Samuel Rodriguez

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Nationality: French

Doctor in acoustics - Mechanical engineer

EDUCATION

2006 - 2009 **PhD thesis in Acoustics**. "Wave phenomena in air intake systems and their influence on the internal combustion engine performances." *Under the direction of V. Gibiat (University of Toulouse III Paul Sabatier - PHASE laboratory), A. Lefebvre and S. Guilain (Renault SAS).*

2004 - 2005 **Master of science:** ATIAM, Acoustics and signal processing applied to music. Psychoacoustics. *Pierre and Marie Curie University (UPMC) and IRCAM (research institue in Acoustics and Musics), Paris.*

2002 - 2005 **Engineering school ENSTA-ParisTech**: Specialization in mechanics, fluid dynamics and acoustics. *Paris.*

RESEARCH ACTIVITIES

Ultrasonic Imaging:

The imaging methods based on the topological dericative require the computations of two wave propagations: the signal emitted by the transducer array during the experiments and the time-reversed measured signals. These methods allow a high resolution even with a single illumination of the medium and a small number of transducers. I developed the Fast Topological IMaging method where time-domain finite-difference computations are replaced by a frequency-domain semi-analytical method. The computation cost is divided by more than 60, so that real time applications are possible. The method has been successfully tested in solids, fluids, and complex media with different kinds of illumination of the medium. The high resolution obtained, even with a single illumination, makes it very useful for high frame rate ultrasound such as transient elastography and flow measurements with the Echo-PIV. The so called Plane-Wave Echo-PIV has been also developed.

Acoustic radiation of structures vibrating in a flow:

A flow along a vibrating plate changes its vibration properties. We developed and tested in wind tunnels a non invasive flow velocity probe for aircrafts that is based on this principle.

Duct and flow duct acoustics:

The pressure wave generated by the moving of the piston during the intake stroke of an internal combustion engine, propagates in the duct carrying cool gases and comes back to the cylinder by reflections. Acoustic phenomena can increase the amount of air trapped in the engine by 30% and so its performances. During my PhD, we developed a numerical tool that couples a non-linear one-cylinder engine model with the experimental input impedance of the air intake system. It allows the influence of acoustics on the engine air filling to be quantified and validates the choice of the linear air intake input impedance as a characterizing tool of the wave phenomena. We developed two innovative experimental methods: a flow impedance and a transfer matrix measurement method.

The acoustic nozzle is an invention developed at the LAM (Musical Acoustics laboratory) in Pierre and Marie Curie University. During my master, we modelled the response of the system with a 1D-approach of the nozzle in order to compute its radiation pattern.

TEACHING ACTIVITIES

Acoustics in master: 20 hours in French and English. *ENSICA Engineering school.*

Computer science in license: 24 hours. *University of Toulouse III.*

PROFESSIONNAL EXPERIENCE

Oct 2011 - Feb 2012 **Researcher**: Development of an innovative ultrasonic imaging and nondestructive testing method. Application to 2D flow measurements. *University of Toulouse III Paul Sabatier - PHASE laboratory.*

Mar 2010 - Mar 2011 **Researcher**: Developement of a flow velocity probe based on vibration. *ISAE Aerospace Institute - Toulouse.*

Sep 2006 - Oct 2009 **Doctoral thesis**: "Wave phenomena in air intake systems and their influence on the internal combustion engine performances." *Under the supervision of V. Gibiat (University of Toulouse III Paul Sabatier - PHASE laboratory), A. Lefebvre and S. Guilain (Renault SAS, near Paris).*

Sept 2005 - Aug 2006 **Research engineer in CNRS.** *CNRS (national center for scientific research) and Haliaetus Technologies, start-up created in Pierre and Marie Curie University, Paris.*

Mar 2005 - Sep 2005 **Master's thesis:** "Modelling of the response and the radiation pattern of the acoustic nozzle. " *under the supervision of J-D Polack, Pierre and Marie Curie University - LAM (Musical Acoustic Laboratory).*

May 2004 - Jun 2004 **Research assistant:** "Sound synthesis of a cymbal based on a nonlinear modelling of the vibration of a spherical shell.**"** *C. Touzé, ENSTA engineering school.*

PUBLICATIONS in INTERNATIONAL PEER REVIEW JOURNALS

S. Rodriguez, P. Sahuguet, V. Gibiat and X. Jacob, "Fast topological imaging", **under review in Ultrasonics**.

S. Rodriguez, V. Gibiat, S. Guilain and A. Lefebvre, "Input impedance in flow ducts: theory and measurement", **under review** in the **Journal of the Acoustical Society of America**, (2012).

