Review of L-CSS 22-0290

1 Summary

The authors present a data-driven method for designing an estimator for unmeasured inputs in linear discrete-time systems. It is assume that recorded input-output data of the system is available, including data from the input that is assumed unmeasurable once the system is put in service.

Overall, the language and the paper organization is adequate, and it seems technically correct. However, I have some concerns related to the contribution of the paper and how it contrast with the state of the art.

2 Main comments

1. The contribution of the work related to other results in the literature is not clear. For instance the convergence properties of the proposed method are not contrasted with the ones in the referred literature, for instance [1,6,9]. In this direction, there is also no clear advantage of the proposed method with respect to the conventional two step design approach, i.e., model identification followed by the controller/estimator design. The reason is the complexity of the calculations in (16) and the requirement of a singular value decomposition to obtain N_1, N_2 and N_3 in (14).
2. Please clarify in Section II what is assumed for (1). Implicitly it seems that the authors assume a minimal realization, but this is not clearly stated.
3. The proposed method provides an estimate of the past input delayed by N_{mea} samples. Please explain if this is the usual case when compared to other methods in the literature, or if this is a limitation of the proposed method.
4. The sufficient part of Theorem 1's proof is not clear to me. To clarify the point it may help that the authors explicitly state the assumed rank for H and H_u, and how the persistency of excitation condition in Assumption 1 impacts those ranks.

3 Minor comments and typos

1. In the abstract "... are estimated recursively by the IRO which asymptotically converge to..."
2. In the proof of Lemma 2, there is a missing bar in u_t.
3. The symbol for the transpose of a matrix is different in (12) and (16).

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