SIMULATING STIFF SYSTEMS WITH A LINEAR PARAMETERIZED LATENT SPACE

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ABSTRACT

Stiff ordinary differential equations present distinct challenges in various engineering disciplines. Specifically, these types of problems cannot be solved with traditional explicit time integration methods. Rather, costly implicit methods must be used to find solutions. Additionally, the timescale separation of various elements of the solution in stiff problems are handled poorly with modern machine learning techniques. Methods, such as Neural ODE (NODE), have proven to be insufficient for learning stiff systems. This work builds upon the NODE framework, to create surrogate models for stiff problems which can be solved in a linear parameterized latent space, using explicit time integration methods. Additionally, the approach can be extended to include additional input parameters, in the same fashion as the Parameterized Neural Ordinary Differential Equation approach proposed in [1]. This poster will demonstrate a new surrogate modeling approach that allows for the use of explicit methods to model stiff ordinary differential equations which have input-parameter-varying dynamics.

REFERENCES

[1] Kookjin Lee and Eric J. Parish. Parameterized neural ordinary differential equations: applications to computational physics problems. Proceedings of the Royal Society A: Mathematical, Physical and Engineering Sciences, 477(2253):20210162, September 2021.