

Robust non-computability

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It is well known that, in the the context of computable analysis, there are some operators which can transform computable inputs into non-computable outputs. An example is differentiation, since there are continuously differentiable and computable functions whose derivatives are not computable. Another example of such phenomenon is Pour-El and Richards' initial value problem for the wave equation that has computable initial conditions but a non-computable unique solution.

A question that naturally arises is whether those results are physically relevant. This can be seen from several perspectives. Here we analyze whether such results are robust to perturbations over continuous spaces. To achieve this task we present several notions of robustness of non-computability and study the degree of robustness of several well-known non-computable processes involving the differentiation, the wave equation, and a continuous version of the Halting Problem (finding basins of attraction).

References

- [1] D. S. Graça and N. Zhong. Robustness of non-computability. *Preprint available at <https://doi.org/10.48550/arXiv.2109.15080>*.