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Receptivity of Tollmien–Schlichting Waves to Acoustic Disturbances and Combined Two- and Three-Dimensional Surface Roughness¹ JAMES E. KLESS, EDWARD B. WHITE, Case Western Reserve University -Recent computational studies have demonstrated that transient disturbances such as those generated by three-dimensional (3D) roughness elements can suppress the growth of unsteady Tollmien–Schlichting-like (TS) disturbances. This finding suggests that deliberately introduced 3D roughness might be used for passive transition control. Laboratory studies on the effectiveness of this technique have included TS waves produced by a two-dimensional (2D) source near the waves' first neutral point and transient disturbances produced by spanwise arrays of 3D roughness elements. To date, these studies have been inconclusive because the introduction of 3D roughness into situations where TS waves exist changes the TS waves' initial amplitudes. The present experimental study explores the origin of the changed initial amplitudes using TS waves produced by freestream acoustic waves and a 2D roughness strip. The key objective is to determine whether the modified initial amplitudes that are observed when 3D roughness is introduced result from superposed TS-like waves that originate at the 2D roughness strip and also the 3D roughness array or whether the spanwise-varying steady flow generated by the 3D roughness modifies the receptivity characteristics of the 2D source in a more fundamental manner.

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