Scuola di Dottorato in ICT – PhD School in ICT

Research project for a PhD curriculum in ICT – Computer Engineering and Science

**Tutor**: Prof. Paolo Pavan

**(\*) Italian Co-tutor:** Prof. Luca Larcher (DISMI)

**(\*\*) Foreign Co-tutor:**

**Proposed Title of the research:** Applications of nanomaterials in the electroacoustic field

**Keywords(5):** nanomaterials, CNT, thermoacoustic, loudspeaker, amplifier.

**Research objectives(max 10 rows):**

The aim of this research is to study the technological enhancements offered by the nanomaterials in the electroacoustic field. Particular focus will be devoted to the carbon nanotubes (CNT) that, thanks to their exceptional physical properties and low cost, enable the exploitation of physical principles considered impractical up to now. Also, other nanoscale materials will be considered, such as silver nanowires.

Thin CNT films show a strong thermoacoustic (TA) effect, acting as an electro-thermo-acoustic transducer, or TA loudspeaker. CNT can also be employed to build field-effect transistors (FET), and thus amplifiers.

Those properties will be studied to model the behaviour of the TA loudspeaker and the CNT FET. The results will be used for the development of a CNT TA loudspeaker with embedded CNT amplifier.

**Proposed research activity(max 10 rows):**

Study of the electronic, electroacoustic and thermoacoustic theory

Modeling of the electro-thermic and thermo-acoustic phenomena

Modeling and characterization of a TA loudspeaker

Analysis of TA loudspeaker samples and validation of the developed model(s)

Modeling and characterization of the CNT transistor

Analysis of CNT transistor samples and validation of the developed model(s)

Design and development of a CNT transistor based audio amplifier

Design and development of a CNT based TA loudspeaker with embedded CNT based amplifier

**Supporting research projects(and Department):**

FET-Open, to be presented, April 2016 deadline

**Possible connections with research groups, companies, universities..**

Prof. Paolo Lugli, Technische Universitat Munich, UK

ASK Industries, Reggio Emilia

RCF gourp, Reggio Emilia

(\*) optional

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