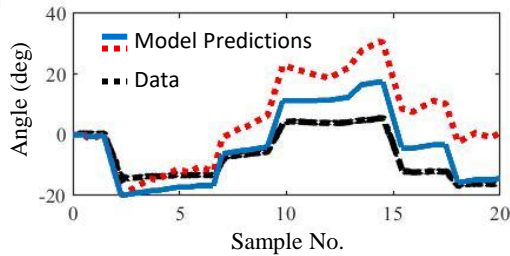




Dealing with Unknown Time Delay in Hydraulic Manipulators

Olivia Albrecht, PhD Researcher, o.albrecht@lancaster.ac.uk

What is the problem?



Control of Hydraulic manipulators, such as the one to the right, is researched to improve the use of hydraulics in highly radioactive environments, where electronics, and therefore, electrically actuated robotics, fail quickly.

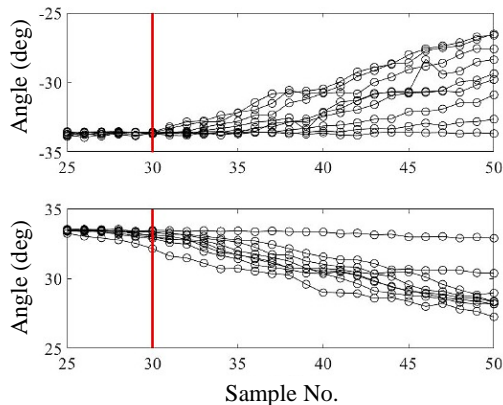
As a preceeding step to designing a controller, modelling the system revealed an intriguing characteristic: variable time delays, which makes the system more difficult to model and control. Literature shows that few controllers for similar applications address variations in time delay and it is more popular to linearize and simplify such a non-linear system.

What am I currently working on?

In terms of controller design, I am looking into a multi-model controller and a neural network predictive controller to see how these already researched methods compare with existing PID and proportional-integral-plus controller designs.

In terms of modelling, I am looking into designing an algorithm to identify the time delays correlating to any change in input magnitude within an experiment, allowing us so understand the range of possible time delays and what the time delay may be dependant on (such as deadband or other system non-linearities).

How will this work develop?



The process of understanding and implementing the multi-model and neural network predictive controllers will provide insight into what works for this system and what doesn't. This will provide insight into what different parts of the controller do and how these can possibly be adapted for use on the current system.

Upon completion of the time-delay-estimation algorithm, it will be possible to analyse a large amount of data from future experiments, understand relationships between time delay and other variables, and use this information to model and control the system more effectively.

Presented in conjunction with the following article: Albrecht, O., Monk, S.D., Bandala, M. and Taylor, C.J. (2020) Control of hydraulically-actuated manipulators with dead-band and time-delay uncertainties, 3rd UK-RAS Conference for PhD Students & Early-Career Researchers

HydroLek Manipulator (right) - <http://www.hydro-lek.com/>

