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Can fractal objects operate as efficient inline mixers?[1] SYLVAIN LAIZET, JOHN CHRISTOS VASSILICOS, Imperial College London, TURBULENCE, MIXING AND FLOW CONTROL GROUP TEAM — Recently, Hurst & Vassilicos, PoF 2007, Seoud & Vassilicos, PoF 2007, Mazellier & Vassilicos, PoF, 2010 used different multiscale grids to generate turbulence in a wind tunnel and have shown that complex multiscale boundary/initial conditions can drastically influence the behaviour of a turbulent flow, but that the detailled specific nature of the multiscale geometry matters too. Multiscale (fractal) objects can be designed to be immersed in any fluid flow where there is a need to control and design the turbulence generated by the object. Different types of multiscale objects can be designed as different types of energy-efficient mixers with varying degrees of high turbulent intensities, small pressure drop and downstream distance from the grid where the turbulence is most vigorous. Here, we present a 3D DNS study of the stirring and mixing of a passive scalar by turbulence generated with either a fractal square grid or a regular grid in the presence of a mean scalar gradient. The results show that: (1) there is a linear increase for the passive scalar variance for both grids, (2) the passive scalar variance is ten times bigger for the fractal grid, (3) the passive scalar flux is constant after the production region for both grids, (4) the passive scalar flux is enhanced by an order of magnitude for the fractal grid.

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Sylvain Laizet
Imperial College London

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