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KOOPMAN MEETS KALMAN

A deep learning approach to model RF cavity detuning

Andrei Maalberg et al. | ST3 Meeting in Zeuthen, 26.06.2025

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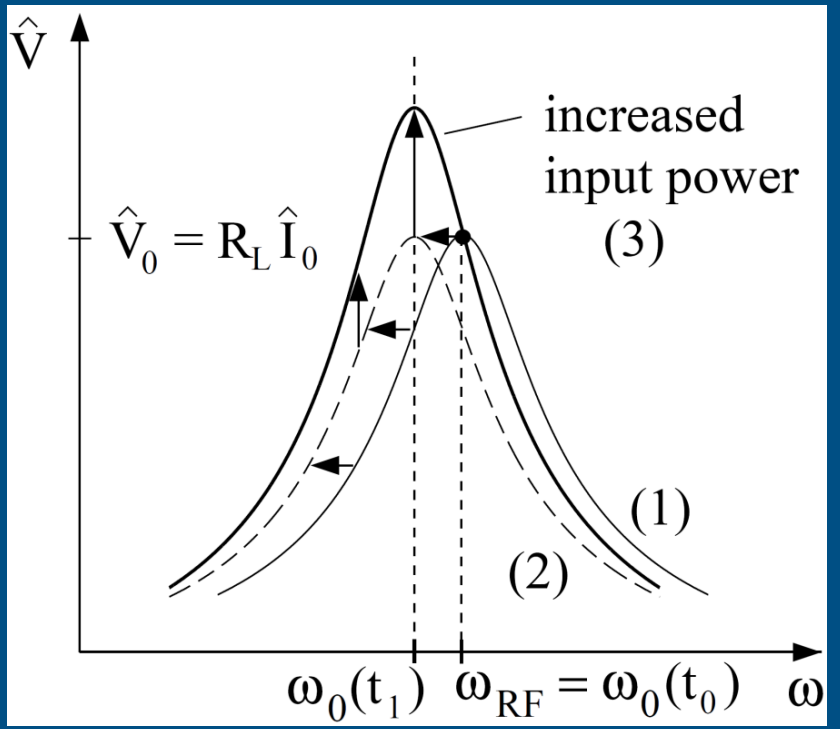
RF cavity detuning

- Represents a decades-old topic in control for accelerator physics
- Affects energy consumption in particle accelerators
- Still remains an open issue
- We need a better detuning modeling approach!



Principle of cavity detuning. Adapted from [1].

[1] T. Schilcher. Vector Sum Control of Pulsed Accelerating Fields in Lorentz Force Detuned Superconducting Cavities. Ph. D. dissertation, Hamburg University, 1998.

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Kalman-inspired neural decomposition, or KIND

- Decompose detuning into stationary and transient dynamics
- Use deep learning to make the decomposition data-driven
- Become inspired by Kalman and blend the dynamics as
- We get a promising modeling approach for nonlinear and time-varying cavity dynamics!

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Thank you

Koopman went to meet Kalman