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### Biography

Sarah BENCHABANE graduated with an MSc in Optics and Optoelectronics from the University of Saint-Etienne in 2003 and a PhD in Engineering of the Université de Franche-Comté in Besançon in 2006. Her PhD thesis was dedicated to the study of guiding and filtering phenomena in phononic crystals. She subsequently undertook a post-doctoral research position at the Institut de Ciencies Fotoniques (ICFO) in Barcelona (Spain). Her work there mainly focused on lithium niobate integrated optoelectronic devices based on periodical poling. She was appointed a full-time researcher at FEMTO-ST in 2008. Since then, her research activities have mostly revolved around the investigation of elastic wave propagation and confinement in micro- and nano-structures. Her current interests lie in the investigation of electromechanical systems at the crossing of phononics, MEMS/NEMS and electro-acoustics for the development of classical and quantum information processing devices that can be used either in an independant fashion or as a basis for the investigation of strain-mediated coupling, most notably for optomechanics.

### Surface acoustic wave-driven mechanical resonators for phononic circuitry

Guided elastic waves are powerful information carriers standing at the core of modern telecommunication devices. Surface acoustic waves (SAW), in particular, have been industrially used as radio-frequency filters or delay lines since the 1970s and remain relevant in all current connectivity standard technologies. More recently, the scope of their potential application fields has expanded covering fields as diverse as life science and quantum information technology [1]: SAWs are mechanical vibrations, and as such, can coherently couple to a number of physical systems. This intrinsic property has recently pushed towards the development of hybrid electromechanical or phonon-based devices. In this context, the implementation of scalable phononic circuits has become an appealing prospect in view of increasing the versatility of electro-acoustic devices. Recent demonstrations have made convincing steps towards this objective by proposing phononic architectures inspired by photonic integrated circuits [2] or combining the rich dynamics of micro- and nano-electromechanical (M/NEMS) resonators with propagating elastic waves [3].
Here, we propose to exploit the interaction between surface acoustic waves (SAW) and locally-resonant, micron-scale mechanical resonators in order to achieve coherent driving of the resonator motion with SAW and, reciprocally, to control the elastic energy distribution at a deep sub-wavelength scale. We investigate the proposed physical system both in the linear [4] and non-linear regimes [5] and reveal that the elastic field behavior can be further controlled through resonator-to-resonator coupling, leading to a variety of interaction schemes affecting both the frequency response and the polarization of the resonating structures. The proposed devices, that operate in the 70-MHz range, are readily scalable to higher frequencies. They illustrate the potential of SAW-based architectures for the implementation of densely integrated phononic circuits with complex dynamics operating at gigahertz frequencies.

### Keywords:

Photonics; Surface acoustic waves; Micro-nano-electromechanical systems

### References

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