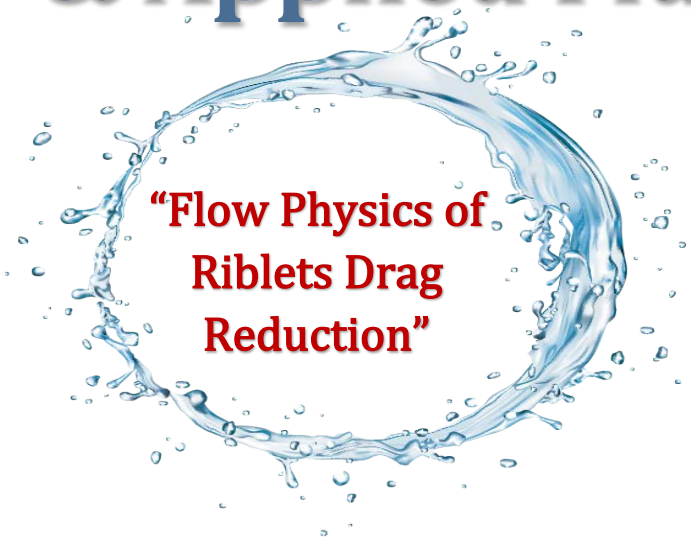
Center for Environmental & Applied Fluid Mechanics



Prof. Daniel Chung
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Mechanical Engineering

Riblets are a surface texture that reduce skin-friction drag in turbulent flow, and can now be found on in-service aircraft. Riblets are a repeating pattern of flow-aligned ribs, with spacing smaller than the smallest vortices of turbulence. On the fuselage of a passenger aircraft, this spacing is about 100 microns. Riblet performance is notoriously sensitive to the fine details of their micro-structure, with optimal performance thought to require sharp tips, which are impossible to manufacture and maintain in practice. Thus, their successful application requires careful lifetime management of performance benefits, balanced against manufacturing, installation and maintenance costs. Key to this balancing act is our ability to accurately predict riblet performance given the inevitable micro-structure imperfections. To this end, I will discuss our group's flow-physical modeling of the interaction between detailed riblet shapes and the near-wall vortices of turbulence; the outcome is a consistent improvement in accuracy of performance predictions across diverse riblet shapes. I will also discuss the flow behavior that influences the performance near the optimum, specifically, the occasional appearance of spanwise-rolling flow structures, and where our flow-physical modeling can be refined to capture this riblet-shape effect. The flow physics of riblets continues to fascinate, with many open questions now seemingly amenable to closure, and with broader implications on other rough and drag-reducing surfaces now coming into view.

Fall 2023 CEAFM Seminar Series

November 17, 2023 ✖ 3:00 PM ✖ Hodson Hall 210