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ANALYSIS OF DAMPING MEASUREMENTS IN PEP*

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NOTICE

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Introduction THAT PRECLUDES SATISFACTORY REPRODUCTION

This report deals with the mathematical analysis of damping measurements performed at PEP (Log Book 19, pages 96 to 100). The experiment involved beam position measurements as a function of time following an initial excitation or displacement. The motion was predictably described as a linear combination of exponentially damped sinusoids representing the motion in both the horizontal and vertical directions. A variety of mathematical techniques were applied in order to determine the damping coefficients themselves, and their relationship to beam and accelerator parameters such as current and chromaticity. The most reliable of these methods involved an application of the convolution theorem for Fourier transforms in order to filter out unwanted oscillations by their characteristic frequencies. This method, when applied to the experimental data, yielded damping coefficients that were consistent with the Head Tail Instability model.

The Data

The experimental data sets consisted of a processed beam position monitor signal sampled 4096 times at intervals of 2 or 5 μ s. Each set of points corresponds to a particular value of beam current and accelerator parameters (i.e. X & Y chromaticities, rf frequency, etc...), and to the application of various frequency filters to the input signals. A total of 96 such sets of measurements were made and subsequently stored on magnetic floppy disk tracks.

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