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Identification of aerodynamic sound sources: the key problem in noise control

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Despite the recent advances in the noise control technology, the key mechanisms of aerodynamic sound emission remained poorly studied. The "well-recognized" methods of TCAA did not lead to any breakthrough in this topical problem, and what seems most disappointing, the family of "acoustic analogies" is still used by many for definition of aerodynamic noise sources, though the sufficient set of mathematical proofs has been given by the author that this model is wrong. Experimental approaches aimed at localization of aerodynamic noise sources, including the method of acoustic imaging via using a microphone array, are considered, and their inherent limitations are pointed out. Unfortunately, no current experimental technique enables one to measure instantly all sound sources and sound disturbances inside the zone of generation, and so the latter is often regarded as a kind of "black box". The two-medium nonlinear theory of aerodynamic sound, based on the original decomposition of each flow variable into two components, for unsteady background flow and for acoustic field, has been created, that promotes better comprehension of the noise generation phenomena and opens new ways in flow/noise control. The main properties of this theory are now indicated in comparison with the most detrimental delusions originated from "acoustic analogies".