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Improved spectrofilter applied to diesel engine noise : combustion and mechanical noise separation

Laurent Pruvost[a], Quentin Leclere[b] and Etienne Parizet[a]
[a]Laboratoire Vibrations Acoustique, Insa Lyon, 25 bis, av. J. Capelle, 69621 Villeurbanne Cedex, France
[b]Laboratoire Vibrations Acoustique - INSA Lyon, 25 bis avenue Jean Capelle, Bâtiment Saint-Exupéry, F-69621 Villeurbanne cedex, France

For engineers working on alternative fuels and diesel engine sound quality, being able to separate combustion noise and mechanical noise would be of prime interest. This separation can be attempted using a spectrofilter (also called Wiener filter) when in-cylinder pressure signals can be recorded. The major drawback of the spectrofilter is its unability to separate correlated sources like combustion and piston slap. An upgraded version of the spectrofilter can be computed. Its computation just requires to consider only the random parts of the engine signals. Actually, considering these random parts artificially uncorrelates the noise sources. Highly correlated signals have been synthesised and successfully separated by the upgraded spectrofilter. When dealing with real-life engine noise, the quality of the separation cannot be judged directly since the signals to separate are unknown. The spectrofilter's causality and stability have been used as criteria to judge its quality. These two criteria both confirmed the superiority of the spectrofilter computed using the random parts of the signals. A synchronous averaging step is required to estimate the signals random parts. This estimation has been found to depend on the phase-locking strategy.