# PhD Proposal 2017

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| **School: Ecole Centrale de Lyon** | |
| **Laboratory: LTDS and ICJ** | **Web site:** |
| **Team: Vibroacoustics and Complex MEDIA (VIAME)** | **Head of the team: Prof M. Ichchou** |
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| **Collaboration with other partner during this PhD:**<br><br>**In France:** | **In China: Prof Fusheng SUI**<br>**Chinese Academy of Science**<br>**Institute of Acoustics** |

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| **Title: Structural-Borne sound and acoustic efficiency of built-up structures: geometry and assembly effects** |
| **Scientific field: Mechanical Engineering, numerical Methods, Acoustics and Vibration** |
| **Key words: Vibroacoustics, Acoustic radiation, SEA, BEM** |

**Details for the subject:**

**Background, Context:**

Noise emissions are more and more important in a number of sectors. Regulations around the world become drastic and lead to new design of structures with regard to vibroacoustic performances. The prediction of the acoustic radiation of built-up structures is thus necessary for noise and vibration harshness (NVH) issues handling. Several analytical and numerical methods are already available to estimate the noise emission and the structural borne sound. Analytical methods were initiated early seventeen's and improved since that time. Analytical expressions of the radiation efficiency and the radiation loss factor, among others, are often used for structural design. In the other hand numerical methods, such as, boundary element methods (BEM) are daily used to numerically predict noise for realistic elements.

The work proposed here is aimed to address an interesting question with regards to the literature. The issue is to provide design rules for early stage development of built-up structures. This is an interesting aspect which aims at providing trends of structural-borne emissions with regards to marcroscopic entries. Precisely, the target will be to analyses the effect of structural assembly and to provide guidelines for assembly design. The effects of the local behavior of junctions between structural parts will be considered to handle the global acoustic emission of the entire built-up elements. The achievement is expected to be reached through both analytical and numerical approaches. The frequency effect will be handled through either a BEM-like strategy for the low-mid frequency domain and through a Statistical Energy Analysis (SEA) way of thinking for the high-mid frequency range..

**Research subject, work plan:**

The achievement is expected to be published in visible high ranked international journals dealing with vibrations and acoustics. The work plan suggested fulfilling the subject objectives can be the following:

- State of the art about interface effects on structural-borne sound.
- Analytical prediction of noise emitted of Kirchhoff-Love plates assembly.
- Parametric survey and acoustic optimization.
- Numerical predictions of noise emitted of Kirchhoff-Love plates assembly.
- Parametric survey and acoustic optimization.
- Methods comparisons and assessments

**References:**

[1] Modeling the response of composite panels by a dynamic stiffness approach
D Chronopoulos, B Troclet, O Bareille, M Ichchou ; Composite Structures 96, 111-120

[2] A unified approach for the broadband vibroacoustic response of composite shells
D Chronopoulos, B Troclet, M Ichchou, JP Lainé ; Composites Part B: Engineering 43 (4), 1837-1846

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