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Adaptive Resonance Control for LANSCE-R

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Resonance control of the low level RF control of the linac accelerator system
achieves the match between the driving RF frequency and the cavity resonance
frequency, the match between the cavity resonance frequency and the linac design
operating frequency. First of all, these matches are obtained by adjusting the
driving RF frequency to the cavity resonance frequency. When the driving RF
frequency is far from the cavity resonance frequency, the frequency difference is
estimated. This frequency error estimate programs the NCO whose output is used for
the carrier frequency of the IQ modulator in the low level RF system. When the
adjustment of the driving RF frequency to the cavity resonance frequency is
successful and hence the frequency error estimate is within the design
specification, the water resonance cooling control system (RCCS) begins to tune
water system such that the cavity resonance frequency tracks the linac design
operating frequency while the driving RF frequency continuously tuned to follow the
cavity resonance frequency as well. As tunes proceed further successfully, the
driving RF frequency and the cavity resonance frequency enter the region of
frequency within the specified boundary of the design linac operation frequency.
The
driving RF frequency is locked to master oscillator which runs at the linac design
operating frequency and only the RCCS tunes the cavity resonance frequency to
follow
the design linac operation frequency.
In this paper, we propose an adaptive algorithm that estimates the frequency
difference between the generator frequency and the cavity frequency, the tracking
scheme of the generator frequency to the cavity frequency, the system level design
of the hardware in the ALTERA DSP Builder Environment, implementation of the whole
scheme on the ALTERA STRATIX II FPGA, and the system test on the LANSCE low power
RF system test-stand.

Author: Mr KWON, Sungil (LANL)

Co-author: PROKOP, Mark (LANL)

Presenter: Mr KWON, Sungil (LANL)

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