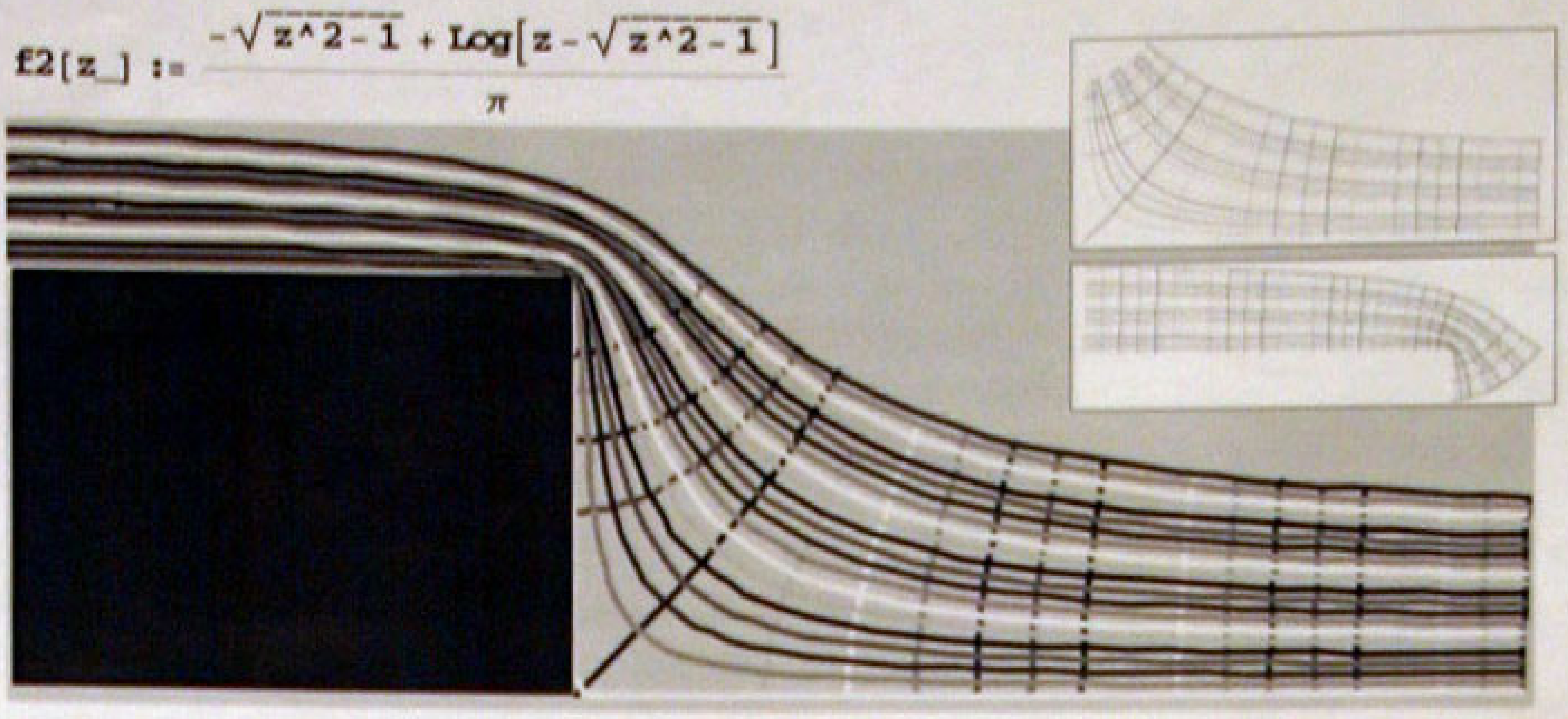
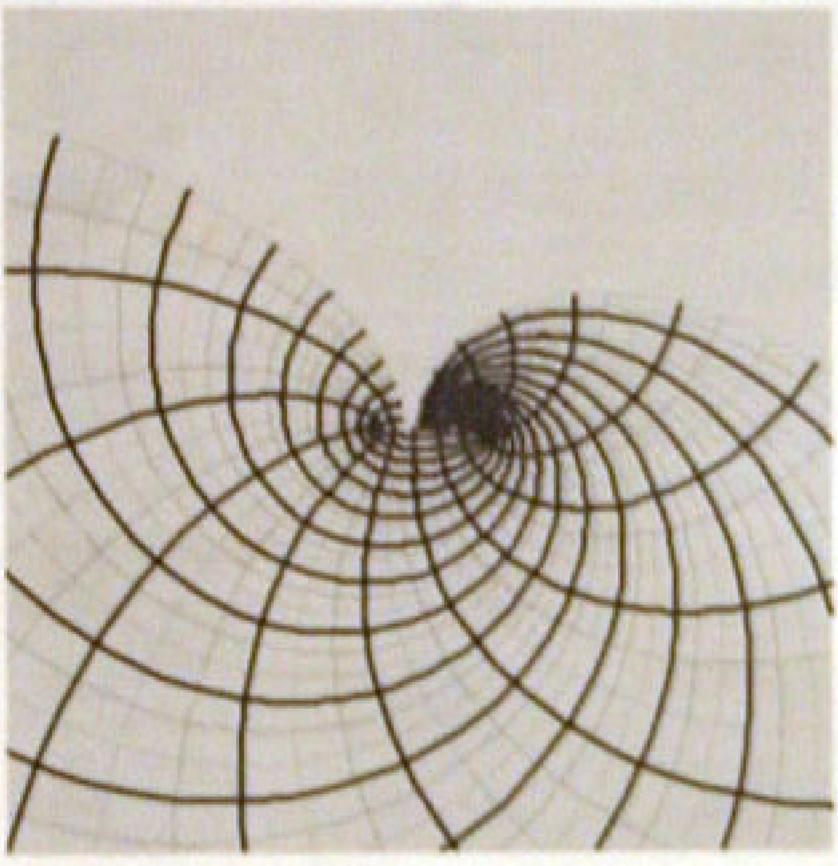
Piecewise Representation of Flow over an Obstacle

