KAZUTOSHI YAMADA *Zanden Audio System Company, Limited*

I studied electrical and electronic engineering at Osaka Prefecture University to understand the finest nuances of amplifier operation. Since founding Zanden Audio in 1980, I have devoted more than thirty years to perfecting amplifier design. During this time, I have not only worked on the technology but have also participated in live performances as an "audio coordinator."

Through my involvement in over 500 concerts, I have observed first-hand the very wide gap between the sound of live music and its reproduction. This gap causes a disconcerting feeling of disconnection from the live event. Many listeners who love and enjoy music have experienced the same phenomenon, and shared their perceptions. This led me to realize that, as an audio engineer, I had a duty, even a sacred mission, to close the gap between the sound of a live performance and its reproduction.

What musical qualities were you striving for in the 8120 and 3100?

One of the areas where all of our amplifiers excel is the energy balance between the fundamental and overtones. Getting this balance correct is key to reproducing accurate low-level detail. The timbre is more realistic, allowing the listener to not only easily discern the type of instrument, but also to hear the subtle differences between instruments of the same type. Massed strings sound like individual instruments playing together (rather than a homogenous sound). Music is layered and textured with a lifelike, three-dimensional character.

The 8120 and 3100 are some of your most affordable products. How has your experience in designing flagship-level products informed your approach to creating the 8120 and 3100?

Our work designing such products informs everything we do. Although making our products more widely available is a primary goal, every product must uphold Zanden standards of quality and musicality. We know what sounds good and what does not. Where we can reduce material costs while maintaining Zanden performance, we do so. If we cannot, we will not.

Both the model 3100 and model 8120 are excellent examples of this product philosophy. They share the same basic architecture as their more illustrious siblings. The primary differences with our flagship-level offerings are the cost of materials. Although the cost of the model 3100 and 8120 is significantly less than our flagship models, the effect on performance is minute.

You've chosen to work with tubed circuits. What do you see as the advantages of tubes?

By their very nature tubes are more linear than solid-state devices and allow for relatively simple circuits. Solid-state amplifiers, on the other hand, require greater complexity. As a general rule, the more complex a circuit becomes, the more difficult it is to achieve ideal results. Additionally, tube circuits can be constructed without using any negative feedback at all, or in the case of our model 8120 with minimal amounts.

"Measurements can tell you when something is wrong, but they cannot tell you when something is right."

This is not to say that I will never design solid-state components, and it would be a mistake for people to regard Zanden simply as a tube equipment manufacturer. I have already designed a solid-state phonostage, our model 120. Our circuits contain few traditional elements, and many aspects of our tube designs are applicable to solid-state amplifiers. In addition, the judicious use of solid-state components allows us to reduce the cost of our equipment with minimal reductions in performance.

How much of the design process is based on measurement and how much on listening? Is there a correlation between an amplifier's technical performance and its musical qualities?

Measurements are not central to my design process because they cannot account for the listening experience. Observation is our best tool for evaluating circuit designs. If I were to rely on theory alone, I would never have designed tube amplifiers, and especially not single-ended tube amplifiers. Yet many of my earliest amplifier designs were single-ended tube amplifiers. Neither measurements nor theory can explain why SET amplifiers often sound so much better than other designs. Experience contradicts theory and measurements. This gap between theory and observation was one of the primary inspirations for our push-pull amplifiers.

By technical performance I infer that you mean measured performance. Assuming that a product is generally well designed, there is very little correlation between measured performance and musical qualities. Measurements are counterproductive in that they create artificial goals with minimal cor-

relation to observed performance. Measurements are useful for checking the technical soundness of a circuit. They can reveal problems that have been overlooked, mistakes, or unexpected behaviors. Measurements can tell you when something is wrong, but they cannot tell you when something is right.

How much better will amplifiers get over the next ten years? Are you still learning new things?

The pace of progress in the analog world is normally much slower than in the digital one. Our current knowledge base is quite limited and so many areas remain veiled by uncertainty and ignorance. In general, I see the influence of high-frequency noise to be one largely unknown factor that is detrimental to the performance of audio components and the musical experience associated with the playback of recorded music. Without the allocation of large financial resources to basic science and research, the chances of a technological revolution in audio are unlikely. I would expect improvements to continue at the current slow pace, which is characterized more by evolutionary advances rather than revolutionary ones.

Each amplifier technology has weaknesses, and that is where we can find room for the greatest improvement. The filtering techniques used for reducing the audible effects of sampling noise in digital amplifiers are currently inadequate. Solid-state amplifiers require improvement in their power-rectification sections. In order to improve tube amplifiers further, we need a revolutionary advancement in output transformer manufacturing. Lastly, I believe that both solid-state and tube amplifiers would benefit from a review of feedback technology.

Of course I am still learning. Advances do not happen in a vacuum. If you had asked me ten years ago whether Zanden would have made the advances in amplifier technology that we have achieved, I would have said "no." At the time, other challenges such as the unaccounted effects of digital low-pass filters on digital playback loomed large. In the process of solving one problem you learn new things, and sometimes they have applications in other areas. Also, advances by manufacturers in other fields, such as speaker and cartridge design, reveal new insights.