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Ahmed Rassili (eds.)**

**NVH Analysis Techniques for Design and
Optimization of Hybrid and Electric Vehicles**

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4	BE	University of Liège
5	BE	V2i - From Vibration to Identification
6	BG	University of Ruse
7	BG	University of Transport T. Kableshkov
8	BR	University of Sao Paulo
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Preface

The constantly increasing fossil fuel prices, the need to reduce transport-generated CO₂ emissions and traffic noise and the striving to improve urban air quality have prompted the automotive industry to focus efforts on development of fuel efficient vehicle technologies. Amongst these technologies the development of Electric Vehicles (EVs) and Hybrid Electric Vehicles (HEVs) is considered as most promising in solving both the economic and ecological concerns. To be competitive such vehicles must have an acceptable Noise, Vibration and Harshness (NVH) behaviour, not only inside the vehicle, but also outside with the requirement to guarantee safety of weaker road users such as two-wheelers and pedestrians. Most of the NVH design and problem-solving knowledge gathered since many years has concentrated on internal combustion vehicles and so there is a need to develop novel analysis techniques for vehicles with these new drives. It is significant that after many years spent in reducing noise one big challenge is now become the generation of sound by vehicles.

The reason of creation of TU1105 COST Action ‘NVH analysis techniques for design and optimization of hybrid and electric vehicles’ is the attempt to deal with this new and other challenges like accumulation, development and dissemination of novel analysis techniques in NVH of electric and hybrid vehicles.

Nowadays a common NVH issue for automotive companies is to assess robust experimental troubleshooting methodologies to decrease high timely-consuming trial and error procedures. In addition it is asked to multiphysics virtual tools to take advantage of experimental activities in developing optimal and efficient designs. The TU1105 COST Action consortium has promoted knowledge to solve these difficulties together with the goal to understand customer perceptions of the new NVH sources, treat the external sound generation issues for road users safety and evaluate the effect of the loss of noise & vibration masking from the currently implemented internal combustion engines

The Action ‘NVH analysis techniques for design and optimization of hybrid and electric vehicles’ was started in April 2012 (Memorandum of Understanding 4187/11) with 13 representatives from 8 countries, and then was enlarged to 23 entities from 14 countries. Currently, near the end of the fourth year, the network is composed by 37 entities from 17 countries, including 3 Non-COST Countries: New Zealand, Brazil and United States. The partners, Universities and Research Institutes, have brought together experienced

academic and early-stage researchers. Several short courses, seminar, training schools, short-time scientific missions have been performed in order to increase and join knowledge, exchange information and demonstrate new potential techniques. Several interactions with other COST Actions were made and research programme proposals have been set.

This book collects scientific and end of visit reports as results of the Action working activities dealing with state of art, test procedures, novel analysis techniques and methodologies. Both interior and exterior sound aspects have been treated together with the coupling of internal combustion engines with electric devices. From the experimental side, techniques for structural aspects (i.e source contribution identification, vibro-acoustic characterisation of lightweight materials, rotational dynamics system monitoring and new challenging virtual sensing approaches) together with exterior aspects (i.e. warning sound definition and dedicated sound quality metric development) are discussed. On the other hand numerical approaches to develop novel resonant metamaterials for acoustic insulation and predict sound field produced by emitting systems of hybrid powertrains are evaluated.

The results of the Action are intended to be as useful guidelines for future students, researchers, EU authorities, and industrial representatives coping with electric and hybrid vehicle NVH aspects for both environmental and technological future purposes.

The acknowledgement of all COST partners goes to EC and COST Office for support, cooperation and assistance for all Action duration. I would like to give a special thanks to Dr. Nuria Campillo and Dr. Bert Pluymers, respectively, actual Action Chair and Vice-Chair, who contributed to build, support and guide the Action with enthusiasm and competence. I wish also to thank Dr. Ahmed Rassili for his helpfulness in managing the economical and formal relationships with EC. Them with all researchers and academia experts involved in the consortium gave his contribution to the excellent achievements obtained by the Action.

Simone Delvecchio,

Action Proposer and First MC Chair of the TU1105 Action

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