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Interaction of free-stream turbulence with laminar separation bubble: direct numerical simulation[1] SHIRZAD HOSSEINVERDI, HERMANN FASEL, University of Arizona — The separated laminar boundary layer in the presence of free stream turbulence was investigated using direct numerical simulation (DNS). To separate the laminar boundary layer, a suction blowing velocity distribution was applied along the upper boundary of the computational box, which resembles an inverted airfoil in the experiments of the Hydrodynamics laboratory at the University of Arizona. First, two and three-dimensional DNS were performed for the clean flow (without any disturbances). Flow transition was suppressed in the 2-D DNS, however transition to turbulence was observed in 3-D DNS (initiated in the separated shear layer above the wall) and the bubble was longer than in both 2-D DNS and experiment. In fact, the background disturbances, which originate from round-off and truncation errors in a numerical simulation, are not sufficient to reproduce "realistic" separation bubbles. As an alternative to introducing selective or random disturbances inside the boundary layer, we applied a numerical model for generating isotropic grid turbulence since this approach is less artificial and is based on relevant physical mechanisms. A good comparison was obtained with this method.

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[X] Prefer Oral Session
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