

Re: solving this impasse could result in solving the Navier–Stokes

# Re: solving this impasse could result in solving the Navier–Stokes

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*Source:* <http://sci.tech-archive.net/Archive/sci.math/2007-08/msg04004.html>

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- *From:* David Purvance <[d.purvance@xxxxxxx](mailto:d.purvance@xxxxxxx)>
  - *Date:* Thu, 23 Aug 2007 16:40:06 -0700
- 

On Aug 23, 4:35 pm, David Purvance <[d.purva...@xxxxxxx](mailto:d.purva...@xxxxxxx)> wrote:

On Aug 23, 4:08 pm, Stephen Montgomery–Smith

<[step...@xxxxxxxxxxxxxxxxxxxx](mailto:step...@xxxxxxxxxxxxxxxxxxxx)> wrote:

David Purvance wrote:

On Aug 23, 12:57 pm, Stephen Montgomery–Smith  
<[step...@xxxxxxxxxxxxxxxxxxxx](mailto:step...@xxxxxxxxxxxxxxxxxxxx)> wrote:

David Purvance wrote:

On Aug 23, 10:44 am,  
Robert Israel  
<[isr...@xxxxxxxxxxxx](mailto:isr...@xxxxxxxxxxxx)>  
wrote:

On Aug 23,  
5:06 am,  
David  
Purvance  
<[d.purva...@xxxxxxx](mailto:d.purva...@xxxxxxx)>  
wrote:

On  
Aug  
22,  
4:09  
pm,  
Stephen  
Montgomery–Smith  
<[step...@xxxxxxxxxxxxxxxxxxxx](mailto:step...@xxxxxxxxxxxxxxxxxxxx)>  
wrote:

David  
Purvance  
wrote:

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On  
Aug  
21,  
8:37  
pm,  
Robert  
Israel  
<isr...@xx>  
wrote:

Stephen  
Montgomery–Smith  
<step...@xxxxxxxxxxxxxxxxxxxxxxxx>  
writes:

David  
Purvance  
wrote:

This  
problem  
is  
for  
math  
professionals.  
Euler's  
equation  
can  
be  
written  
as  
a  
rather  
simple  
looking  
matrix  
differential  
equation  
 $du/dt=A(u)$   
u  
(1)  
where  
u  
is  
an  
incompressible  
flow  
field  
in  
wavenumber  
space

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and  
A(u)  
is  
a  
matrix  
that  
is  
a  
function  
of  
u.  
It  
is  
easy  
to  
add  
viscous  
shear  
to  
(1)  
to  
obtain  
the  
Navier–Stokes  
equations.  
The  
Taylor  
time  
expansion  
of  
u  
in  
Euler's  
equation  
results  
in  
a  
second  
equivalent  
matrix  
differential  
equation  
 $\frac{du}{dt}$   
=  
 $\sum \{ A_n(c_n) t^n \}$   
u  
(2)  
where  
A\_n  
are

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matrices  
that  
are  
a  
function  
of  
wavenumber  
alone  
and  
 $c_n$   
are  
the  
Taylor  
expansion  
coefficients  
of  
u.  
 $A_n$   
diagonalize  
nicely,  
i.e.,  
their  
eigenvectors  
form  
unitary  
matrices  
and  
their  
eigenvalues  
are  
zero  
or  
purely  
imaginary,  
suggesting  
that  
if  
 $A_n$   
commute  
and  
when  
viscous  
shear  
is  
added,  
the  
Navier–stokes  
equations  
are  
stable  
for

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all  
time.  
Proving  
that  
 $A_n$   
commute  
boils  
down  
to  
proving  
if  
the  
eigenvectors  
of  
 $A(u)$   
in  
(1)  
can  
be  
a  
function  
of  
time.  
If  
they  
cannot,  
then  
the  
Navier–Stokes  
Millennium  
problem  
is  
solved,  
The  
proposed  
solution  
to  
(1)  
and  
relevant  
discussion  
can  
be  
found  
at:  
["http://purvanded.wc](http://purvanded.wc)  
[Please](#)  
[chime](#)  
[in](#)  
[and](#)  
[help](#)

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us  
resolve  
this  
impasse.

