Universität Stuttgart
Institut für Energieübertragung und
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Manual v1.0

Frequency Response Analysis – Web Application

This website offers a tool for automatic FRA interpretation. It is based on the research conducted at the Institute of Power Transmission and High Voltage Technology (IEH) at the University of Stuttgart. The diagnosis is based on the numerical indicator: the Standard Deviation of Difference (SDD), and its minimum value, the Winding Assessment Factor (WAF). A WAF value falling below -5 at frequencies above 2 kHz may indicate transformer failure. For some background on the related research, see Tahir et al., “Novel Calculation Method for Power Transformer Winding Fault Detection using Frequency Response Analysis” (2019)

How to use:

Use the two buttons to upload one file for the FRA trace and one for the reference. **Only the specified file types** are supported. Measurement and reference don’t need to be of the same type.
Each file must contain **frequency and magnitude** values, with units of **Hertz and Decibel**, respectively. The tool automatically detects these values. Complex values cannot be analyzed and must be converted beforehand. Phase values are currently ignored.
The application can load and compare only one **measurement per file –** meaning **only a single sweep and a single trace**. If a file contains more than one measurement, the tool will simply select the first one it finds, or it may fail to load.
Make sure the **decimal point is a period** (this is essential for CSV and other plaintext formats).

Troubleshooting:

Here are some actions you can try if the analysis fails. These are not mandatory, but they may help resolve the issue:
For CSV or spreadsheet files (e.g., excel):

- Remove all columns and data except for frequency and magnitude. Place frequency in the first column and magnitude in the second.
- Upload only files with a single sheet.
- Remove any text or unusual characters from the file.

Additional Indices

These indices, taken from literature, are also used for FRA interpretation. They are not used for this program's diagnosis but serve solely for comparison. For their calculation, the frequency band is divided into sub-bands, and a single value is calculated for each sub-band. The indices are:

- Cross-Correlation Factor (CCF)
- Lin's Concordance Coefficient (LCC)
- Standard Deviation (SD)
- Comparative Standard Deviation (CSD)
- Standardized Difference Area (SDA)
- Sum of Error (SE)

CCF and LCC indicate a perfect match at a value of 1 and no match at 0. For the CCF, values below 0,96 might indicate damage. SD, CSD, SDA and SE show perfect match at 0 and have no upper limit.