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Roughness induced flow separation in adverse pressure gradient[1]
JONGWOOK JOO, United Technologies Research Center , MIKE EMORY, SANJEEB BOSE, Cascade Technologies , GORAZD MEDIC, OM SHARMA, United Technologies Research Center — Surface roughness does not only increase turbulent mixing, but also thickens boundary-layers, making flows more susceptible to separation. Detailed flow physics related to the separation is not understood well. Bammert and Milsch (1972) demonstrates a clear example of surface roughness induced separation under adverse pressure gradient. In the study, compressor cascades with NACA 65 airfoils are systematically roughened and the flow over suction surface gradually separates early as roughness increases. A set of Large-Eddy Simulations (LES) over the Bammert's case is investigated, since RANS simulations using roughness models suffer from capturing the separation. In the current study, surface roughness is represented in two different approaches; 1) Realistic rough surface represented by stochastically distributed hills and valleys are gridded and solved with unstructured finite volume method, 2) Using block-structured grid, surface roughness is gridded as a staggered array of 3D rectangles, in a similar way of the previous study for roughened low pressure turbine (GT2016-57912). The current LES's capture rich features of the flow phenomena, which will bring comprehensive understanding of the roughness induced separation.

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