Reproducibility Package
Chaotic PID/PIDD Evolutionary Optimization

This document describes all components required to reproduce the results of:

R. Vrabel
Evolutionary Optimization on Chaotic Closed-Loop Landscapes: A Comparative Study
Submitted to *Evolutionary Computation* (MIT Press).

The package contains the full experimental workflow used in the article:

- `run_experiments.py` – executes PSO and DE across 50 runs
- `compute_statistics.py` – computes summary statistics, robustness, PSI
- `generate_latex_tables.py` – generates table fragments
- `requirements.txt` – minimal dependency list

Installation

Python 3.10 or newer is recommended.

```
pip install -r requirements.txt
```

Dependencies:

- numpy
- scipy
- pandas
- mealpy

Running the Experiments

1. Optimization runs

```
python run_experiments.py
```

Output:

- `all_runs.csv`

2. Compute statistics

```
python compute_statistics.py
```

Outputs:

- `summary_statistics.csv`
- `psi_statistics.csv`

3. Generate LaTeX tables

```
python generate_latex_tables.py
```

Outputs:

- `latex_table_summary.txt`
- `latex_table_psi.txt`

Reproducibility Notes

- Canonical PSO and DE (no hybrid variants).
- Independent random seed for every run.
- Closed-loop simulation uses Radau IIA solver on $t \in [0, 25]$.
- Controller gains in $[0, 10]$.
- PSI computed using performance pair (J, time), which is monotonic with evaluation count under fixed simulation budget.

Suggested Repository Structure

```
chaotic-pid-evolutionary-study/
|
|-- run_experiments.py
|-- compute_statistics.py
|-- generate_latex_tables.py
|-- README.pdf
|-- requirements.txt
|
‘-- example_output/
|-- all_runs.csv
|-- summary_statistics.csv
|-- psi_statistics.csv
|-- latex_table_summary.txt
‘-- latex_table_psi.txt
```

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