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By Marco Gallieri

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This thesis proposes a novel Model Predictive Control (MPC) strategy, which modifies the usual MPC cost function in order to achieve a desirable sparse actuation. It features an ℓ_1 -regularised least squares loss function, in which the control error variance competes with the sum of input channels magnitude (or slew rate) over the whole horizon length. While standard control techniques lead to continuous movements of all actuators, this approach enables a selected subset of actuators to be used, the others being brought into play in exceptional circumstances. The same approach can also be used to obtain asynchronous actuator interventions, so that control actions are only taken in response to large disturbances. This thesis presents a straightforward and systematic approach to achieving these practical properties, which are ignored by mainstream control theory.

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About the Author

Marco Gallieri received a PhD in Engineering as an EPSRC scholar from Sidney Sussex College, the University of Cambridge, in 2014. His research was on Model Predictive Control for redundantly actuated systems, with focus on marine and air vehicles. In 2007 he received a BSc and in 2009 an MSc in information and industrial automation engineering from the Università Politecnica delle Marche, in Italy. He wrote his MSc thesis in 2009 during an Erasmus exchange at the National University of Ireland Maynooth in collaboration with BioAtlantis Ltd and Enterprise Ireland. The topic was modeling and control design for a crane-vessel for seaweed harvesting. Between May and September 2010 he was a Marie Curie early state researcher at the Instituto Superior Técnico in Lisbon, working on non-linear methods for formation control of autonomous underwater vehicles with range only measurements. He is author of ten international conference papers as well as a Journal article.

Since February 2014 he is with McLaren Racing Ltd. From July 2015 he is involved in the development of the F1 car simulator. Previously he worked as a control systems engineer and developed a model based Li-Ion battery management system for the 2015 Honda power unit. Further relevant projects included car speed and attitude estimation via sensor fusion, predictive analytics for fuel sensor management and fuel system design optimization.

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