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A Combined Numerical and Asymptotic Approach to Boundary Layer Receptivity Problems

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The interaction of free-stream disturbances with the leading edge of a body and its effect on the transition point is considered. This paper presents a method which combines an asymptotic approach in the receptivity region, and a numerical method to march through the Orr-Sommerfeld region. The asymptotic receptivity analysis produces a three deck eigensolution which in its far downstream limiting form, produces an initial condition for our numerical Parabolized Stability Equation (PSE). We discuss the advantages of this method against existing numerical and asymptotic analysis and present results which justifies this method for the case of a semi-infinite flat plate, where asymptotic results exist in the Orr-Sommerfeld region. The results show that the upstream boundary conditions being imposed are consistent, leading us to discuss how this method can be applied to more general bodies with curvature.

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