Automatically Reproducing Live Performances of Violins via Novel Sound-Post Controlled Electrification

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Sound posts are essential musical instrument components particular to the violin family that transfer string vibrations to the plates, where they resonate the instrument body to produce sound. However, current electronic violins (EVs) have neither sound posts nor bodies; they merely amplify string vibrations electrically and output the resulting sounds via speakers. Herein, I report on the development of a completely novel EV type equipped with a vibrator in its sound post that can perfectly reproduce the sounds of acoustic violins. To observe sound-post vibrations during the experimental stage, I miniaturized vibration-controlling elements and installed them in handmade actual-size violins. Then, based on numerical simulations related to vibration and sensor experiments, I optimized sounding conditions. Spectrogram comparisons show that the resulting module could perfectly reproduce live performance quality sound since it vibrates sound posts in the same manner as an acoustic instrument. In fact, the module surpasses previous EVs because it can collaborate and support the player's performance, thereby making it useful for training. It also allows differences between skilled and unskilled musicians to be identified because the sound-post vibrations reflect those of the strings, thereby providing a useful teaching perspective. Furthermore, since the module is small enough to be removable, low-cost reversible electrification of an acoustic violin has been realized for the first time. The module can also be used to silence the violin similar to noise canceling for nighttime practicing, and allows the user to study the violin anywhere and anytime by feeling reproduced virtuoso performances.

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