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SMOOTHING BASED ON BEST-FIT TRANSFORMATOIN

Smoothing is a technique to achieve accurate relative alignment of components and it's a main concern of accelerator alignment. Several smoothing techniques are reviewed in this article and the principle and application of smoothing based on best-fit transformation are introduced as there is no other paper discussing this before.

Compared with other methods, smoothing based on best-fit transformation uses design information which is more preferable in a way. It uses best-fit transformation, which is extremely easy to use, between reference and as-built group to find an optimal expression of the interested magnets or girders so that the relative alignment of them can be properly judged.

It has been used in the touch-ups of NSLS-II storage ring girders recently and also the whole storage ring re-adjustment of SSRF during 2012 shutdown. Both applications yield good alignment result. Moreover, it's expected to be used for long term maintenance of NSLS-II and have the ability to solve the potential conflict between short shutdown time and tight alignment tolerance when it is in full operation.

Summary

Best-fit transformation is a basic technique for accelerator alignment in the current time, but smoothing seems a little bit fancy as it usually associates with different language, such as Fourier function, cubic spline or Principal Curve Analysis etc. But the application of best-fit transformation makes smoothing a lot easier and any surveyor can do it.

It's not only a great tool for partial and whole alignment of an accelerator at the beginning of running a machine, but also a possible solution for long term maintenance of storage ring when more constraints present.

With dedicated script, the whole smoothing process can be fully automated and high efficiency is expected.

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