Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

3D flow investigation near the denticles of biomimetic shark skin model using Digital In-line Holographic Microscopy[1] MOSTAFA TOLOUI, JIARONG HONG, University of Minnesota — It has been hypothesised that the complex microscopic denticles on a shark skin reduce the total drag for a swimming shark. However, the fundamental mechanism of this hydrodynamic function is not fully understood due to the inability to reproduce the complex shark surface and resolve the detailed flow around the skin denticles. Here we report a preliminary experiment using a 3D printed transparent rough surface replicating the morphological features of real shark skin. The model skin consists of closely-packed denticles of 2 mm in scale, i.e. $\sim$ 10 times of the real size. Particle image velocimetry based on digital in-line holography is employed to measure 3D flow structures. To reduce optical abberration and enable imaging around the denticles, we use a fluid medium that has the same optical refractive index as that of the skin model. The experiment is conducted in 2"x2" square channel at a moderate Re number matching the general flow around a cruising shark. Several samples of the 3D velocity field amid and above the denticles are obtained. The follow-up research envisions a large dataset of these samples over the rigid/deformable model operated in stationary/undulating mode to ellucidate the dominant flow structures generated by the denticals.

[1]This research is collaborated with Prof. George Lauder's group.

Mostafa Toloui
University of Minnesota

Date submitted: 01 Aug 2013 Electronic form version 1.4