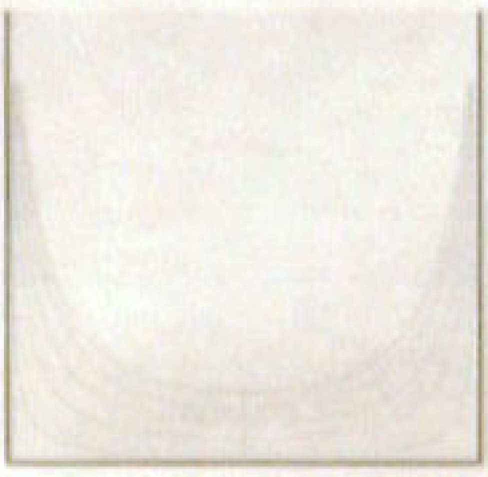
$$f1[z\_] := \frac{\sqrt{z^2-1} + \mathrm{Log}\left[z + \sqrt{z^2-1}\right]}{\pi};$$

$$f2[z\_] := \frac{-\sqrt{z^2-1} + \mathrm{Log}\left[z - \sqrt{z^2-1}\right]}{\pi}$$



Complex Mapping with Built-in Functions in *Mathematica*





The left plot uses a spherical Bessel function in **PolarPlot**

A fluid hugs the walls of a box in the plot above. The argument for **CartesianPlot** is $f(z)=\arcsin(z)$.

Conclusions

In using the concept of an ideal fluid flow across the complex plane, we first defined the velocity vector, followed by the complex potential. Only fluids of irrotational flow were considered. Using the equation of continuity, equipotentials and streamlines were defined. These functions can easily be plotted using *Mathematica*. The visualization of such fluid flows is important for understanding ideal effects, such as those observed with the Joukowski Airfoil. Conformal mapping techniques can also aid in visualizing functions of complex variables.

Resources

Harlow, F. H. "Numerical Fluid Dynamics". American Mathematical Methods. Vol. 72, No. 2, p. 84-91. Feb 1965.

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