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# A Model-based approach to Motion Control design at the Australian Synchrotron

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Reliable, robust, and predictable control of motion axes is a key component to any synchrotron beamline. To this end, new motion controls hardware (Geo-Brick-LV-GBLV, Delta-Tau-UK) was recently introduced at the XAS, IMBL, SXR and XFM Beamlines. Challenges included optimising and tuning motion axes behaviour for in-vacuum motors, closed-loop tracking axes, and scanners with velocity requirements.
Generally, the GBLVs are very powerful motion controllers, which can be utilised for many different applications by soft configuration/tuning. This sophistication and flexibility often implies complex and potentially difficult configuration and tuning processes by highly specialized engineers, particularly for non-trivial motion environments at beamlines.
In order to address these challenges, a model-based approach was used to provide a framework for generalising and formulating the motion control system. The model makes it possible to classify applications (e.g. positioning, scanning), and suggest optimum motor configuration and tuning based on design inputs of motor and stage specification and user requirements (e.g. accuracy, speed).
The model developed has been applied successfully to more than 50 motion axes at XAS, IMBL and SXR, adequately predicting motor performance outcomes. It strongly improves the classical approach of system design based on expected configurations and manual tweaking in the field. This is because a model-based solution documents and incorporates learning, evolves to handle more and more complex systems, classifies problem types, and, importantly, reduces non-standardisation while improving usability, which ultimately benefits the user community through more effective beamline operation.

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## Summary

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