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Development of ARES Cavity Simulator

For the SuperKEKB project, a new LLRF control system has been developed to realize high accuracy and flexibility. Accordingly the evaluation of the new LLRF system carries significant weight. For the test operation in quantity production of new LLRF systems, an ARES cavity simulator was developed. The ARES is a special normal conducting cavity for the KEKB, which has a unique structure in order to avoid the coupled-bunch instability. It is a three-cavity system: the accelerating cavity is coupled with a storage cavity via a coupling cavity.
This simulator calculates real-time evolution of base-band (I, Q-components) from difference formula of resonators. It is extended to three-cavity system by adding coupling terms in the equations. This calculation is performed by an FPGA. This simulator has I/Q modulators and demodulator, and then it can directly receive an RF signal as a cavity input, and can also output the responses as RF signals. Furthermore, this simulator can receive tuner control pulses, and simulate the cavity (de-) tuning. The cavity parameters such as Q-values and input coupling can be configured arbitrarily.
The stability condition of calculation will be is also discussed in this report.

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