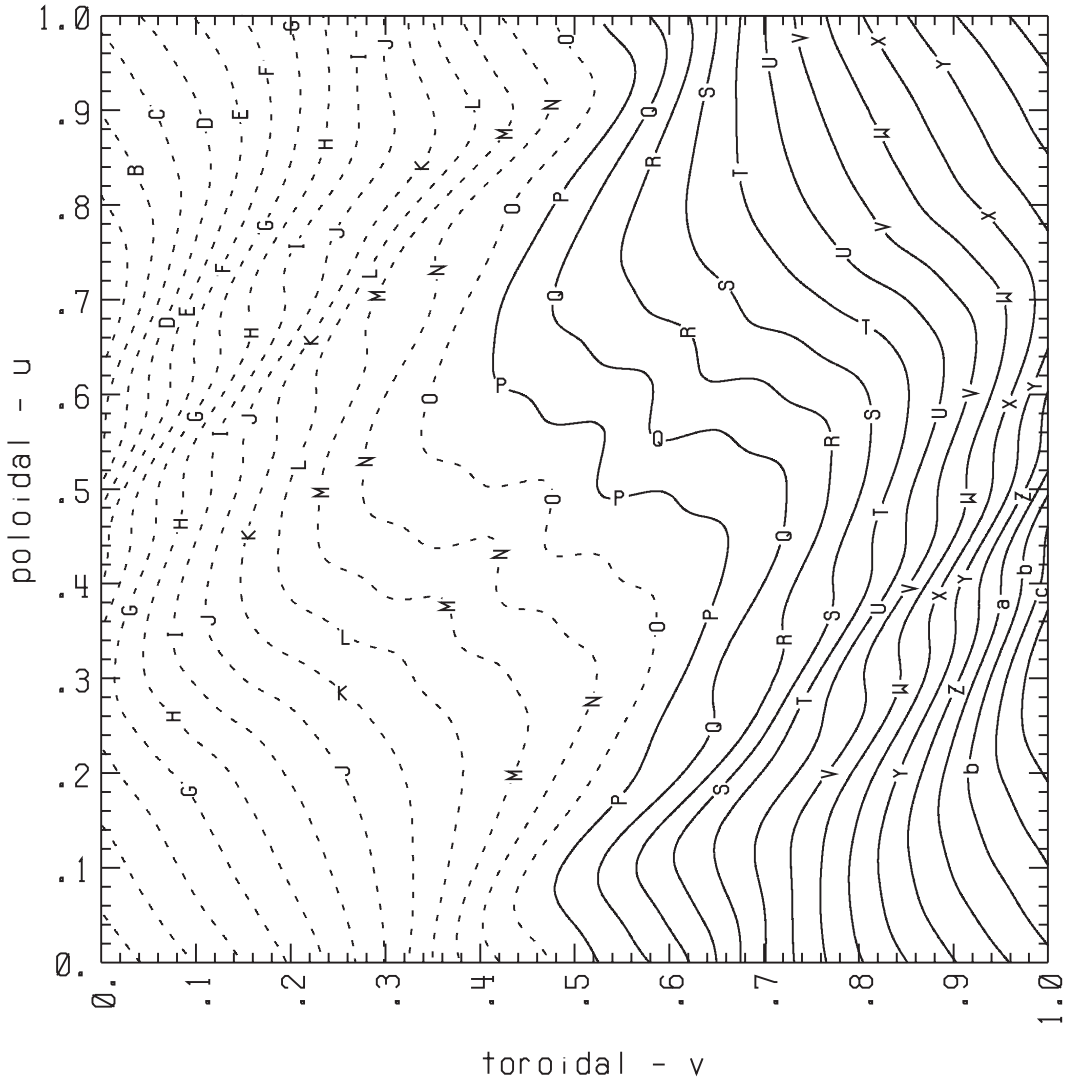


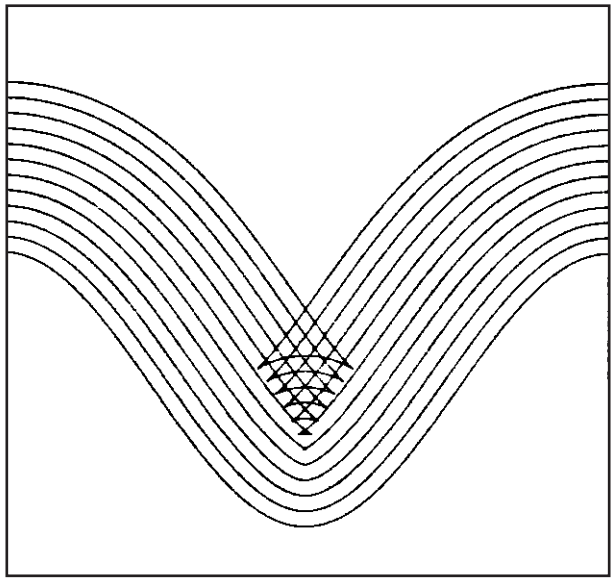
figure 13

Current Potential qo36v.f1010.d10.3

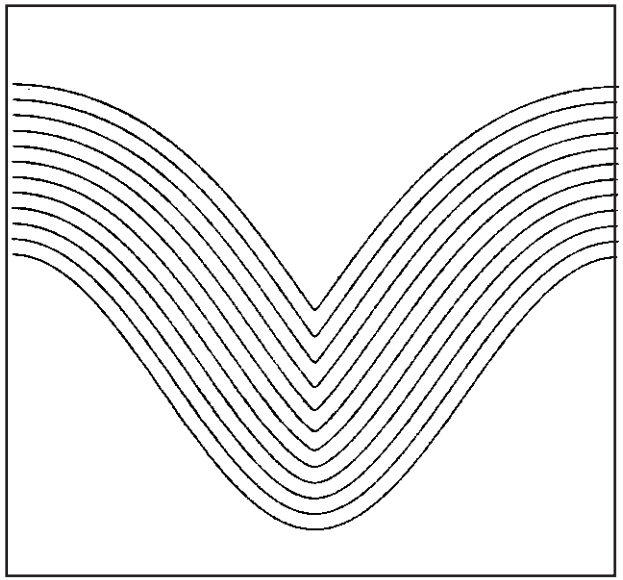
0.0 1.0 0 0 0

Max Value · 1.13E+00 Min Value · -1.33E-01 Contours · 4.08E-02





Swallowtail



Entropy Solution

Cosine curve propagating with unit speed

Fast marching methods are computational methods that approximate the solution to the nonlinear Eikonal equation of the form

$$|\nabla u(x)| = F(x) \text{ in } \Omega,\ F(x) > 0,$$

$$u = g(x) \text{ on } \Gamma$$

where Ω is a domain in R^2 or R^3. Here, the right-hand side, $F(x)$, is typically supplied as a known input to the equation as is the boundary condition that u is equal to a known function, $g(x)$, given along a prescribed curve or surface Γ in Ω

The to key to the algorithm is the use of an upwind differencing scheme (Godunov) to approximate the gradient operator. The central idea is to systematically construct the solution in a "downwind" fashion to produce the solution u. That is, the Eikonal equation is solved by building the solution outward from the smallest value of u.

Initialization

Tag all points in the initial conditions as **ALIVE**

Tag as **CLOSE** all points one grid point away

Tag as **FAR** all other grid points

The Computational Loop

1) Let **TRIAL** be the point in **CLOSE** with the smallest value of u.

2) Tag as **CLOSE** all the neighbors of **TRIAL** that are not **ALIVE**. If the neighbor is in **FAR** remove it from that list and add it to **CLOSE**.

