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# **Estimated accuracy of the analysis of momentum loss thickness in the laminar boundary layer on a hemisphere impermeable surface in a supersonic air flow**

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*The momentum loss thickness in the laminar boundary layer is one of its important characteristics, and the question of the accuracy of its calculation from the known formulae has not been satisfactorily described in the literature. In this paper, this problem is solved on the basis of systematic numerical calculations of boundary layer equations.*

**Key words:** momentum loss thickness, laminar boundary layer, supersonic airflow

## REFERENCES

- [1] Avduevskiy V.S., Galitsiyskiy B.M., Glebov G.A., et al. *Osnovy teploperedachi v aviationsionnoy i raketno-kosmicheskoy tekhnike* [Fundamentals of Heat Transfer in the Aviation and Aerospace Technology]. Koshkin V.K., ed. Moscow, Mashinostroenie Publ., 1975, 624 p.
- [2] Zemlyanskiy B.A., Lunev V.V., Vlasov V.I., et al. *Konvektivnyi teploobmen v letatelnykh apparatakh* [Convective Heat Transfer in Aircrafts]. Moscow, FIZ-MATLIT Publ., 2014, 377 p.
- [3] Predvoditelev A.S., Stupochenko E.V., Pleshanov A.S. *Tablitsy termodinamicheskikh funktsiy vozdukha (dlya temperatury ot 200 do 6000 K i davleniya ot 0,00001 do 100 atm.)* [Tables of Air Thermodynamic Functions (for Temperatures between 200 and 6000 K and Pressures from 0.00001 to 100 atm.). Moscow, Vychislitelnyi Tsentr AN SSSR Publ., 1962, 268 p.
- [4] Hirschfelder J.O., Curtiss Ch.F., Bird R.B. *Molecular Theory of Gases and Liquids*. John Wiley & Sons, Inc., New York Chapman And Hall, Ltd., London 1954.
- [5] Gorskiy V.V., Fedorov S.N. *Inzhenerno-Fizicheskii Zhurnal – Journal of Engineering Thermophysics*, 2007, vol. 80, no. 5, pp. 97–101.
- [6] Sokolova I.A. Koeffitsienty perenosa i integraly stolknoveniy vozdukha i ego component [Transfer coefficients and collision integrals of air and its components]. In: *Fizicheskaya kinetika. Aerofizicheckie issledovaniya* [Physical kinetics. Aerophysical Research.]. Novosibirsk, Proceedings of the Institute of Theoretical and Applied Mechanics SO AS USSR, no. 4, 1974, pp. 39–104.
- [7] Capitelli M., Colonna G., Gorse C., D'Angola A. Transport properties of high temperature air in local thermodynamic equilibrium. *The European Physical Journal*, 2000, № 11, pp. 279–289.
- [8] Gorskiy V.V. *Zhurnal vychislitelnoy matematiki i vychislitelnoy fiziki RAN – Journal of Computational Mathematics and Computational Physics RAS*, 2007, vol. 47, no. 6, pp. 939–943.
- [9] Ekkert L. *Voprosy raketnoy tekhniki – Rocket Technology*, 1957, no. 4, p. 3.

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