

Abstract Submitted  
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**PIV Measurements of the Near-Wake behind a Fractal Tree<sup>1</sup>**

KUNLUN BAI, CHARLES MENEVEAU, JOSEPH KATZ, Johns Hopkins University — An experimental study of turbulent flow in the wake of a fractal-like tree has been carried out. Fractals provide the opportunity to study the interactions of flow with complicated, multiple-scale objects, yet whose geometric construction rules are simple. We consider a pre-fractal tree with five generations, with three branches and scale- reduction factor 1/2 at each generation. Its similarity fractal dimension is  $D_s \sim 1.585$ . Experiments are carried out in a water tunnel with the ability of index- matching, although current measurements do not utilize this capability yet. The incoming velocity profile is designed to mimic the velocity profile in a forest canopy. PIV measurements are carried out on 14 horizontal planes parallel to the bottom surface. Drag forces are measured using a load cell. Mean velocity and turbulence quantities are reported at various heights in the wake. Mean vorticity contours on the upper planes show signatures of the smaller branches, although the wakes from the smallest two branches are not visible in the data possibly due to rapid mixing. Interestingly, their signatures can be observed from the elevated spectra at small scales. Momentum deficit in the wake profiles and drag forces are compared. The results from this experiment also serve as database against which to compare computer simulations and models.

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