Note on "three-dimensional" plotting as a technique for finding the zeros of functions in the complex plane

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This note explains the usefulness of a projected three-dimensional plot in locating the poles and zeros of a complex function.

Portions of F. M. Larkin's (1964) "combined graphical and iterative approach to the problem of finding zeros of functions in the complex plane" have been programmed in complex arithmetic (FORTRAN IV) for the IBM-7094 computer at Los Alamos. The Stromberg–Carlson 4020 film plotter is used as the "automatic graph plotter." The contour plots obtained from the test function

$$f(z) = \frac{(z-1)(z-i)}{(z+1)(z+i)^2} \qquad (1)$$

where $z = x + iy$, are in agreement with Larkin's results.

We have added a projected 3-dimensional plot of the absolute value of $f(z)$ which has been quite useful in providing a visual display of the quality of the function. In more complicated complex functions, small perturbations of the "3-D" plot have led to closer (finer mesh) investigations of the perturbed areas and have assisted in the definition of obscure poles and zeros.

Fig. 1 is a plot of eqn. 1, $|f(z)|$, $-1\cdot5 < (x \text{ and } y) < 1\cdot5$, truncated for clarity. The poles and zeros are obvious and the relative order of the poles, in this instance, is evident from the area of their cross-section. We must comment that, in addition to the utility of the "3-dimensional" displays, they are rather appealing aesthetically.

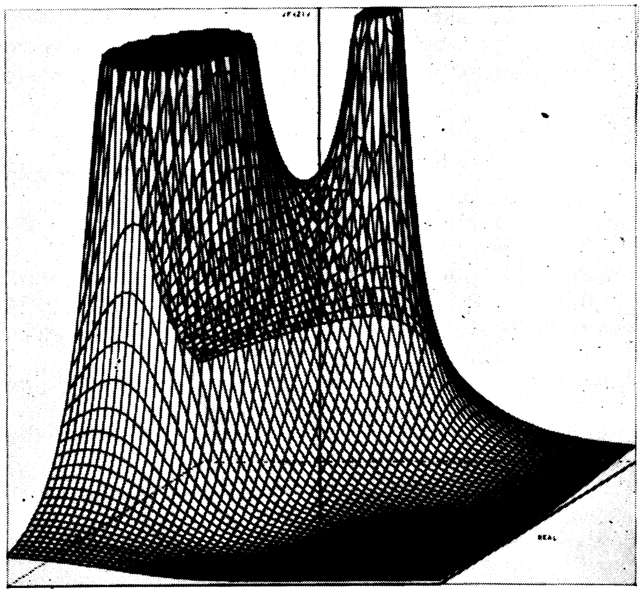

Fig. 1

A projected three-dimensional plot in the complex plane

Reference

LARKIN, F. M. (1964). "A combined graphical and iterative approach to the problem of finding zeros of functions in the complex plane," *The Computer Journal*, Vol. 7, p. 212.

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