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## LIST OF ABBREVIATIONS

$a$	Particle radius
$c$	Specific heat
$d$	Diameter
$f_e$	Equivalent volume concentration
$h$	Interfacial layer thickness
$h_f$	Averaged heat transfer coefficients of based fluid
$h_{nf}$	Averaged heat transfer coefficients of nanofluid
$h_p$	Enthalpy
$j_p$	Total nanoparticles mass flux
$j_{p,B}$	Nanoparticles mass flux due to Brownian diffusion
$j_{p,T}$	Nanoparticles mass flux due to thermophoresis
$k$	Thermal conductivity
$k_b$	Boltzmann's constant
$k_{cp}(r)$	Thermal conductivity of nanoparticle clusters predicted by Bruggeman model
$k_{c,x}, k_{c,y}$	Thermal conductivity components of the complex elliptical particle
$k_{eff}$	Effective thermal conductivity
$k_{pe}$	Equivalent thermal conductivity of the equivalent particles
$k_{static}$	Effective stagnant thermal conductivity of solid-liquid mixture
$k_v$	Enhancement in the thermal conductivity due to the thermal dispersion
$n$	Empirical shape factor given by $n = \frac{3}{\psi}$
$m$	Number of the particles per unit volume
$p$	Probability for a particle to travel along any direction
$u, v, w$	Velocity components in X, Y, Z Cartesian coordinates
$\bar{C}_{RM}$	Random motion velocity of nanoparticles
$C$	Modified model constants

## LIST OF ABBREVIATIONS (Continued)

$D$	Diameter of tube
$D_B$	Brownian diffusion coefficient
$D_T$	Thermal diffusion coefficient
$Kn$	Knudsen number
$P$	Pressure
$Pr$	Prandtl number
$Re$	Reynolds number
$S_i$	Remaining viscous term corresponding to the coordinate system
$T$	Temperature
$T_\infty$	Temperature at the infinite distance
$ \bar{V} $	Averaged velocity

### *Greek symbols*

$\gamma$	Ratio of interfacial layer thickness to particle radius = $\frac{h}{a}$
$\beta$	Function in Leong et al's model (2006) = $1 + \gamma$
$\beta_1$	Function in Leong et al's model (2006) = $1 + \frac{\gamma}{2}$
$\alpha$	Thermal diffusivity
$\lambda$	Ratio of the water molecule mean free path to the nanoparticle diameter
$\forall$	Volume
$\phi$	Volume fraction of the nanoparticles
$\tau$	Shear stress
$\rho$	Density
$\mu$	Viscosity
$\psi$	Sphericity

**LIST OF ABBREVIATIONS (Continued)***Subscripts*

<i>f</i>	Base fluid
<i>lr</i>	Interfacial layer
<i>nf</i>	Nanofluid
<i>p</i>	Particle