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Crowdy's extensions to Schwarz-Christoffel formulae for conformal mapping

Professor Darren Crowdy, Chair of Applied Mathematics, Imperial College, London

The 140 year-old mathematician's problem has been solved by Dr Darren Crowdy, Chair of Applied Mathematics at Imperial College London in his work with conformal mapping, a key theoretical tool used by mathematicians, engineers and scientists to translate information from a complicated shape to a simpler circular shape for easier to analysis.

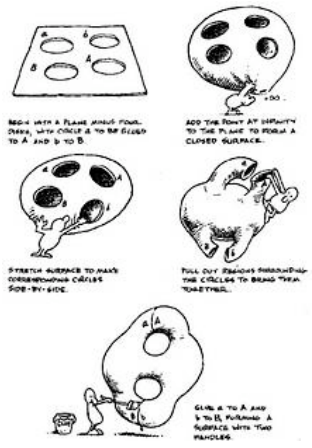
The theoretical tool has a long history and is used in a large number of fields including modelling airflow patterns over intricate wing shapes in aeronautics. It is also currently being used in neuroscience to visualise the complicated structure of the human brain.

A formula, the Schwarz-Christoffel formula, was developed by two mathematicians in the mid-19th century to enable them to carry out this kind of mapping. However, for 140 years there it has had a deficiency: it only works for shapes without holes or irregularities.

Now Professor Crowdy's additions to the formula mean it can be used for these more complex shapes.

"This formula is an essential piece of mathematical kit which is used the world over. Now, with my additions to it, it can be used in far more complex scenarios than before. In industry, for example, this mapping tool was previously inadequate if a piece of metal or other material was not uniform - for instance, if it contained parts of a different material, or had holes," he explains.

Professor Crowdy's work overcomes these obstacles and he says he hopes it will open up many new opportunities for this kind of conformal mapping to be used in diverse applications.



Constructing the Riemann surface of a planar figure with 2g holes. From Indra's Pearls

"With my formulae extensions, you can take account of these differences and map them onto a simple disk shape for analysis in the same way as you can with less complex shapes without any of the holes," he adds.

Source: http://www.ma.ic.ac.uk/~dgcrowdy/index.html

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