PECULIARITY OF THE EFFECT OF THE TEMPERATURE FACTOR ON HEAT TRANSFER IN PHYSICAL GASDYNAMICS, LASERS AND PLASMA CHEMISTRY

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XX age was famous for new scientific achievements in gasdynamics, aviation, internal combustion engines, gas flow lasers, plasma arc generators, coupled heat and mass transfer, theory of similarity, dissociation and non-equilibrium processes, high temperature gaseous atomic and nuclear reactors, plasma chemical reactors, air quenching processes, aeronautics, etc. All these processes had one main and common problem – the effect of the temperature factor T_f/T_w (where T_f is the bulk temperature of the gaseous flow, T_w is the temperature of a cold or hot wall) on the form of final numerical heat transfer equations.

For the first half of XX century one extrapolated equation was recommended for two cases: $0.1<T_f/T_w<1$ and $1<T_f/T_w<10$. Special investigations were made in the second half of XX century at the Lithuanian Energy Institute in Kaunas following the professional advices of Academician Algirdas Zhukauskas in a successful scientific cooperation with Academician Rem Soloukhin from the Heat and Mass Transfer Institute of the National Academy of Sciences of Belarus in Minsk.

For that long years, to make investigations in Kaunas the first plasma arc generators were got from Minsk and Novosibirsk, where R.I. Soloukhin together with Academician M.F. Zhukov were the main scientific pioneers in this new trend. In Minsk those works were extended by the late Prof. O.I. Yasko and his co-workers.

The comprehensive theoretical and experimental investigations into the effect of the temperature factor on high-temperature heat transfer in physical gasdynamics during 1960-1990 years in Kaunas and Minsk showed that the form of the heat transfer equation depended on the temperature factor, i.e., the heat flux direction from a hot wall to a cold gaseous flow or from a hot flow to a cold wall. For first case: $0.2< T_f/T_w <1.0$, the heat transfer equation for tube flow must be expressed by $Nu_f = 0.019\ Re_f^{0,8}\ (T_f/T_w)^{0,25}$. For second case: $0.1<T_f/T_w<10$ this equation must be expressed by $Nu_f = 0.019\ Re_f^{0,8}$, without the temperature factor, i.e., no effect of the temperature factor on the expression of the equation. The last expression can be used for dissociated diatomic gases (air, nitrogen, etc.) using additional methods. All of this together with the theoretical calculations will be presented during the colloquium.