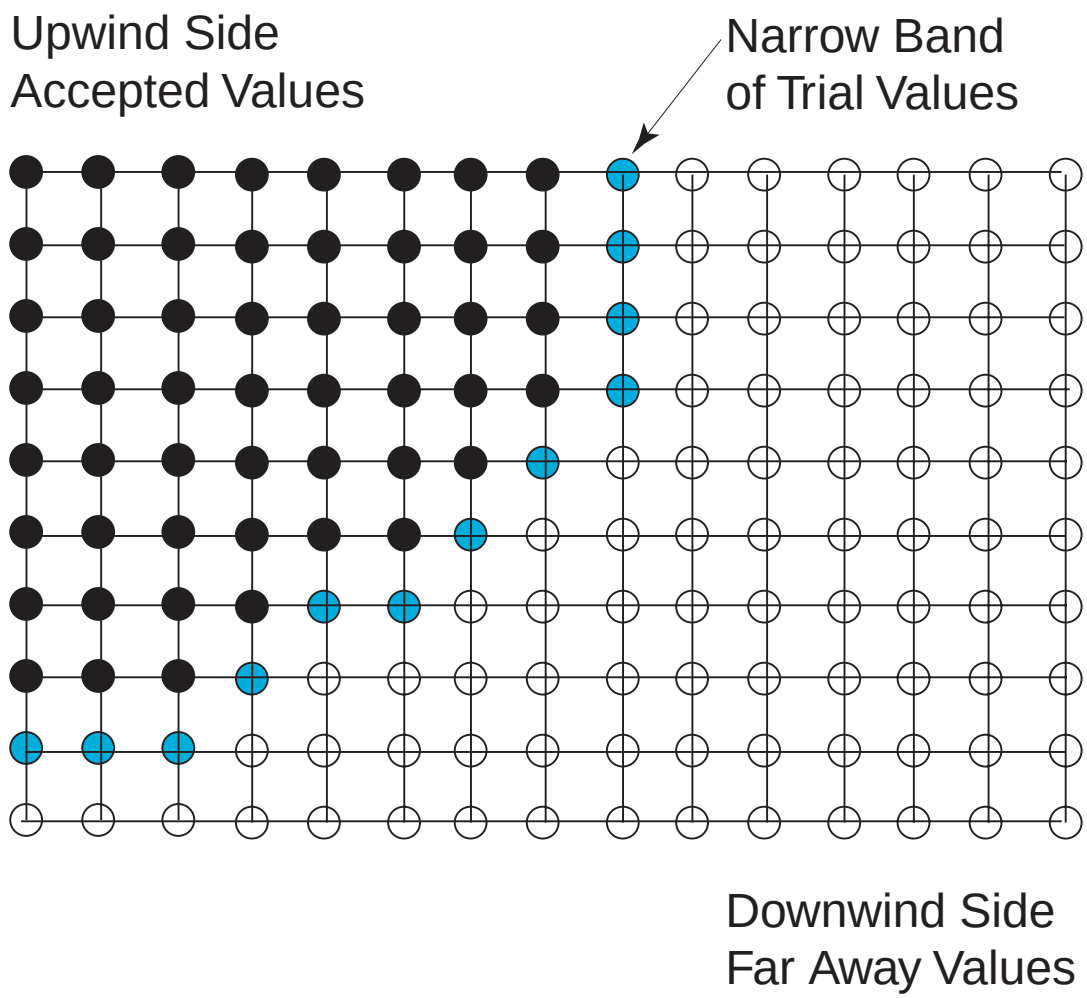
3) Recompute the values of u at all **CLOSE** neighbors of **TRIAL** by solving the quadratic that is obtained from the upwind differencing scheme.

