

WHEN DO KOOPMAN EMBEDDINGS EXIST? A USER’S GUIDE

MATTHEW D. KVALHEIM

ABSTRACT. The following list gives precise references to those results relevant to existence of continuous (or smoother) one-to-one linearizing maps from my presentation “When do Koopman embeddings exist?” at the 2025 SIAM Conference on Dynamical Systems (DS25) delivered on Sunday, May 11, 2025.

- **Slide 6:** Theorems 2.3, 2.5 and 2.6 and Remark on p. 47 of [LM13]; Propositions 2 and 3 of [KR21].
- **Slide 7:** Theorem 2 of [KS25].
- **Slide 8:** the first proposition is Proposition 1 of [KS25]. The second proposition is Theorem 10 of [Kva25]. The theorem is Theorem 1 of [Kva25].
- **Slide 10:** the first bulleted result is Corollary 6 of [KA24]. The second bulleted result is Corollary 3 of both [LOS23] and [LOS25].
- **Slide 12:** Theorem 1 of [AK23].
- **Slide 13:** Figure 1 of [AK23].
- **Slide 18:** Theorem 3 combined with Remark 3 of [KA24].
- **Slide 20:** Example 7 of [KA24].
- **Slide 21:** the theorem is a partial statement of Theorem 4 in [KA24].
- **Slide 22:** the theorem is a combination of Theorems 1 and 2 in [KA24].
- **Slide 23:** Figure 1 of [KA24].
- **Slide 24:** Corollaries 1 and 2 of [KA24].

ACKNOWLEDGMENTS

Most of my results mentioned here were obtained through separate collaborations with Philip Arathoon, Shai Revzen, and Eduardo Sontag. I thank Petar Bevanda and Igor Mezić for their kind invitation to speak at their minisymposium “Theory of Koopman Operators for Data Driven Dynamical Systems” at SIAM DS 2025.

REFERENCES

- [AK23] P Arathoon and M D Kvalheim, *Koopman embedding and super-linearization counterexamples with isolated equilibria*, arXiv preprint arXiv:2306.15126 (2023), 1–7.
- [KA24] M D Kvalheim and P Arathoon, *Linearizability of flows by embeddings*, arXiv preprint arXiv:2305.18288v6 (2024), 1–20.
- [KR21] M D Kvalheim and S Revzen, *Existence and uniqueness of global Koopman eigenfunctions for stable fixed points and periodic orbits*, Phys. D **425** (2021), Paper No. 132959, 20. MR 4275046
- [KS25] M D Kvalheim and E D Sontag, *Global linearization without hyperbolicity*, arXiv preprint arXiv:2502.07708 (2025).
- [Kva25] M D Kvalheim, *Differential topology of the spaces of asymptotically stable vector fields and Lyapunov functions*, arXiv preprint arXiv:2503.10828 (2025).
- [LM13] Y Lan and I Mezić, *Linearization in the large of nonlinear systems and Koopman operator spectrum*, Phys. D **242** (2013), 42–53. MR 3001394

- [LOS23] Z Liu, N Ozay, and E D Sontag, *On the non-existence of immersions for systems with multiple omega-limit sets*, IFAC World Congress, Yokohoma, Japan (2023).
- [LOS25] ———, *Properties of immersions for systems with multiple limit sets with implications to learning Koopman embeddings*, Automatica **176** (2025), 112226.