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Determination of wall pressure flows at supersonic Mach numbers
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Abstract
This article investigates the wall pressure dissemination on a circular duct when the flow is exhausted into a CD nozzle. This study aims at to scrutinize the static pressure on the duct wall and its growth when the control is activated. The microjets are employed at the base at pitch circle radius (PCR) of 6.5mm, and the radius of the microjets are 0.5mm. The Mach numbers and the duct area ratio used are 2.56, Mach (M) 2 and 3. The lift to diameter ratio (L/D) and nozzle pressure ratio (NPR) of the study were from L/D=10 to 1 and NPRs from 3 to 11. The NPRs tested were at different expansion level for M=2. The oscillations in the duct flow field are seen when they are under expanded, and this trend continues for the total length of pipe. When the nozzles are ideally expanded the oscillations are absent as at this NPR only the Mach waves will be present. Similar trends are also seen at NPR 3 as well as whenever there is an adverse pressure gradient at Mach 2. With the decline in pipe length, the wavy nature of the flow is getting died out, and pressure recovery is smooth. The duct length and the backpressure has a crucial role to play in dictating the magnitude of wall pressure. L/D=2 seems to be sufficient for M=2 to continue to remain committed with the pipe, whereas for M=3 the lowest duct size required is L/D=4.

Author Keywords
Expansion level; Nozzle; Static pressure; Sudden expansion; Wake

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