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Calculating boundary layer receptivity to transiently growing roughness-induced perturbations using experimental data[1] NICHOLAS DENISSEN, EDWARD WHITE, Texas A&M University — The receptivity problem is of great interest in perturbations generated by surface roughness. To quantify non-modal receptivity, continuous spectrum amplitude distributions are calculated for transiently growing roughness-induced perturbations in a flat-plate boundary layer. Complex, realistic, surface roughness is beyond the scope of direct numerical simulation (DNS) currently. This makes analyzing the receptivity of experimental results essential. A method using regularizing functionals is shown for calculating the distributions when only partial experimental data is available. These results are validated against DNS results. These amplitude distributions provide a way of rigorously characterizing the boundary layer receptivity to surface roughness. Extracting the continuous spectrum amplitudes using the partial data technique reveals the underlying vortex behavior that creates transient growth that is too difficult to measure experimentally. The method described is amenable to future work with realistic distributed roughness and complex surface geometries, and is applied to cases currently beyond the scope of DNS.

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