PTB innovationen
Technologieangebot

Figure: Side view of the synchronous generator

Advantages

- **Synchronisation with signal of an atomic clock**
- **Frequency stability less than $2 \cdot 10^{-11}$**
- **High spectral purity**
- **Compact design at reasonably low cost**

Highly stable synchronous generator

To realise the capacitance unit and its traceability to the quantum Hall effect, the so-called quadrature bridge plays an essential role. The sine wave generator required for this quadrature bridge only needs to create a few discrete frequency values in the kHz range, however with a relative precision and stability better than $6 \cdot 10^{-10}$ and a very pure spectrum. For this purpose, a digital sine wave generator has been developed at PTB. Its output signal is derived directly from the 10 MHz or 5 MHz reference signal of an atomic clock. This generator is based on a simple design with proven reliability and does not require the so-called "phase-locked loop". The generator offers compact dimensions and has been used reliably for several years now. Moreover, its setup only requires commercially available electronic components, which means that specially fabricated parts are not necessary.

The sine wave generator can be switched between three possible frequency values, for example between 616.57 Hz, 1233.15 Hz, and 2466.29 Hz. Other frequencies can be achieved by adapting the layout correspondingly. The relative frequency stability is less than $2 \cdot 10^{-11}$ and without any long-term drift. The spectrum of the sinusoidal signal is very pure, showing only a very small content of harmonics (-90 dB for the second harmonic and at least -100 dB for all higher harmonics). Further reduction of the harmonics is possible if required.

Economic impact

Sine-wave generators with correspondingly high frequency stability are especially used by National Metrology Institutes.

Development status

The system has been thoroughly tested. If you are interested, we offer to license the layout for the synchronous generator within the framework of a cooperation.

Contact:

Andreas Barthel
Technology Transfer
Phone: +49 531 592-8307
Fax: +49 531 592-69-8307
Email: andreas.barthel@ptb.de

Dr Jürgen Schurr
Working Group Quantum Impedance

Physikalisch-Technische Bundesanstalt
Bundesallee 100
D-38116 Braunschweig

www.technologietransfer.ptb.de

#8XXX / 04.2022