Intensity error sensing in the active control of free field sound radiation

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Abstract

The annoyance of low frequency tonal noise, such as from electrical transformers, has long since been recognised, with many examples of passive and active noise control being applied on transformers and other sources that radiate into a free space. Passive techniques have been found to be ineffective at low frequencies, requiring very heavy materials which are impractical due to maintenance and ventilation requirements as well as cost. Active noise control may be the answer to solving such noise problems. However, as yet very few practical active noise control implementations exist.

This thesis describes by theory and experiment, the effectiveness of an alternate error sensing strategy suitable for the control of general free field sound radiation problems, namely active intensity. While active intensity sensing is not new (Sommerfeldt and Nashif (1994), Swanson (1994), Reichard et al. (1995), Kang and Kim (1997), Qiu et al. (1998), Berry et al. (1999) and Li (2000)), simulations of their performance have led to mixed results. In this research, active intensity error sensing has been rigorously analysed:

1. in the near and far field of the disturbance source.
2. to determine its ability to lead to global control via sound power attenuation.
3. in a real control system.

Contents