Research shows promise in quieting complex noise clusters

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University of Cincinnati researcher Mingfeng Li, research associate in UC's College of Engineering and Applied Science (CEAS), and his team are waging a war against noise pollution. Better yet, how to eliminate it.

Li is set to present his latest findings at the 2012 INTER-NOISE conference in New York City, August 19-22, 2012, in a paper titled "Enhanced Inverse Model LMS Algorithm for Active Control of Harmonic Response Clusters."

Li serves as the primary investigator of his team, with its focuses on active noise control. Active noise control eliminates noise by using an anti-phase sound wave to counteract the original sound. Together, he and his colleagues, Teik C. Lim, CEAS interim dean, and Jie Duan, former CEAS research assistant, have worked to develop mathematical equations (or algorithms) to apply to and battle active noise.

Every noise has its own sound wave frequency. When multiple noises are combined, their different frequencies join together and form a group. These groupings, called clusters of harmonic responses, can be found in a number of mechanical applications like vehicle powertrains, gear vibration and rotating machinery.

Making clusters of harmonic responses quieter is far more difficult than individual noises that have a single sound frequency. The team is addressing noise clusters with multiple frequencies and sound waves that overlap so that the result is a very complex web of intertwined sound

waves. Finding a means of making the entire web or cluster quiet is the challenge that Li and the team are addressing.

Through their research, Li and his team have configured a mathematical model using an enhanced algorithm called the "inverse model least mean square algorithm," or IMLMS, applied to the clusters. Their set of equations identifies the multiple sound wave frequencies in a given cluster and allows the control system to achieve faster convergence and better performance on attenuating the noise. Li and his team have performed a variety of numerical simulations in applying their model to different clusters. Their results show significant improvement on the convergence of the system, which will achieve more reductions in noise over a wide range of frequencies.

Their algorithm is one key to a quieter future for vehicles and other machinery. The range of applications for the algorithm is extensive, ranging from vehicles to offices. Commercialization of the team's algorithm can potentially be seen in more than just industrial applications, and a patent application is expected.

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