NOMENCLATURE

a – thermal diffusivity, m^2/s
A_c – area of the undisturbed flow, m^2
A_v – reduced area, m^2
d_1 – maximum dimension of the oval profile of the rod, m
d_h – hydraulic diameter, m
D_t – effective coefficient of diffusion
F – open area of the bundle, m^2
F_{rods} – total cross-sectional area of rods in the bundle, m^2
G, g – flow rate of the coolant, kg/s
acceleration due to gravity, m/s^2
i, h – enthalpy, J/kg
I – momentum transfer, $kg/(m^2 \cdot s)$
l – diffusion length, m
distinctive length, m
m – bundle porosity with respect to the coolant, F/F_{rods}
m_k – flow rate of the coolant in the k-th cell, kg/s
n – number of rods in the bundle
p_k – pressure in the cell, N
rem – root-mean-squere;
s – rod spacing, m;
T, t – temperature, K
pitch of the wire wrapping, m
u – flow velocity, m/s
x – bundle length, m
Q, q – heat flux, W/m^2
$y_{k,n}$ – width of the velocity profile, m
α – heat transfer coefficient, $W/(m^2 \cdot K)$
β_q – coefficient of interchannel mixing
β_v – coefficient of volumetric expansion

$\delta_{k,n}$ – characteristic momentum mixing length
Δh – pressure difference on the Pitot tube, N
ε_q, μ_q – thermal diffusivities, m/s
ε_τ, μ_τ – turbulent viscosities, m/s
ε – blockage ratio of the flow area, $\varepsilon = A_n/A_c$
φ – angle, °
χ – shape factor
λ – thermal conductivity of the coolant, W/(m·K)
ν – kinematics viscosity, m²/s
$\Pi_{k,n}$ – length of the gap in which the cells interact, m
ρ – density, kg/m
τ – shear stresses, N/m
ξ – resistance coefficient of the bundle
ψ – relative heat transfer coefficient
ζ – resistance coefficient of the spacer grid
Fr_m – dimensionless number, characterizing the intensity of the flow swirl in the bundle of rods with a wire wrapping (modified Froud number $\mathrm{Fr}_m = T^2/d_1 d_h$)
Pr – Prandtl number ($\mathrm{Pr} = \mu c_p/\lambda$)
Nu – Nusselt number ($\mathrm{Nu} = \alpha d_h/\lambda$)
Ra – Rayliegh number ($\mathrm{Ra} = g\beta_v \Delta t l^3/\nu a$)
Re – Reynolds number ($\mathrm{Re} = u d_h/\upsilon$)
Le – Lewis number ($\mathrm{Le} = \rho c_p D_t/\lambda$)
St – Stanton number ($\mathrm{St} = \alpha/c_p \rho u$)

Subscripts and superscripts

∞ – in the free flow
ad – adiabatic
b – bundle
c – calculated
ch – channel
cr – critical
en – entrance
ex – experiment
f – conditions as to the flow temperature
i – cell number
is – isolation conditions

j – surface number
k,n – between the cells k and n
lar – laminar
q – heat
r – rough
ran – random
rem – root-mean-squere
ss – self-similar
sg – spacer grid
sh – shell
sm – smooth
st – stabilization
$syst$ – systematic
t – tube
ts – two-sided
w – conditions at the wall
τ – friction

Abbreviations

DARS – Lithuanian abbreviation for calculation of gas-cooled reactors
FA – fuel assembly
MVL – maximum velocity line
N – normal
PMV – point of maximum velocity
PN – principal normal
SG – spacer grid