4) Add the point **TRIAL** to **ALIVE** and remove it from **CLOSE**.

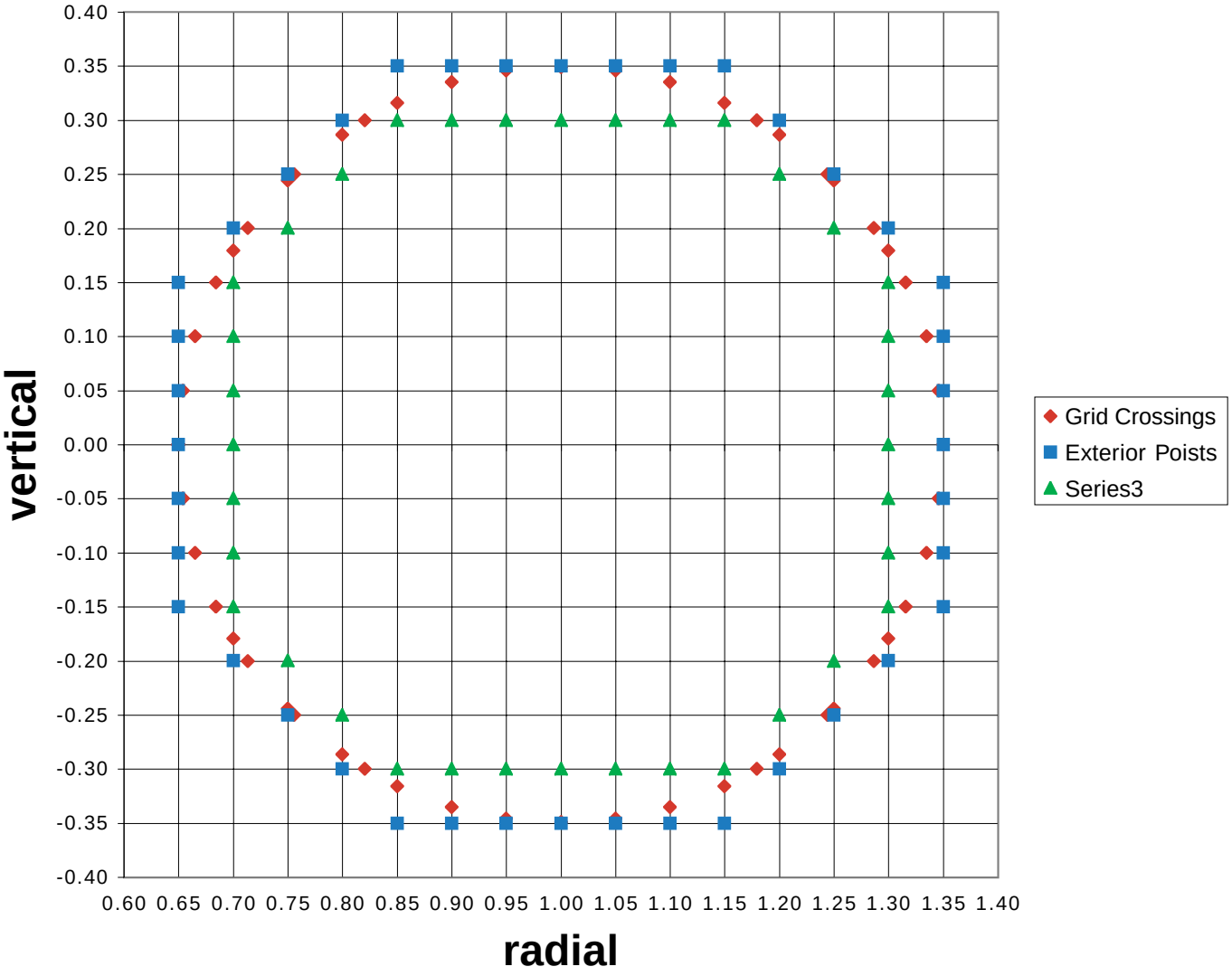
5) Return to the top of the loop.

