Title: **A novel Cartesian cut-cell approach.**

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Published in: *Finite volumes for complex applications*, **IV**, 515–524, (2009)

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The cut-cell approach to the solution of differential equations was historically one of the original methods to deal with complex, changing boundaries, i.e., the MAC code by Harlow and Welch, 1965. The advantages of the cut-cell methodology derived from the use of cartesian grid where the discrete representation of the differential equations is uniform and of know error.

The cut-cell or embedded cartesian grid is used in the simulation of environmental phenomena, wave mechanics, flame propagation, and similar problems.

In this paper, the authors present an alternative treatment of the boundary conditions. Instead of extrapolating the values of the solution to the grid points in the boundary, this new approach extrapolate the boundary conditions to the nearby cartesian grid-line by means of a Taylor expansion. The geometric configurations that can result from such approach are very limited in number and of straightforward solution.

Details of the 1-dimensional and 2-dimensional boundary condition cases are presented, as well as examples of the numerical results obtained from the application of this methodology to the shallow water equations.

See also:

1. This approach is used by Delft Hydraulics Laboratory software:
   `http://www.wldelft.nl/soft/waves/triton/index.html`

2. Schwartz, P. et al., Cartesian grid embedded boundary method for the heat equation and Poisson's equation in three dimensions, available online at:
   `http://www.stanford.edu/ barad/publications/SchwartzBaradColellaLigocki.pdf`