7.7.5 Damping by finger, hand and capo

Placing the guitar on a heavy stone table in order to do measurements usually guarantees good reproducibility, because no trembling hand moves the object to be examined. However, such a bearing is not very close to practical reality, because of course the strings are touched while playing. The fretting hand (mostly) rests against the back of the guitar neck, and a finger presses the string against the fret. From the point of view of vibration technology, the neck of the guitar is a cantilever and/or torsion beam; despite being of a stiff structure, it can nevertheless be bent and twisted – not by much, but to a significant degree. Contact with the hand and/or finger alters the mechanical vibration parameters of the neck, and influences resonance frequencies and their damping. The bendable and rotatable guitar neck resonates as soon as a string vibrates, sending vibration energy into the hand and the finger(s). The more vibration-energy our hand and fingers pick up, the stronger the string will be damped. The exact differences between active and reactive energy shall not be discussed in more detail here; the measurement results are self-explanatory.

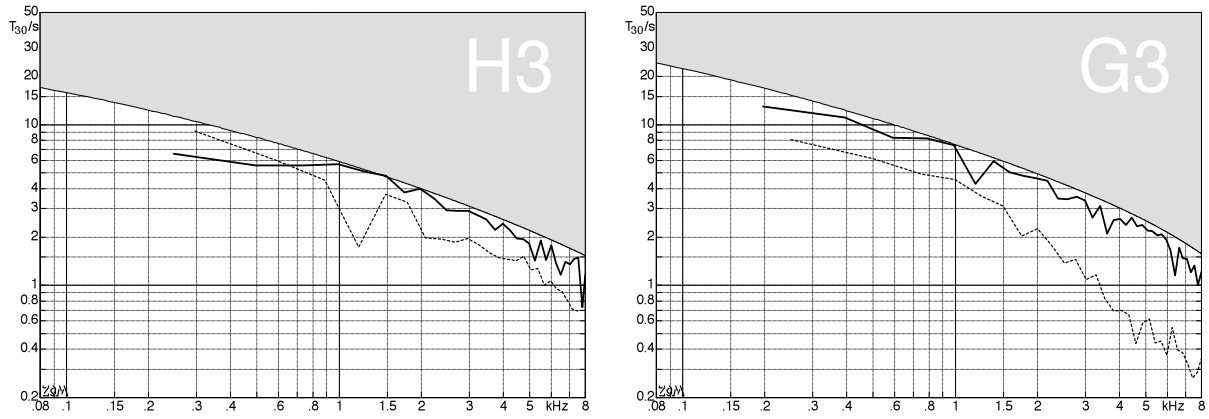

Fig. 7.82: Decay times of partials of the string vibration, Stratocaster. The dashed curves were measured with a capodastro placed on the 3rd fret for measuring of the B-string ("H3"), and on the 4th fret for the G-string.

In order to keep the guitar as still as possible, a Shubb **capo** was mounted to the neck of a Stratocaster, replacing the gripping hand (Fig. 7.82). As with the other analyses, the string to be measured was struck fingerboard-normally next to the capo, the measurement of the string velocity was taken two-dimensionally near the bridge. The exact capo position and its contact force probably play a role, but detailed investigations were not planned at this point. Instead, the principal effect was to be demonstrated; this is successfully done with **Fig. 7.82**: the capo acts mainly as an additional damper, and it reduces the decay times especially in the high-frequency range. Similar results were found in experiments with a hand placed on the back of the guitar neck; depending on circumstances, the damping caused by the hand may be even more pronounced than that produced by the capo. Since attaching the capo will change the pitch of the string and the position of its bearing, other pairings between frequencies of partials and frequencies of neck resonances occur – this will bring other selective resonance dips into play. In view of such grave effects, it does not make sense to pay very close attention to small dents in the T_{30}- curve. The sound changes caused by the plucking/picking hand and fretting hand will dominate compared to most damping mechanisms due to bearing of the string. Only a few resonances of bridge, neck and/or string will be able to shorten the decay time of individual partials considerably – corresponding listening tests are summarized in a separate section.

