Quasi Periodic Package

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1 Introduction

This package was originally written to have a custom-made algorithm that is
able to handle two-parameter continuation in a general regenerative nonlinear
model of milling (cutting) processes [1]. It has been modified here to deal with
the HKB equations [2].

2 List of functions

All functions contain their own explanatory header in the corresponding `.m` files.

- `cont_2dtori.m`: main function to perform the torus continuation. It can
  be initiated from a single point or using an entire branch. It performs
  correction and prediction based on the system files.

- `jac_collocation_2dtori.m`: delivers the Jacobian of the invariant torus
  equation.

- `br_plot.m`: branch plot routine.

- `fun_invariance_2dtori.m`: returns the collocation based invariant torus
  equations.

- `fun_invariance_cont.m`: gives the additional continuation condition.

- `jac_cpari_ex.m`, `cptaustate_ex.m`, `cpstate_ex.m`, `j2kl.m`, `kl2j.m`, `fun_IC.m`,
  `fun_IR.m`: outsourced files dealing with different state transformations and
  indexing to reach optimized parallel execution of `cont_2dtori.m`.

- `fun_rhs_HKB.m`, `fun_sys_tau_HKB.m`, `fun_deri_HKB.m`, `fun_cond_HKB_FFT.m`: HKB [2] related files defining the right-hand-side (rhs), the derivatives for the Jacobian (deri) and the delays (tau). The system specific two parameter continuation conditions are in `fun_cond_HKB_FFT.m`.

- `sys_rhs.m` and `sys_deri.m`: system files of HKB equations [2] defined according to the `ddebiftool` manual [3].

- `run_*.m`: script to initialize a single parameter (`01` and `02`) continuation, while the others (`03` and `04`) start two parameter continuation based on the condition file (`fun_cond_HKB_FFT.m`).

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Statement: This is a purely research oriented algorithm, made in a result oriented way. It is only optimized up to a convenient level. Please report inefficiency, errors and grammatical mistakes and suggestions, using the above email. Any usage or publications based on the algorithm must be authorized by the author. The algorithm is optimized for MATLAB 2018b (MATLAB licence for 2022-2023 held by BME where the author is employed).

References

[1] Z Dombóvári and G Stépán, On the bistable zone of milling processes, Philosophical Transactions of the Royal Society A, 373, 20140409

[2] P J Beek, C E Peper and A Daffertshofer (2002), Modeling rhythmic inter-limb coordination: Beyond the Haken-Kelso-Bunz model, Brain and Cognition, 48, 149–165.

[3] K Engelborghs, T Luzyanina and D Roose (2002), Numerical bifurcation analysis of delay differential equations using DDE-BIFTOOL, ACM Transactions on Mathematical Software, 1, 1-21.