



Study of time reversibility/irreversibility of cardiovascular data: theoretical results and application to laser Doppler flowmetry and heart rate variability signals

Submitted by Emmanuel Lemoine on Thu, 01/30/2014 - 14:35

Titre	Study of time reversibility/irreversibility of cardiovascular data: theoretical results and application to laser Doppler flowmetry and heart rate variability signals
Type de publication	Article de revue
Auteur	Humeau-Heurtier, Anne [1], Mahé, Guillaume [2], Chapeau-Blondeau, François [3], Rousseau, David [4], Abraham, Pierre [5]
Editeur	IOP Publishing
Type	Article scientifique dans une revue à comité de lecture
Année	2012
Langue	Anglais
Date	2012/07/07
Numéro	13
Pagination	4335 - 4351
Volume	57
Titre de la revue	Physics in Medicine and Biology
ISSN	0031-9155
Résumé en anglais	<p>Time irreversibility can be qualitatively defined as the degree of a signal for temporal asymmetry. Recently, a time irreversibility characterization method based on entropies of positive and negative increments has been proposed for experimental signals and applied to heart rate variability (HRV) data (central cardiovascular system (CVS)). The results led to interesting information as a time asymmetry index was found different for young subjects and elderly people or heart disease patients. Nevertheless, similar analyses have not yet been conducted on laser Doppler flowmetry (LDF) signals (peripheral CVS). We first propose to further investigate the above-mentioned characterization method. Then, LDF signals, LDF signals reduced to samples acquired during ECG R peaks (LDF_RECG signals) and HRV recorded simultaneously in healthy subjects are processed. Entropies of positive and negative increments for LDF signals show a nonmonotonic pattern: oscillations—more or less pronounced, depending on subjects—are found with a period matching the one of cardiac activity. However, such oscillations are not found with LDF_RECG nor with HRV. Moreover, the asymmetry index for LDF is markedly different from the ones of LDF_RECG and HRV. The cardiac activity may therefore play a dominant role in the time irreversibility properties of LDF signals.</p>
URL de la notice	http://okina.univ-angers.fr/publications/ua1472 [6]
DOI	10.1088/0031-9155/57/13/4335 [7]
Lien vers le document	http://dx.doi.org/10.1088/0031-9155/57/13/4335 [7]

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- [7] <http://dx.doi.org/10.1088/0031-9155/57/13/4335>

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