7.7.4.3 Residual damping

Generally, the string does not end at the bridge or the nut but passes over it to its actual mounting point. In certain circumstances, these **remaining sections of the strings** (residual strings) located beyond the main section of the string may form an effective absorber that can deprive the main section of the string of oscillation energy. This is termed residual damping.

If the string would exhibit a pure transversal movement, it could not transfer energy to the residual string across the fixed support bearing. However, as was already explained in Chapter 2.7, the string is also subject to a **bending stress**, and the related bending moment acts across the bearing and excites the residual string. Also, the longitudinal forces occurring within the string (→ dilatational wave) may at least partially act across the bearing – especially for small bend angles, the string may relatively easily slide across the contact area.

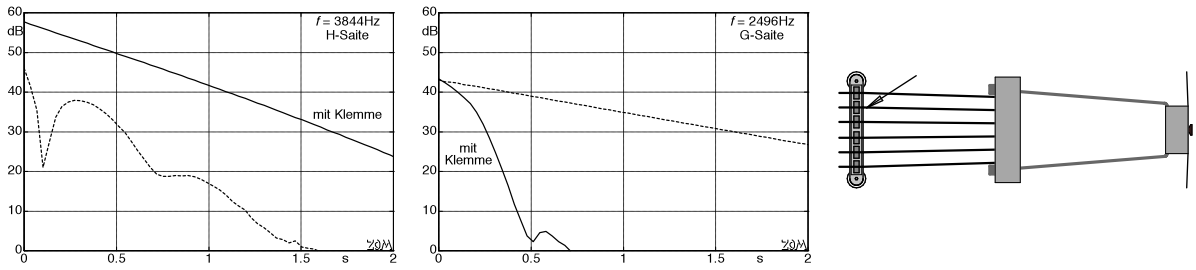

Fig. 7.72: Modification of the decay of partials (at the specified frequ.) due to mass loading by the residual string at the bridge; Gibson ES-335 TD; "H-Saite" = B-string, "G-Saite" = G-string, "mit Klemme" = with clamp.

To quantify the effects of this residual damping via two examples, a string of an ES-335 was plucked fretboard-normally near the nut; measurement of the fretboard-normal velocity was done near the bridge saddle using a laser vibrometer. As a modification, a small clamp was attached to the residual string near the bridge (**Fig. 7.72**, arrow). The measurements were carried out for the B- and G-string, with always the plucked string being measured and modified. For many partials, no considerable effect resulted – but in some cases the decay was indeed influenced. This happened in different ways: for the partial of the B-string shown in the left picture, the additional mass improves sustain and level, while in the other example, the additional mass chokes off the oscillation rather rapidly♣.

It is difficult to formulate these damping mechanisms analytically because two transversal modes and one dilatational wave occur in combination – in fact on both sides of the bridge! Therefore, these examples only serve to show that the effect of the residual strings must not be generally neglected. However, because the decay of only a few partials will vary, the sonic impacts remain fairly low. With the investigated ES-335, no audible difference in the "electrical sound" could be found when damping the residual strings during playing with the heel of the hand.

It is obvious that such a damping mechanism cannot be found with measurements at an empty bridge (bridge without string). On the other hand, the saddle conductance (Chapter 7.7.4.4) can only be determined without the string because the location of the string bearing can only be allotted once to one single taker. Already the ancient philosophers knew: where there already is something, nothing else may be.

♣ For the sake of completeness it is noted that even between the individual strings und their partials, vibration coupling and thus damping may occur – this effect will not be further investigated here, though.

