Jean-Luc Thiffeault <jeanlucth@gmail.com>

Topological Entropy Problems

5 messages

Miriam Ritchie <mritchie@maths.dundee.ac.uk> Fri, Feb 28, 2014 at 8:48 AM
To: jeanluc@math.wisc.edu

Dear Jean-Luc,

I am a PhD student in the University of Dundee's MHD group. I am working on a project where the idea is to try and relate heating of coronal magnetic loops to the nature of the photospheric surface motions. We had the idea to model the coronal loops as magnetic braids (under an ideal MHD evolution the space-time diagram of the surface motion corresponds to the magnetic field structure in the solar corona).

One measure we were hoping to examine to characterise the photospheric flow is its topological entropy and to carry out the calculation in practice we have tried using your MATLAB routines, as in the Appendix of the Chaos (2010) paper and now with your braidlab package.

We have hit a bit of an obstacle and wanted to check-in with you before going too much further down these lines - the essential problem is that with some test flows with zero metric entropy the braidlab routines give a positive topological entropy. Maybe this is to do with the class of flow - the routines being designed for more complex flows? Or maybe there is something we're missing - we wonder whether you have any comments? A short pdf describing the basic problem is attached.

We'd really appreciate any input you have into this.

2 attachments

drive_simple.m
1K

Top_Problems_update.pdf
126K

Jean-Luc Thiffeault <jeanluc@math.wisc.edu> Fri, Feb 28, 2014 at 9:01 AM
To: Miriam Ritchie <mritchie@maths.dundee.ac.uk>

Hi Miriam,

I think the problem lies with periodicity: your flow is periodic, but you are only running it for one period? A "true braid" is closed, in the sense that the final points have to match with the initial ones, as a set. If the braid is "chaotic" and long enough, then the small error made in closing the braid becomes negligible.

So, if you run your flow for many periods, you should see the entropy of sig1 sig2 converge to zero, whereas that of sigma1 sigma2^-1 should not (unless there is some chaos in the s1s2 flow).

If you run into problems with larger braids, you can also use complexity(b), which is a measure of entropy for one application of the braid (entropy(b) iterates the same braid many times). For enough iterations, complexity(b)/iterations should give entropy(b).

Let me know if this works,

Best,

Jean-Luc
[Quoted text hidden]

Jean-Luc Thiffeault <jeanluc@math.wisc.edu> Fri, Feb 28, 2014 at 11:29 AM
To: Miriam Ritchie <mritchie@maths.dundee.ac.uk>

Here's an example (not the best code). At the end the entropy per period and complexity per period are different, but they're both small (converging to zero). Try it with the pseudo-Anosov braid: they should be much more similar.

Jean-Luc
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test_drive_simple.m
1K

Miriam Ritchie <mritchie@maths.dundee.ac.uk> Wed, Jun 11, 2014 at 12:30 PM
To: Jean-Luc Thiffeault <jeanluc@math.wisc.edu>

Hi,

My apologies for not getting back to you sooner, other work had taken priority over the topological entropy work for a while. Thank you very much for your help, taking more periods has worked, and I have used your example code and adapted it a little. Thanks again,

Miriam Ritchie.
[Quoted text hidden]

Jean-Luc Thiffeault <jeanluc@math.wisc.edu> Wed, Jun 11, 2014 at 1:35 PM
To: Miriam Ritchie <mritchie@maths.dundee.ac.uk>

No prob. Glad it helped.

JLT
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