

Worksheet

Question 1:

Electrical current is flowing through a square block. The top and left hand wall are insulated and current flows uniformly in through the bottom and out of the right hand wall. Calculate the values of the stream function along all the boundaries if the block is 1m by 1m and the total current is 100amps.

Question 2:

Calculate the analytical solution to this problem. It will take the form of an infinite series solution with one set of terms for each of the boundaries. You will need to calculate the infinite series required to match each of the boundaries and add these solutions up.

Question 3:

Write a Python script to calculate the stream function values at every point on a 100x100 grid.

You should use sufficient terms in your approximation of the infinite series that your residual is less than a value that you choose (accuracy to 5 or 6 significant figures is likely to be sufficient). Note that the infinite series solution will not converge in the corner points as these will remain zero. To avoid this issue you could use the known values of the stream function on the boundaries rather than the values obtained from the infinite series.