Come  
on  
guys,  
and  
help  
us  
out.  
I  
am  
trying  
to  
convince  
David  
that  
the  
step  
(7–23)  
=>  
(7.24)  
is  
incorrect,  
because  
he  
doesn't  
have  
any  
reason  
to  
suppose  
that  
 $V$   
is  
not  
a  
function  
of  
 $t$ .  
You  
can  
more  
or  
less  
read  
(7–18)  
through  
(7–24)

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in  
isolation,  
without  
having  
to  
read  
the  
rest  
of  
the  
paper.  
I  
am  
rather  
convinced  
that  
his  
assertion  
that  
the  
matrices  
in  
question  
diagonalize  
nicely  
are  
completely  
correct,  
and  
also  
that  
his  
starting  
equation  
(7–1)  
is  
correct.  
Indeed  
my  
sense  
is  
that  
he  
did  
rather  
well  
to  
get  
as  
far  
as

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he  
did,  
but  
that  
his  
mistake  
is  
essentially  
an  
elementary  
mistake  
in  
finite  
dimensional  
linear  
algebra,  
and  
sci.math  
regulars  
like  
David  
Ullrich  
or  
Robert  
Israel  
definitely  
have  
sufficient  
expertise  
to  
help  
me  
to  
point  
out  
to  
David  
the  
flaw  
in  
his  
argument.

I  
think  
you  
said  
it  
well  
enough:  
what

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do  
you  
need  
me  
for?  
Well,  
perhaps  
to  
find  
a  
simple  
example.  
Consider  
[  
t  
1  
]  
[  
0  
1  
]  
[  
1  
0  
]  
[  
0  
0  
]  
] A  
=  
[  
t^2  
t  
]  
=  
[  
0  
0  
]  
+  
t  
[  
0  
1  
]  
+  
t^2  
[  
1  
0  
]

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]
=
A0
+
A1
t
+
A2
t^2.
We
diagonalize:
A
=
V
L
V^(-1)
with
[
1
-1
]
V
=
[
t
t
]
[
t/2
t/2
]
[
1/(2t)
-1/(2t)
]
but
V^(-1)
A0
V
=
[
-t/2
-t/2
]
and
V^(-1)
A2
V
=
[
1/(2t)



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make  
them  
realistic,  
friend.

But  
you  
can  
make  
Robert's  
example  
include  
a  
time  
invariant  
vector  
of  
the  
form  
you  
describe.  
Simply  
embed  
his  
example  
into  
a  
3  
by  
3  
matrix,  
in  
which  
all  
the  
other  
entries  
are  
0.  
Then  
 $v=(0,0,1)$   
does  
what  
you  
describe.

I  
would  
think  
that  
at

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a  
minimum  
a  
realistic  
counter  
example  
would  
have  
to  
be  
at  
least  
a  
9x9  
with  
 $v=(k_1,k_2,k_3,0,0,0,-k_3,-k_2,-k_1)$   
(v\_perp  
in  
my  
paper)  
plus  
a  
3D  
u\_0  
from  
which  
you  
could  
verify  
v  
was  
an  
eigenvector  
of  
A\_0.  
I  
really  
don't  
see  
how  
Robert  
Israel's  
example  
will  
lead  
to  
anything,  
i.e.,  
you  
get  
A\_1

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from  
knowledge  
of  
A\_0,  
A\_2  
from  
A\_0  
and  
A\_1,  
etc.,  
and  
assuming  
a  
matrix  
exponential  
solution,  
which,  
in  
turn  
,  
depends  
on  
assuming  
what  
you  
are  
trying  
to  
disprove.  
(You  
mised  
the  
reader  
a  
little  
when  
you  
said  
he/she  
only  
needs  
to  
look  
at  
(7–18)  
thru  
(7–24)  
and  
it  
led  
to

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his  
rather  
childish  
example.)  
My  
paper's  
Comment  
62  
at  
["http://purvanced.wordpress.com/2007/05/09/by-david-purvance/"](http://purvanced.wordpress.com/2007/05/09/by-david-purvance/)  
pretty  
much  
shows  
why  
the  
idea  
of  
multiple  
flow  
bases  
is  
contradictory.

My "rather  
childish  
example"  
was not  
meant to be  
realistic in  
terms of  
your  
problem.  
It's simply  
to illustrate  
that there's  
a gap in one  
step of your  
proof. It  
may well be  
that the  
matrices  
 $V^{(-1)} A_k$   
V are  
diagonal in  
the case  
you're  
considering,  
but as far as  
I can see  
you

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haven't  
proven it.  
Robert  
Israel  
isr...@xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx  
Department  
of  
Mathematics  
<http://www.math.ubc.ca/~israel>  
University  
of British  
Columbia  
Vancouver,  
BC, Canada

And just how does your  
"Winnie the Pooh" example  
illustrate that  
there's a gap in one step in  
my proof? Be very specific,  
please. Eq.  
(7-21) states that  $V^{(-1)}$   
 $A_n V$  must be diagonal.

