

UNIQUE RESOURCES FOR RESEARCH AND DEVELOPMENT IN ACOUSTICS AND VIBRATION AT GROUPE D'ACOUSTIQUE DE L'UNIVERSITÉ DE SHERBROOKE (GAUS)

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Résumé

Cet article présente les ressources humaines et les infrastructures disponibles au Groupe d'Acoustique de l'Université de Sherbrooke (GAUS) situé à Sherbrooke, QC, pour la recherche et le développement dans le domaine de l'acoustique. Le GAUS a été fondé en 1984 par Jean Nicolas et est aujourd'hui reconnu à travers le monde comme un groupe de recherche incontournable dans le domaine de l'acoustique et des vibrations, avec une équipe d'environ 60 personnes. L'expertise, l'infrastructure et quelques exemples d'applications sont présentés dans cet article.

Mots clés : acoustique, vibrations, contrôle, ultrasons

Abstract

This paper presents the human resources and infrastructure available at Groupe d'Acoustique de l'Université de Sherbrooke (GAUS) located in Sherbrooke, QC, for research and development in acoustics. GAUS was founded by Jean Nicolas in 1984 and is now recognized worldwide as one of the leading research groups in acoustics and vibration, with a team of around 60 people. The expertise, infrastructure and examples of applications of the work conducted are shown in this paper.

Keywords: acoustics, vibration, control, ultrasounds

1 Introduction

Since its inception, Groupe d'Acoustique de l'Université de Sherbrooke (GAUS) [1] has established itself as a leading research group in acoustics and vibration, with recognized expertise, comprehensive infrastructure and unique approach in terms of internal and external collaborations, and graduate education [2]. Part of its success lies in the fine balance that GAUS has always achieved between fundamental and applied research. The expertise available at GAUS is briefly outlined, together with the unique infrastructure, and a few examples of applications.

2 Expertise

A strong and wide expertise has been developed at GAUS in the field of acoustics and vibration. The modeling expertise covers numerical simulation tools for noise control materials (Atalla and Panneton), analytical and numerical simulation tools in both vibroacoustics (Berry, Atalla) and ultrasonics (Masson and Micheau). The experimental expertise covers acoustic materials characterization tools (Panneton and Atalla), noise and vibration performance evaluation of complex structures (Champoux and Atalla), 3D laser vibrometry (Masson), acoustic imaging and spatial sound field reproduction (Berry), and implementation of arrays of ultrasonic transducers (Masson and Micheau). The control expertise covers active noise and vibration control (Berry,

Masson and Micheau), transducers design and fabrication (Masson), system identification and control (Micheau).

3 Infrastructure

GAUS has laboratory facilities which are unique in Canada, allowing research and development work to be conducted in acoustics, vibrations, vibroacoustics, aeroacoustics and ultrasonics. Through major funding obtained recently from government agencies (CFI, MELS and MDEIE) and from private partners, GAUS extended its laboratories with a new anechoic room coupled to a wind tunnel and a Wave Field Synthesis facility (Fig. 1).



Figure 1: Laboratories at GAUS: anechoic room coupled to a wind tunnel (top) and Wave Field Synthesis room (bottom).

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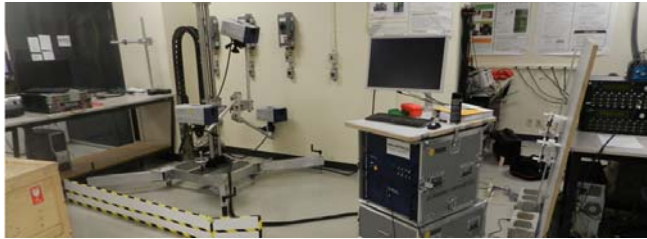


Figure 2: Equipment at GAUS: microphone array (top) and 3D scanning laser vibrometer (bottom).

Significant pieces of equipment were also recently added to an already extensive set of excitation and measurement tools, such as a powerful hydraulic shaker, a 196-microphone array, low and high frequency multi-channel acquisition systems, and a 3D laser vibrometer (Fig.2). All this enables GAUS researchers to tackle large-scale acoustics and vibration problems found in the transportation industry. As active members of *Calcul Canada*, GAUS researchers have also access to a platform of unequalled computing power in Canada.

4 Applications

The unique set of expertise and infrastructure has been used in both fundamental and applied research work, and has positioned GAUS as a pioneer and active player in large research networks such as in AUTO21 (leader of three projects in acoustics and vibrations for automobile applications), or in the CRIAQ (leader of six projects in acoustics or ultrasonics for aerospace applications). Industrial partnership has always played an important role, through collaborative projects and contracts with industry. Although partnerships have covered a wide range of applications, the transportation area has been of special interest over the past few years. In this respect, GAUS hosted two NSERC Industrial Chair positions in “Aviation Acoustics” (in partnership with Bombardier Aerospace, Pratt & Whitney Canada, Bell Helicopter Textron Canada, from 2009 to 2014 (chair holders : Nouredine Atalla and Alain Berry).

For example, noise and vibration control strategies have been developed using passive approaches with acoustic materials [3] or advanced structural design [4], or using active and semi-active approaches, both in acoustics [5] or vibrations [6]. Techniques have been developed for noise sources identification and reproduction [7], and efforts have been put forward to launch GAUS into sustainable acoustics [8].

Structural health monitoring strategies using guided ultrasonic waves have been developed within the CRIAQ, NSERC or contract projects. For example, dedicated

transducers have been designed [9], and advanced damage imaging techniques have been proposed [10].

5 Conclusion

For more than 30 years, GAUS has achieved international recognition, for its expertise, its infrastructure and its unique approach in terms of internal and external collaborations, and graduate education. GAUS has always tried to balance fundamental and applied research. Major contributions to fundamental knowledge in acoustics and vibrations have been achieved. Industrial partnership has always played an important role, through collaborative projects and contracts with industry.

In the future, GAUS aims to maintain and improve its track record by fulfilling the following missions in the diverse aspects of acoustics and vibrations: 1) contribute by research to the improvement of leading-edge knowledge, 2) train engineers and qualified researchers, 3) insure knowledge transfer to industry and public sector, and offer practical and innovative solutions.

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