Возникает вопрос: существует ли алгоритм поведения отдельного P-автомата в строке, решающий ПФФ, для которого $C=(C_1, C_2, C_3)$ и $S<95$?

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NMDR SPECTROMETER WITH TWO *rf* FIELD SOURCES AND WITHOUT *rf* COMPENSATION

A. SÜGIS, M. ALLA. KAHE KS-ALLIKAGA TMTR-SPEKTROMEETER ILMA KS-KOMPENSATSIOONITA

А. СЮГИС, М. АЛЛА. СПЕКТРОМЕТР ЯМДР С ДВУМЯ ИСТОЧНИКАМИ ВЧ-ПОЛЯ И БЕЗ ВЧ-КОМПЕНСАЦИИ

Nuclear magnetic resonance (NMR) spectrometers can be divided into four groups according to the principle used for detecting NMR signals:

1) spectrometers with balanced *rf* bridge or crossed-coils probe;
2) time-sharing spectrometers;
3) spectrometers with slightly unbalanced *rf* bridge or crossed-coils probe;
4) spectrometers without *rf* compensation.

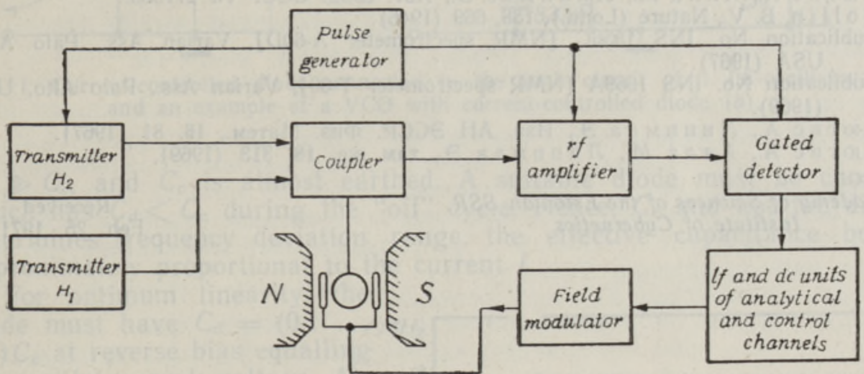
Spectrometers of Groups 1 and 2 operate necessarily with *rf* phase detection and have a separate *rf* reference channel branching off from the transmitter. Spectrometers of Groups 3 and 4 operate with *rf* amplitude detection and have no *rf* reference channel. It is the carrier voltage that plays the role of reference in this case, and it is applied to the amplitude detector together with NMR signal since there is only partial *rf* compensation (Group 3) or there is no *rf* compensation at all (Group 4).

A nuclear magnetic double resonance (NMDR) spectrometer with a separate source for the perturbing *rf* field has a number of advantages even in the homonuclear case, and commercially produced most up-to-date spectrometers — the XL-100 [1], HFX and

HX-90 [2] — already have separate sources for measuring (H_1) and perturbing (H_2) *rf* fields.

Spectrometers of Groups 3 and 4 are considerably simpler, but they are principally uncapable of operating with two *rf* sources. However, one can build a spectrometer without *rf* compensation for H_1, while for H_2 it operates in the modified time-sharing mode [3].

As far as monoresonance experiments are concerned, such a spectrometer (see Fig.) operates as a usual NMR spectrometer without *rf* compensation [4–6]. For double resonance (DR) experiments the trans-



mitter for H_2 and the receiver are intermittently pulsed on and off. Hence, when the transmitter H_2 is off, the receiver operates in the usual way, similar to monoresonance, and when this transmitter is on, the receiver simply gives no output. If we used a simple, ungated *rf* detector, we would get the detected carrier (from H_1) in the chopped form (at pulse repetition rate), which would cause a lot of trouble to filter it out. Actually, the load resistor of the diode detector is disconnected from the earth by a diode switch for an "off" half-cycle while output voltage of the diode detector is held constant and equal to the output voltage at the end of the previous "on" half-cycle. So this unwanted *lf* voltage at pulse repetition rate is suppressed at least 40 db and causes no problem any longer.

The on-off suppression ratio of the transmitter H_2 should be rather high, say about 120 db, while for the *rf* amplifier this ratio can be very low, the only condition being that the carrier voltage from H_1 applied to the detector diode during an "on" half-cycle must not be exceeded by "carrier" voltage from H_2 during the "off" half-cycle. The two transmitters used were frequency synthesizers specially designed for high-resolution NMR [7], and the pulse generator was the same as for usual time-sharing [8]. Suitable pulse repetition rate has been found to be about 10 kHz, which allows convenient separation of signal frequencies determined by field modulations near 5 kHz.

The proposed system does not have the main shortcoming inherent in the Rollin-type detection scheme as used for DR — an excessive noise from the transmitter. Here the output of the transmitter H_1 is not used for spin decoupling and therefore can be kept sufficiently low — some tens of mV — and it does not add anything to the thermal noise of the probe circuit. So the Rollin-type detection scheme that does not have the most critical part of other spectrometers (the *rf* bridge or crossed coils) and which was so far used only in spectrometers for routine chemical analysis, may now be successfully used in full-scale research spectrometers, including strong perturbing *rf* fields, INDOR, etc. For experiments with variable sample temperature it has a serious advantage, since the balance drift of the *rf* bridge or crossed coils is eliminated and the influence of the phase drift connected with the probe circuit is halved.

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A. SÜGIS

CURRENT-CONTROLLED DIODES AS VARICAPS IN OSCILLATORS

A. SÜGIS. VOOLUGA TÜÜRITAVAD DIOODID KUI VARIKAPID OSTSILLAATORITES

А. СЮГИС. ДИОДЫ, УПРАВЛЯЕМЫЕ ТОКОМ, КАК ВАРИКАПЫ В ГЕНЕРАТОРАХ

Voltage-variable capacitors have strongly nonlinear voltage-capacitance characteristics hindering their usage in voltage-controlled oscillators (VCO-s), unless only a small portion of the characteristic is used or rough nonlinearity can be tolerated. Operating of a varicap or even a rectifier diode in a detecting mode solves this nonlinearity problem for VCO-s. We have used diodes in the detecting mode for the improvement of frequency synthesizers [1], while Touissant and Olfs noted only some extension of the tuning range of an oscillator [2].

A diode detector is converted into a current-controlled diode by applying a control voltage E_{in} to the load resistor R_L (Fig. 1, *a*), which controls mean current I through the diode. This diode is switched on and off by the oscillator voltage, while conducting angle is controlled by E_{in}. A suitable capacitance C_c which couples the tank circuit LC of an oscillator to the diode, is essential for proper operation. During the "on" cycle,