

5.5.6 Time variance

In systems theory, resistors, inductances and capacities are initially taken to be linear and time-invariant such that at every point in time the same laws of proportionality hold for the quantities of voltage and current. For small drive values, every guitar pickup is indeed sufficiently linear whereas time-invariance cannot be fundamentally taken for granted. The pickup parameters introduced on the previous pages do change over time (intra-individual scatter), and for another specimen of the same type, any specific values only hold with reservations (inter-individual scatter).

The **DC-resistance** of each pickup is temperature-dependent, it rises by 0,39 % per °C. Within the temperature interval of 17° – 30° the DC-resistance therefore changes by 5% (e.g. from 6000 Ω to 6300 Ω). This needs to be considered for the values given in literature which are sometimes surprisingly precise as seen e.g. in a specification for the Stratocaster: 6100 Ω (Vintage reissue), 6210 Ω (Texas special). Due to manufacturing tolerances, the wire diameter will have a scatter of typically ±10%, which renders the comparison of two pickups problematic: do we have the same type but with slightly differing wire strength, or is it the other type with a different number of turns?

The **coil inductance** is given – other than by the coil geometry – by the space filled by the field. As ferromagnetic and/or conductive materials are introduced into this space, the inductance may change. Not just pickup covers but also other guitar parts can change the coil inductance. These include the metal mounting plate of the Telecaster bridge pickup just as shielding foils under the pickguard which enclose the pickups and enable eddy currents to flow. We should not expect dramatic deviations but for precision-measurements, the environment should be clearly defined. For the time-variance of magnet-parameters see chapter 4.5.

For the **coil capacitance** as well, the space filled by the field should be considered. If a hygroscopic material able to absorb water is used for the insulation of the coil wire the capacitance will depend on the give water-content. In case of potted coil-winding an increase of the capacitance will happen because all potting material have a dielectric number larger than 1. However, since the major share of the overall capacitance is given not by the pickup but by the cable capacitance, the effects of changes in the pickup-capacitance are – as a general rule – only of secondary importance.

An environmental influence which is often overlooked results from the **acoustical surroundings**. As soon as the pickup signals are amplified and radiated by a loudspeaker, the pickup becomes part of a **feedback loop**. While this does not change the parameters mentioned above, we need to enhance equivalent circuit of the pickup by controlled sources. A complete description requires a (as far as possible) complete description of the transmission coefficients of air-borne and structure-borne sound, the coefficients themselves being dependent on time-variant mechanical dampening factors. It is, for example, conceivable that rubber bearings stiffen over the course of decades and influence the sensitivity to structure-borne sound. Depending on personal preferences, such an effect can be either classed as insignificant and ignored, or be defined as belonging to the guitar body, or be seen as effect of the pickup aging.