Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Optimization of mangrove-root inspired arrangements for minimizing wake disturbances AISHWARYA S. NAIR, AMIRKHOSRO KAZEMI, OSCAR M. CURET, SIDDHARTHA VERMA, Florida Atlantic University — Coastal protection measures such as seawalls are vital for reducing the impact of storms and risk of flooding. The root systems of red mangroves, which are a part of certain coastal ecosystems, provide a natural barrier that dissipates wave energy effectively. The replication of such systems could benefit the design of coastal protection infrastructure substantially. In this work, we present simulations of flow across arrays of circular cylinders, as a simplified model of the root network. The objective is to determine the optimal root arrangements that minimize the disturbances in their wake. We couple these simulations with a genetic optimization algorithm, NSGA - II, to discover the optimal configurations that generate the least enstrophy in their wake. The configurations that produce the highest and lowest enstrophies were studied experimentally using Particle Imaging Velocimetry, and a soap film setup. The resulting flow patterns are analyzed to relate the increase or decrease in wake-disturbance to interactions among vortices shed at the individual cylinder level within the arrangements.

Aishwarya S. Nair
Florida Atlantic University

Date submitted: 26 Jul 2019 Electronic form version 1.4