S. Rodriguez, V. Gibiat, S. Guilain and A. Lefebvre, "Use of a mechanical analogy to couple the time-domain of a one-cylinder cold-engine model with the input impedance of its intake system", **Journal of Sound and Vibration** 300, 5769-5783 (2011).

S. Rodriguez, V. Gibiat, S. Guilain and A. Lefebvre, "The three-measurement two-calibration method for measuring the transfer matrix", **Journal of the Acoustical Society of America** 129, 3056-3067 (2011).

S. Rodriguez, V. Gibiat, S. Guilain and A. Lefebvre, "The reflection map: A new tool for frequency to time domain study of 1D acoustical systems", **Acta Acustica united with Acustica** 95, 795-804 (2009).

INTERNATIONAL CONFERENCES WITH PROCEEDINGS

S. Rodriguez, P. Sahuguet, X. Jacob, V. Gibiat, "Ultrasonic imaging based on frequency-domain optimization form", **Acoustics 2012**, Nantes, FRANCE, Paper 785 (2012).

S. Rodriguez, V. Gibiat, S. Guilain, A. Lefebvre, "Computing acoustic propagation in ducts carrying a complex three dimensional flow: a methodology", **ICSV 15th**, Daejeon, South Korea, T0377 (2008).

CONFERENCES WITHOUT PROCEEDINGS

S. Rodriguez, X. Jacob, V. Gibiat, "Application of topological imaging to high frame rate ultrasound", **7th GDR meeting** on Wave propagation in complex media for quantitative and NDE , Oléron, FRANCE (2012).

S. Rodriguez, P. Sahuguet, V. Gibiat, "Frequency-domain topological imaging", *journées* **SIAM** (Signal and image in medical acoustics), Créteil, FRANCE (2011).

S. Rodriguez, V. Gibiat, S. Guilain, A. Lefebvre , "From frequency to time domain: Signal features and physical characteristics for resonant acoustical systems", **Acoustics'08**, Paris (2008).

REVIEWS

of 1 express letter in the Journal of the Acoustical Society of America

PATENTS

For the account of Renault: (The authors are presented in alphabetical order)

US201100045/WO2009019350: "Internal combustion engine inlet manifold", L. Mamy and S. Rodriguez.

FR2936285: "Gas intake manifold for internal combustion engine of motor vehicle, has conduits in which gas circulates along same direction and reverse directions, where areas of cross sections of conduits are equal", J.-C. Le guern and S. Rodriguez.

FR2935748: "Supercharged internal combustion engine, has valve placed on path of derivation pipe, where opening of derivation pipe is triggered based on pressure measured by upstream and downstream pressure sensors", J.-C. Le guern and S. Rodriguez.

FR2931207: "Gas e.g. intake gas, transferring device for internal combustion engine, has separated ducts joined in main duct opening in gas manifold, where overall sectional surface of ducts is constant during passage from main duct to separated ducts", E. David, J.-C. Le Guern and S. Rodriguez.

FR2925126: "Air intake method for internal combustion heat engine of motor vehicle, involves regulating flow of air stream by partially opening valves to permit even flow of air in engine to obtain acoustic characteristics at working point of engine ", J.-C. Le guern and S. Rodriguez.

FR2921436: "Intake and exhaust collector for heat engine of motor vehicle, has internal cavity of tubular body or plenum conformed by loop for allowing gas flow circulation between neighboring intake/exhaust ducts ", L. Mamy and S. Rodriguez.

FR2920487: "Air distributor for supercharged internal combustion engine, has plenum provided with air inlet and opening in conduits, where two conduits having different geometries such that distances separating inlet from outlets of conduits are equal", E. Jean, S. Rodriguez and L. Vedrenne.

For the account of ISAE and university of Toulouse III - Paul Sabatier:

FR1060513: "Dispositif de mesure de vitesse et/ou de direction d'un écoulement fluide le long d'un véhicule, et procédé correspondant", V. Gibiat, C. Nouals and S. Rodriguez.

REFERENCES

on request

LANGUAGES & COMPUTER SKILLS

English	Advanced level. TOEIC : 885/990.
German	*Baccalauréat* with a european, german label. Several stays in Germany.
French	Mother tongue.
Spanish	Beginner (A2 level).
Computing	**Matlab** , LaTeX, **Finite Element** softwares: FFT **Actran**, LMS **Sysnoise** and **Comsol**. Basic knowledge: C, Adapco StarCD (CFD), Adobe Photoshop, Illustrator and InDesign.

ADDITIONAL INTERESTS

Music	Guitar playing in bands (rock and jazz): concerts and studio recordings.
Guitar making	Two electric guitars built.
Sport	Team sports.

Community sevice: Weekly french teaching to migrants. *AARAO Association.*