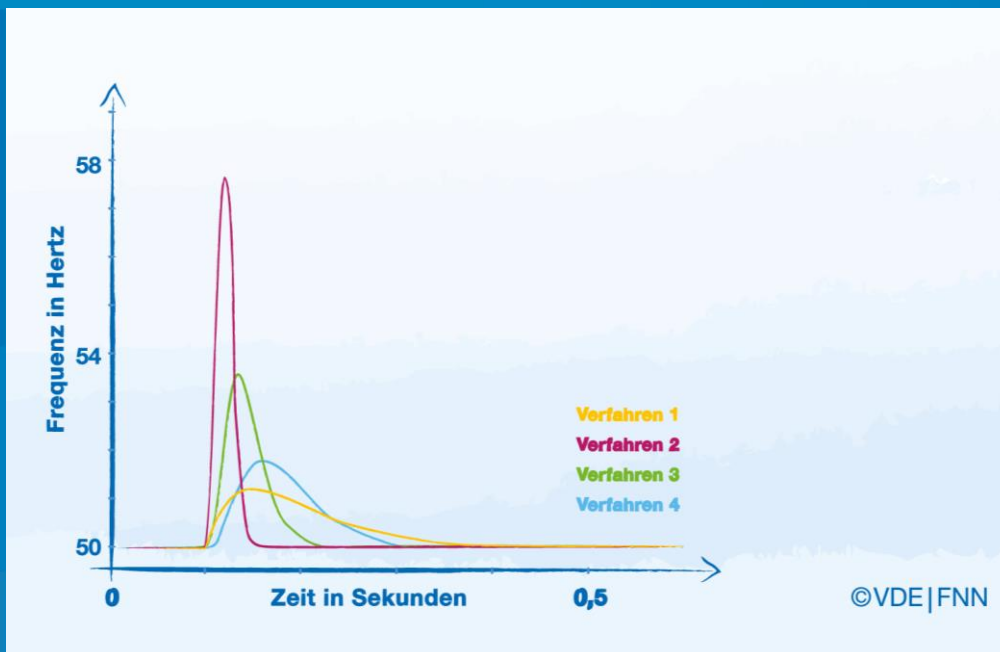


FNN RECOMMENDATION



Determination and Evaluation of the System Frequency – Effects of System-Side Interferences

English translation of the FNN-Recommendation

Ermittlung und Bewertung der Netzfrequenz –

Auswirkungen netzseitiger Störeinflüsse (Version 1.0)

Note: In case of doubt the German version will be valid.

Imprint

© Forum Netztechnik / Netzbetrieb im VDE (FNN)

Bismarckstraße 33, 10625 Berlin

Phone: + 49 (0) 30 3838687 0

Fax: + 49 (0) 30 3838687 7

E-mail: fnn@vde.com

Website: <http://www.vde.com/fnn>

October 2017

Table of contents

1 Motivation and Objectives	5
2 Effects of Interferences on Various Frequency Determination Processes	6
2.1 General information	6
2.2 Interference suppression in the stationary and steady state	7
2.2.1 Effects on the measurement of the frequency	9
2.3 Interference suppression in a phase-angle jump	11
2.3.1 Effects on the measurement of the frequency	12
2.4 Interference suppression in a voltage drop	13
2.4.1 Effect on the measurement of the frequency	14
2.5 Subsequent behavior in a transient frequency change (df/dt)	15
2.5.1 Effects on the measurement of the frequency	16
3 Summary and Conclusion	17
4 List of references	18
5 Appendices	19
A. Frequency measurement example in monitoring systems with different parametrizations	19
B. Requirements to the frequency measurement from protection technology applications	21
C. Requirements to the frequency determination from control technology applications	22

Index of figures

Fig. 1 – Basic wiring diagram of the frequency determination within the context of a power generating plant (PGP) control	5
Fig. 2 – Voltage forms afflicted by fundamental components and unbalances.....	8
Fig. 3 – Representation of a rate of change of frequency (0.04 Hz/s) and of the behavior of two frequency determination methods shown as examples (orange/violet/green/bright blue).....	9
Fig. 4 – Detailed representation in the stationary state and at the start of the rate of change of frequency.....	10
Fig. 5 – Detailed representation of the output signals in the transition from a rate of change of frequency to the stationary operation	11
Fig. 6 – Representation of the reaction to a phase angle jump	12
Fig. 7 – Frequency deviation after a phase angle jump (logarithmic y-axis representation).....	13
Fig. 8 – Representation of the voltages during and after a ground fault	14
Fig. 9 - Representation of the reaction to a voltage recovery after a ground fault	15
Fig. 10 - Representation of the reaction to a rate of change of frequency	16
Fig. A. 1 – Example with single-phase fault in phase L2 (U2)	19
Fig. A. 2 – Results of the various frequency measurements	20

Index of tables

Table 1 – Maximum harmonics levels for the normally operating nominal voltage acc. to EN 50160 and actual values for the outlined testing scenario (medium voltage)	7
Table B.1 – Measurement accuracy and reaction time limits	21