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Enhanced Drag Reduction by High Mach Number Streaming¹ TAPISH AGARWAL, BENI CUKUREL, IAN JACOBI, Technion — Significant drag reduction for a laminar boundary layer is predicted for high Mach number, travelling-wave flow actuation. Historically, low Mach number, temporal or standing waves were used to modify a base laminar flow by Stokes streaming. Predictions for the associated drag reduction were based on asymptotic, high frequency approximations of the governing momentum balance. We present a numeric solution of the full momentum balance for the streaming flow, based on Lin's Reynolds decomposition analysis, which allows for examination of the complete range of forcing frequencies. The solution also provides for analysis of travelling wave actuation, which is better suited for practical implementation in boundary layers and channels. The streaming-induced drag reduction is studied as a function of the Mach number, Reynolds number, forcing amplitude, and frequency. In particular, high Mach number, high frequency travelling waves are predicted to produce significant laminar drag reduction.

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