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Improvement of Peak Hold Method for High Speed Nuclear Pulse Signal

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- **Background:** In nuclear detection, researchers can extract nuclear information by analyzing the narrow pulse signal of the output of the nuclear detector. A scintillator detector which consisting of a scintillator and a photomultiplier tube is one of the most widely used ionizing radiation detectors. When the scintillator absorbs the gamma rays emitted by the radioactive elements, the detector outputs narrow pulse signals of different amplitudes, and the amplitude values of the narrow pulse signals correspond to the energy intensity of the gamma rays.
- **Purpose:** The output of scintillator detector is usually the narrow pulse signal of ns-level.It is difficult for the general electronic system to directly and accurately acquire the amplitude information of the narrow pulse signal.The conventional voltage type peak hold circuit is prone to large overshoot and has a narrow bandwidth.Although the ordinary transconductance type peak hold circuit can effectively reduce the overshoot, it is difficult to simultaneously achieve rapid pulse shaping and long-term stable peak hold. Therefore, it is necessary to design a circuit that simultaneously achieves rapid pulse shaping and stable peak hold.
- **Methods:** An improved peak hold circuit based on the output signal of the scintillator nuclear detector is designed to achieve peak hold of the ns-level high-speed nuclear pulse signal by double-stage peak hold circuit. Each stage of the peak hold circuit uses a transconductance op amp, which can effectively reduce the impact of overshoot on maintaining accuracy. The first stage peak hold circuit achieves a fast response to narrow pulse signals, and the second stage peak maintains the function of achieving a stable amplitude for a long time.
- **Results:** The designed of double-stage transconductance peak hold circuit is suitable for processing high-speed narrow pulse signals output by nuclear detectors. The response time of this circuit is less than 20 ns, the amplitude error of peak hold is less than 2%, and the peak droop rate is less than 5 mV/us. The double-stage transconductance peak hold circuit has the advantages of fast response, high precision, good stability and wide bandwidth,which is suitable for processing ns-level high-speed narrow pulse signals of nuclear detector output.

Summary

The double-stage transconductance peak hold circuit is designed to process the high-speed narrow pulse signal output from the nuclear detector. The first-stage peak hold circuit achieves fast response to narrow pulse signals, and the second-stage peak maintains the function of achieving long-term stable amplitude. . This circuit has the advantages of fast response, high precision, good stability and wide bandwidth when processing high-speed nuclear pulse signals.

Abstract Type

Poster

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