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An Intra-pulse feedforward algorithm for improving pulsed microwave stability

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During the pulsed operation of the linear accelerator in DCLS (Dalian Coherent Light Source), we found a strong correlation between the klystron modulator's high voltage and the klystron output microwave, with noticeable jitter among adjacent microwaves. Therefore, we propose an intra-pulse feedforward algorithm and implement it in LLRF (Low-Level Radiofrequency) systems. This algorithm assumes that the transfer model of the microwave system is linear within a small range of work points and measures the transfer coefficient of the microwave between the LLRF and klystron. For each pulsed microwave of the klystron output, the LLRF system first calculates the vector deviation between the initial measurement within its pulse and the target. The deviation will be compensated in the LLRF excitation so that the jitter in the later part of the pulsed microwave is suppressed. Experiments have shown that this algorithm can effectively suppress the jitter among adjacent microwaves, e.g., improving the amplitude and phase stability (RMS) from 0.12%/0.2° to 0.09%/0.06°. This algorithm can also be applied to other accelerators operating in pulsed modes.

Keyword

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