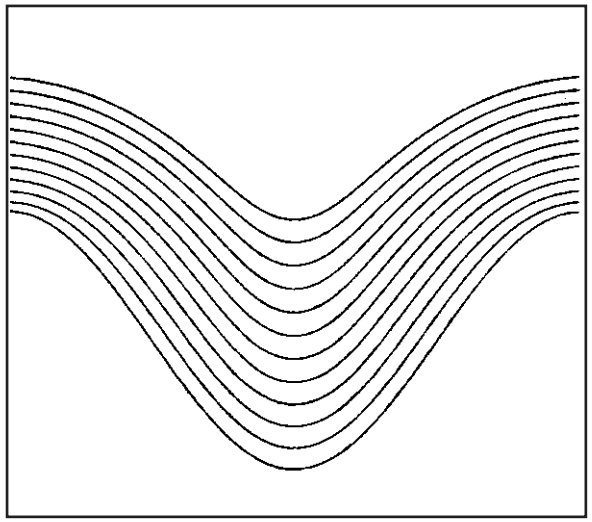
If initial boundary lies on a grid Then start

Else compute the signed distance function from the boundary to the nearest grid points. Grid points outside the surface receive positive values and inside negative values.

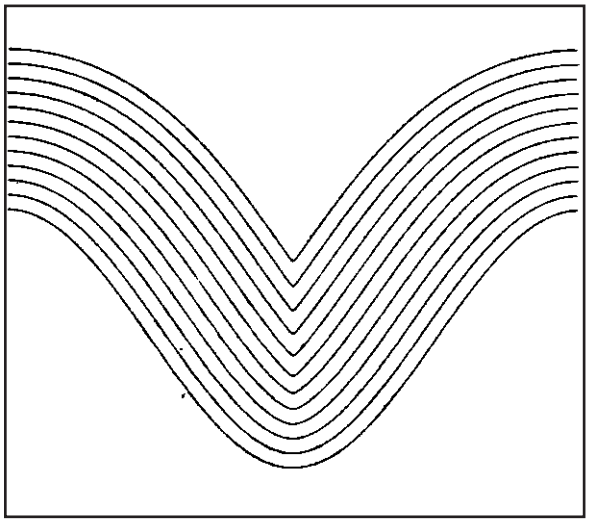

Upwind Side
Accepted Values
Narrow Band
of Trial Values
Downwind Side
Far Away Values

Circle Example





F = 1.0 - 0.25κ



Entropy solution (F = 1.0)

Entropy solution is the limit of viscous solutions