David, you asked if colleagues of mine  
could chime in. Robert Israel  
chimed in, and he completely agrees with  
me that you haven't proved your  
assertion. Please don't insult Robert by  
calling his examples "Winnie  
the Pooh."

Look, instead of getting defensive when  
people try to find flaws in your  
ideas, why don't you go back and think very  
hard about either way they  
are right or why you are right. I think you  
are answering back too  
quickly, and without enough thought.

And honestly, if you really have cracked the  
problem (which I think you  
haven't), your solution is on the internet for  
all to see. You have  
priority on your solution – no-one can steal  
it!

I think that you did well to get as far as you did. But even the best of us make mistakes. I myself have worked on this problem for over 12 years, and I cannot tell you how many times I have thought I have cracked it! But, based on years of hard won experience, my first thought is that I have made a mistake. And sometimes I spend weeks looking for my mistake, which sometimes is quite subtle. In fact, one time I even made exactly the same mistake you made – assuming that the derivative of  $e^{A(t)}$  is  $A'(t) e^{A(t)}$  when  $A(t)$  is a time dependent matrix.

So if I, a professional mathematician, can take weeks to see my mistake, think that maybe you also might be subject to the same flaw, and may also take a long time to see where you went wrong.

I liked the way you thought about the problem. You tried to think "out of the box." But actually nearly all mathematicians try to think "out of the box." I have tried to throw really crazy ideas at this problem – not only do I find that they don't work, but then later I find that other people have also tried exactly the same idea many years before me! All of us working on this problem are trying really, really hard, and we are desperately looking for that sleek simple solution that somehow everyone else missed, as well as those complicated and sophisticated solutions that also don't work.

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So please, allow for the fact that you might have made a mistake. We are not involved in some conspiracy where only professional mathematicians are allowed in the "math club." If your solution really was correct, I assure you that I and Terry Tao would have recognized it, and would be loudly and gladly trumpeting your great discovery, giving you full credit.

Best regards, Stephen

Dear Stephen,

What conspiracy?

I have a right to be frustrated with both you and Robert. You both have given little 2x2 counter examples that I show don't apply to the NSE and then you back off and say your examples mean something more general, which I fail to see. This is engaging in "Winnie the Poohism" as far as I am concerned. And to prove it, rationally like professional mathematicians, let Robert successfully reply to my request that he specifically explain how his "now generalized" example demonstrates that there is a gap in my reasoning. Otherwise you're both copping out.

"

Dear Robert,

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Two comments up there is a typo in my challenge to you.  
 $\sum V^{(-1)} A_n V$   
should read  $\sum (V^{(-1)} A_n V)$ . I apologize.

You might be frustrated with us, but I am also getting frustrated with you. I don't understand why you don't understand that our small 2 by 2 examples are completely sufficient to show that your method of proof is flawed. If you want larger dimensional examples, perhaps with a few more properties, simply embed them into larger numbers of dimensions, or see if you can add more properties. I have identified a very particular step in your reasoning where I think a proof is missing, and you have not provided the missing proof. I and Robert have examples to show this. That they are simple 2 by 2 examples only strengthens our assertions, it does not weaken them!

As for your remark "Why didn't Terence Tao's comment persuade you quit conversing with me long ago?" – what does that mean?

Stephen

You are talking in general terms. Be specific, i.e., use mathematical equations to show how your "now generalized" 2x2 examples mean anything relevant to the impasse. (You'll have to pull your examples from my blog.) You hold my feet to the fire and now I am asking politely that you take some of your own medicine.

Terence essentially said that, as my solution was presented, "B" cannot be deduced from "A". I didn't interpret what he said to mean that it was impossible to deduce "B" from "A" and that my solution was fatally and forever in error. However, if his argument was so convincing to you as you implied today, why didn't you blow me off months ago? I didn't solicit your comments on my blog. Most of them were very helpful, but, why did you bother?

Actually, enough of this already. Please just be mathematically specific on how your examples further your criticism. This is all I ask .

For some reason my last comment didn't display, so I'll resubmit:

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