<Rodo>

Rods clamped on one side and free to vibrate at the other side are the acoustical base of quite many musical instruments and sound installations: reed organs, mouth organs, bandoneon, music boxes with a comb, nail violin, toy piano, Fender-Rhodes piano, Waterphones, Harry Bertoia's installations, African lamellophones, clock gongs to name just a few. Two classes of instruments using this sound source should be distinguished: instruments that only use the fundamental resonant tone (reed organs, Fender-Rhodes, music boxes) and that are always considered pitched instruments and at the other hand those that use the broad spectrum of overtones these rods can generate, when tuned to very low fundamental resonant frequencies (clocks, Waterphone, toy piano...). The fundamental resonant frequency of these rods is inversely proportional to the square of the length of the rod.

The <Rodo> robot was designed to be either an extension or a generalization of the toy piano robot <Toypi>. Just like in the toy piano, the sounds all stem from massive rods clamped at one end in a solid cast iron bar. We started the project, as the automation of the small instrument was very successful and appeared to have many more sonic possibilities than we grasped at the start. So we thought of rescaling the design such that the range would extend much lower and the maximum sound level quite a bit higher. At the same time, we aimed at making the instrument a lot more sturdy than the toy instrument, that needed all too many repairs because the tines broke very easily on very fast note-repetition rates. Also quite some new features were added in this design: individual dampers, an e-drive mechanism and a set of radar sensors to allow gesture interactive activation and playing modes.

We started off by doing experiments on different metals and alloys for the tines: martensic stainless steel, hardened spring steel, brass, aluminum, phosfor-bronze, aluminum-bronze. We even experimented with some non metals such as bamboo, glass, carbon-fibre. Those experiments made us drop the nonmetals very fast as the sound was too weak or the rods too fragile. Obviously the evaluation of sonic quality has to remain a quite subjective issue, since there is no standard to compare to as we are designing a new instrument. After all these experiments were performed we decided to go for the aluminum-bronze alloy. These rods produce a very rich tone, though not as brilliant and loud as spring steel rods. In the design of <Rodo> we took into account the possibility for tuning and adaptation to different tuning systems. To allow this, set screws are used to fix the vibrating length of the tone rods. This arrangement makes it possible to exchange the rods for other sets, as long as the diameter is 8 mm. By default the tuning is chromatic, equal temperament. Due to the high inharmonicity of vibrating bars clamped at one end, it is perfectly possible to consider the instrument as 'non-pitched' in the context of orchestra compositions conceived for our robots. In this respect, the instrument would sound like a set of gongs.

An extra and new feature of the <Rodo> design, as compared to <Toypi> is the electromagnetic feedback driver mechanism. To this end we mounted a powerful (100 W) electromagnet very close (leaving just an air gap less than 0.1 mm) to and underneath the cast iron bar. This electromagnet is driven by a high voltage amplifier whose input comes from an ARM processor. The input for the driver can be either a signal picked up with a piezo transducer from the soundboard filtered and processed by the ARM controller, or a drive signal under midi-controll. This mechanism enables bowed and sustained sounds to be produced from this instrument. Rodo can sound very much like a bowed string instrument in this mode, although sound build-up is rather slow due to the inertia of the mass of the rod assembly.