Experiment design for ships

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Résumé

Modern ships are equipped with various control and automation systems and the tuning of these systems usually requires accurate mathematical models, for example, second-order modulus models. System identification is a natural approach in this application, but a main challenge is that the time for data collection is often quite limited during the commissioning of a new ship, making experiment design a key tool. Here, a dictionary-based approach to experiment design for ships will be discussed. This approach presents a systematic way of choosing the most informative combination of independent experiments out of a predefined set of candidates. This idea is quite general but is here tailored to an instrumental variable (IV) estimator with zero-mean instruments, which is an estimator well suited to deal with parameter estimation for second-order modulus models. The method is evaluated using both simulated and real data, the latter from a small model ship as well as from a full-scale vessel. Further, a standard motion-planning problem is modified to account for the prior-made choice of information-optimal sub-experiments, which makes it possible to obtain a plan for the complete experiment in the form of a feasible trajectory.

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