Vibration suppression of loudspeaker box by assembly material design

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This study discusses the effects of acoustic vibrations in loudspeaker systems and their enclosures, focus on using viscoelastic materials to suppress the acoustic vibrations. First, we measure basic material properties meticulously, obtaining them through precise tensile testing and dynamic mechanical analysis (DMA) experiments. These experiments provide crucial insights into the behavior and properties of the materials under investigation. Subsequently, the research turned to application of Abaqus finite element analysis (FEA) software. Here, we exploit the integration of derived material properties into a complex simulation model. This simulation framework assumes a virtual laboratory and allows us to predict and evaluate how viscoelastic materials affect the acoustic vibration dynamics of loudspeaker systems and their enclosures. Finally, we performed laser Doppler vibrometer (LDV) experiments to verify the consistency of the simulation results with actual physical measurements. The comparison and validation process confirms the accuracy and applicability of the model. Additionally, our research was expanded to examine the impact of different Shore A hardness values, specifically Shore A 30, 40, and 50, on the shock-absorbing effect. This comparative analysis reveals the performance and efficiency changes that can be achieved with materials of different stiffness. Summary, this article provides a comprehensive and complex description of the entire research process. It starts with precise measurements of viscoelastic material properties, continues with loudspeaker spectrum simulations, and finally compares the simulation results with experimental data obtained from LDV experiments. Through this multifaceted approach, our research aims to make an important contribution to the understanding and optimization of acoustic vibrations in loudspeaker system design in the presence of viscoelastic materials.