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Fast, Elegant Set-Oriented Methods for Dynamical Systems using GAIO.jl

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Software

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Summary

GAIO (Global Analysis of Invariant Objects) is a software package for set oriented computations in dynamical systems. These include isolating attractors, discretizing invariant measures and computing their transfer behaviors, among others. The algorithms that make up GAIO have been rebuilt from the ground up using the Julia programming language; the result is a package in which pseudocode for set-oriented algorithms can be written nearly verbatim an executed with high performance.

Statement of need

Code

function RELATIVE ATTRACTOR (f, $\mathcal{B}$, n)
  for $i = \{1, \ldots, n\}$ **do**
    $\mathcal{B} \leftarrow \text{SUBDIVIDE}(\mathcal{B})$
    $\mathcal{B} \leftarrow \mathcal{B} \cap f(\mathcal{B})$
  end for
  return $\mathcal{B}$
end function

```
function relative_attractor(f::BoxMap, B::BoxSet, n)
    for s in 1:n
        B = subdivide(B)
        B = B ∩ f(B)
    end
    return B
end
```

Figure 1: Left: original pseudocode derived in (Dellnitz & Hohmann, 1997). Right: Code within GAIO.jl

Acknowledgements

References

Dellnitz, M., & Hohmann, A. (1997). A subdivision algorithm for the computation of unstable manifolds and global attractors. *Numerische Mathematik*, *75*. https://doi.org/https://doi.org/10.1007/s002110050240