On the synergy field between velocity vector and temperature gradient in turbulent vortical flows

Submitted by Thierry Lemenand on Fri, 03/13/2015 - 18:33

Titre	On the synergy field between velocity vector and temperature gradient in turbulent vortical flows
Type de publication	Communication
Type	Communication avec actes dans un congrès
Année	2010
Langue	Anglais
Date du colloque	19-22/12/2010
Titre du colloque	ThETA3, Third International Conference on Thermal Issues in Emerging Technologies: Theory and Application
Pagination	8
Auteur	Habchi, Charbel [1], Lemenand, Thierry [2], Della Valle, Dominique [3], Peerhossaini, Hassan [4]
Pays	Egypte
Editeur	ASME (American Society of Mechanical Engineers)
Ville	Cairo

Résumé en anglais	The intensity of the secondary flow induced, especially, by streamwise vorticity, which are generated in their turn by vortex generators or in flows with curved streamlines has a direct impact on the heat transfer process. Thus the understanding and quantification of the physical mechanisms underlying the heat transfer by streamwise vorticity are fundamental for practical applications such as multifunctional heat exchangers/reactors (MHER) used in chemical processing industry, cooling of electronic systems and data centers, as well as biomedical engineering. In the present study, CFD simulations are performed to investigate the synergy field in two different flows. The synergy field principle is based on the assertion that the included angles θ between the streamlines and the isotherms is related to the heat flux that arises. From the local distribution of the intersection angle in the flow cross section, it is found that in the thinning region of the thermal boundary layer where the Nusselt number is the highest, θ is minimum. By introducing a characteristic parameter defined as the volume-averaged θ, it is found that the lowest θ value corresponds to the flow configuration presenting the highest Nusselt number. This confirms that the transport phenomena are intensified in the flow where the geometry minimizes this parameter. Finally, the study discusses the use of the synergy field principle in three dimensional turbulent vortical flows, and presents a new intensified MHER which can be used in several industrial processes.

URL de la notice http://okina.univ-angers.fr/publications/ua8839 [5]

Liens
[1] http://okina.univ-angers.fr/publications?f[author]=15323
[2] http://okina.univ-angers.fr/t.lemenand/publications
[3] http://okina.univ-angers.fr/publications?f[author]=15326
[4] http://okina.univ-angers.fr/publications?f[author]=15328
[5] http://okina.univ-angers.fr/publications/ua8839