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New prospects in implementing distributed control strategies for mechanical structures optimization

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The research activities in the fields of smart materials and structures today are very important and represent a large potential for the technological innovations. New methods are now available which allow active transducers and their driving electronics to be directly integrated in otherwise passive structures. Today the main research challenge deals with the development of new multi-functional structures integrating their own electro-mechanical controlling systems. In the past few years, a technological revolution has occurred in the fields of integrated MEMS that offers new opportunities for smart structures design and optimization. By using such as integrated active or hybrid distributed set of electromechanical transducers, we could also control the material's intrinsic mechanical behavior for building new desired functionalities. We can also speak of "integrated distributed smart structures". Through two examples, this paper aims at showing what can be the main advantages in developing such of integrated distributed control strategies in comparison with passive and "classical" active systems. The adopted point of view takes also into consideration energy balance assessments, absolute efficiency and of course robustness. The first introduced example deals with the vibroacoustic impedance control of tube for wave power flow cancellation. The second one treats of the optimization of hybrid shunted piezoelectric distributed patches for mechanical power flow control.