Exposito, D.; Gai, S. L.; Neely, A. J.
A note on the appearance of wave-packets in steady-state triple-deck solutions of supersonic flow past a compression corner. (English) Zbl 07628446

Summary: This study is an attempt at solving steady-state triple-deck equations using the method of Bos & Ruban (Phil. Trans. R. Soc. Lond. A, vol. 358, issue 1777, 2000, pp. 3063-3073) for supersonic flow past a compression corner. This was motivated by the fact that in their above paper, they show solutions for scale angles up to 8, the highest obtained so far in the literature. However, we encountered a stationary wave-packet at the corner for scale angles 1.82 and 1.96, depending on the values of stretching factors. Our solutions are then compared with the steady-state solutions produced using the method of Logue, Gajjar & Ruban (Phil. Trans. R. Soc. A, vol. 372, issue 2020, 2014, 20130342), which do not show such wave-packets. These wave-packets do not appear to be the result of flow instability, as flow instabilities should only appear with unsteady equations (Cassel, Ruban & Walker, J. Fluid Mech., vol. 300, 1995, pp. 265-285). It is therefore suggested that the method of Bos & Ruban (Phil. Trans. R. Soc. Lond. A, vol. 358, issue 1777, 2000, pp. 3063-3073) produces these spurious wave-packets as a consequence of their numerical method. This has important implications in the interpretation of triple-deck solutions.

MSC:
76N20 Boundary-layer theory for compressible fluids and gas dynamics
76J20 Supersonic flows
76M45 Asymptotic methods, singular perturbations applied to problems in fluid mechanics
76M20 Finite difference methods applied to problems in fluid mechanics

Keywords:
corner discontinuity; boundary layer separation; second-order finite difference scheme; Chebyshev collocation point; Newton linearisation

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References:


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