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## **Stability analysis of double-harmonic cavity system in heavy beam loading with its feedback loops by a mathematical method based on Pedersen model**

*Sunday, 7 May 2023 16:00 (2 hours)*

With the high beam current in storage ring, it is necessary to consider the instability problem caused by the heavy beam loading effect. It has been demonstrated that direct RF feedback (DRFB), autolevel control loop (ALC) and phase-lock loop (PLL) in the main cavity can lessen the impact of the beam effect. This paper regarded the beam, main cavity, harmonic cavity and feedback loops as double harmonic cavity system, and extended the transfer functions in the Pedersen model to this system. Some quantitative evaluations of simulation results have been got and conclusions have been drawn. In the case of a passive harmonic cavity, the optimization strategy of the controller parameters in the pre-detuning, ALC and PLL, as well as the gain and phase shift of DRFB were discussed. Meanwhile, it also involved the impact of the harmonic cavity feedback loop on the system stability at the optimum stretching condition when an active harmonic cavity was present. The research results can be used as guidelines for beam operation with beam current increasing in the future.

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### **Footnotes**

### **I have read and accept the Privacy Policy Statement**

Yes

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