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# Modeling Flow in Pipes and Heat Transfer Surface C Turbulators at Cross Section in Frme Square (S/H = 1) and the Rib (S/H << 1) Low-Based on Theory Menter

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## Introduction

Study of flow patterns turbulize mainly conducted experimental methods [1], whereas the calculated current research on the subject is quite sparse and only partially dedicated structure particularly intensified currents; in part procedures (for example, in [2]) is used advantageously integrated approach to the problem under consideration. This report directly devoted study structures flows in pipes, intensified sur-face intermittently established protrusions c cross section of a rib in a compara-tive analysis with turbulence square cross section.

The main objective - To investigate theoretically generated eddy zones for pipes with protrusions square and ribbed cross sections through to factor finitely volumetric methods (FKOM) which were successful way tested in calculations similar currents in [2], where basically considered calculations as averaging intensified parameters flows and heat exchange.

Calculation of current for pipe lines with transverse turbulators annular cross section in the form of rib ( $s/h \ll 1$ , where $S$ - turbulizer width - height of the baffle) for the considered range of the determining parameters $\left(\mathrm{Re}=10^4 \div 10^5; \mathrm{Pr}=0.72 \div 10; d/D=0.95 \div 0.90; t/D=0.25 \div 1.00\right)$ is based on the fact that as a result of previously conducted, for example in [2], numerical computations were obtained local and integral the flow characteristics and heat transfer in the straight round pipes with semi-circular and square turbulators with reduction of corresponding current lines.

Were constructed the calculated current characteristic line for pipes with sur-face turbulence with cross-sections in the form of a square $\left(s/h == 1\right)$ and in the form of rib $\left(s/h == 0.15\right)$ for the above flow conditions.

The results obtained in this study for Low- models calculated data on heat transfer and hydraulic resistance for the conditions $\mathrm{Re}=10^4; \mathrm{Pr}=0.72; d/D=0.98 \div 0.90; t/D=0.25$ to turbulence in the form of a square with edges and $\left(s/h == 0.15\right)$ showed that during the transition from the square to the edge takes place as the increase of the hydraulic resistance and heat:

$\xi_R/\xi_P = 101.5\%; Nu_R/Nu_P = 100.75\%$ for low turbulence and $\xi_R/\xi_P = 138.5\%; Nu_R/Nu_P = 105.5\%$ for high turbulators ( $\xi_R/\xi_P$ , $Nu_R/Nu_P$ ( $\xi$ is the coefficient of hydraulic resistance; - Nusselt number, codes “ “ - rectangular, “ “ - rib)).

For higher Reynolds numbers, ceteris paribus $\left(\mathrm{Re}=10^5; \mathrm{Pr}=0.72; d/D=0.98 \div 0.90; t/D=0.25\right)$ are the following corresponding data: $\xi_R/\xi_P = 109.0\%; Nu_R/Nu_P = 104.3\%$ for low turbulence and for high turbulence. Similar data have large Reynolds numbers , ceteris paribus, the analy-sis of which allows the following conclusions: reduction $Nu_R/Nu_P$ values with increasing Prandtl number from 0.72 to 10 for relatively low turbulence of the order of 1%; for relatively medium $\left(d/D = 0.95 \div 0.93\right)$ - about 2%; for relatively high - of the order of 6%.

## Conclusion

In conclusion, I would like to add that the resulting local and average parameters of the flow and heat transfer in pipes with over-nhostname the turbulence of the flow cross section in the form of a rib $\left(s/h = 0.15\right)$ for a wide range of the determining parameters

$$\left(\mathrm{Re}=10^4 \div 10^5; \mathrm{Pr}=0.72 \div 10; d/D=0.98 \div 0.90; t/D=0.25 \div 1.00\right);$$

for comparison were calculated for the same parameters turbulators square cross-section $\left(s/h = 1\right)$ .

In practical terms, the method allows to improve the weight and size, cardinality, hydraulic, thermal, etc. performance of heat exchangers and heat-exchange equipment of modern aviation and space-rocket production.

## References

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