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\begin{document}

\maketitle

\section{Introduction}

\usepackage{amsmath}

\begin{document}

\title{Theory of Smoothpath}

\author{Apurv Ranjan Sarangi}

\date{June 2025}

\maketitle

\section{Introduction}

```
\begin{table}[h!]

\centering

\begin{tabular}{|c|l|}

\hline

\textbf{Symbol} & \textbf{Meaning} \\

\hline



$fu$ : Stable fluid motion (uniform) \\

$nfu$ : Unstable fluid motion (non-uniform) \\

$Sp$ : Smoothpath \\

$Uh$ : Uniform heat flow \\

$Nuh$ : Non uniform heat flow \\

$Uf$ : The unrecognised force \\

$S$  : The indication of singularity  \\

$kv$ : Kinetic viscosity \\
```

pg : Pressure gradient \\

M : Motion of fluid \\

M_1-M_2: The collision of two motions of object(for this case) \\ Ma : Mass of the fluid \\

f & {F}: External force on fluid \\

If : Internal force \\

\textbf{why these new symbols contribute to this problem}

$p(u+t)$: External on on linear and non linear acceleration \\

$(u+t)$: Linear and non linear acceleration \\

fu:It is the reaction of M and Sp

nfu:It is the reaction of M and $-Sp$

Uh:It is the reaction of If and fu but is added with them

Nuh: It is the reaction of If and nfu but still added with them

$u+t$:When M and Sp are added, $(u+t)$ tend to not be influenced by external force

$p(u+t)$: When there is difference in M and Sp then there is tend to be influenced by external force on $(u+t)$

Textbf{Original} & \textbf{Translation (Symbolic)} \\

\hline

PDE & Meaning \\

ρu :M \\

$u|_{h^0}$: Sp \\

$-|u|_{h^0}$: $-Sp$ \\

$\frac{\partial u}{\partial t} + (u \cdot \nabla)u$: $(u+t)$ \\

$p \left[\frac{\partial u}{\partial t} + (u \cdot \nabla)u \right]$: $p({u+t})$ \\

Δp : pg

$\nu \Delta u$: Kv
Δu : Uh \\

$(-\Delta u)$: Nuh

$(u \cdot t \cdot E^{\infty} \right)$: fu

$-E(s,t) E^{\infty}$: nfu

$Uf(x ,t)$ & Uf \\

$ f+ (u \cdot t \cdot E^{\infty})$: Shows global smoothness $(i.fu-nfu-fu,ii.fu-nfu-S)$ \\

$-E_{u}(s.t) E^{\infty}$: Shows global singularty $(i.fu-nfu-S)$\\

$(-v \Delta v$: $-kg$ \\

$(-\Delta p)$: pg

I used

$f+(u.t.E^\infty)$

To show smoothness happens always in this path.

I used

$-E_{u}(s,t)E^\infty$

To show singularity happens always in this path.

Through my lemma for smoothness, we proved

$f+(u.t.E^\infty)$

\end{table}

\[

\text{We see} \quad fu – nfu – fu

\]

\section{Original}

\[

\begin{equation}

M+Sp\leftarrow (u + t) = pg + kv +Uh +fu

\end{equation}

\]

\subsection{PDE}

[\begin{equation}

$\rho u + |u|_{H_0} \rightarrow \left[\frac{\partial u}{\partial t} + (u \cdot \nabla u) \right] = \Delta p + \v \Delta u + \Delta u +(\Delta u.t.E^\infty)+\Delta u$

\end{equation}

\]

\[

\Downarrow \quad F \text{ is added}

\]

\section{Original}

\[

M-Sp \rightarrow\left (u + t) = pg + Kv + Nuh + nfu + f

\]

\subsection{PDE}

$\rho u - |u|_{H_0} \rightarrow \left[\frac{\partial u}{\partial t} + (u \cdot \nabla u) \right] = \Delta p +
\v \Delta u + f + \left[\mathbb{E}(s, t) E^\infty \right] + (-\Delta u)$

\]

\[

\Downarrow \quad F \text{ removed as If is dominated}

\]

Section{Original}

M+Sp \rightarrow\left(u +t) = pg + Kv + Uh + fu – F

\]

\subsection{PDE}

\[

\begin{equation}

$\rho u + |u|_{H_0} \rightarrow \left[\frac{\partial u}{\partial t} + (u \cdot \nabla u) \right] = \Delta p + \v \Delta u + \Delta u + (\Delta u.t.E^\infty) – f $

\end{equation}

=$ f+ (u \cdot t \cdot E^\infty$)

\[

\text {Another Situation}

Fu – nf u – S

\]

\text {I continue from nfu equation to S cause it may cause confusion}

Nfu path \\

\hspace*{1cm} $\Rightarrow$ F is dominant over If

\textbf{Original}

\[

\begin{equation}

M – Sp \rightarrow p(u + t) = (-pg) + (-kv) + (-Nuh) + nfu + F

\end{equation}

\]

Textbf{PDE}

\]

\begin{equation}

$\rho u - |u|_{H^0}\rightarrow p\left [\frac{\partial u}{\partial t}+(u.\nabla)u \right]= (-\Delta p) + (-v \Delta u) + [-(-\Delta u)]+ [E(s,t) E^\infty)+ f $

\end{equation}

\]

\hspace*{1cm} $\Downarrow$ F dominates over If

\textbf{Original}

\[

\begin{equation}

M \rightarrow (u + t) = Uf + nfu

\end{equation}

\]

\textbf{PDE}

\[

\begin{equation}

$\rho u \rightarrow \left[\frac{\partial u}{\partial t} + (u \cdot \nabla)u \right] = Uf(x,t)+ \left[E(s,t) E^\infty \right] $

\end{equation}

\]

\[

= $-E_u(s,t) E^\infty $

\]

\textbf{Lenma Of Smoothness} \\
\text(concept)

\textbf{Original}

\[

\begin{equation}

M_1 + M_2 + Sp \rightarrow p(u + t) = (If +Lp– Uf) + (fu – nfu)

\end{equation}

\]

\textbf{PDE}

\[

\begin{equation}

$\rho u_1- \rho u_2- |u|_{h^0} \rightarrow \left[\frac{\partial u}{\partial t} + (u \cdot \nabla)u \right] = \left[\Delta p + v \Delta u .etc .+ Lp – Uf(x,t)\right]+\left[u.t.E^\infty-E(s,t) E^\infty \right]$
\end{equation}

\]

\hspace*{1cm} $\Downarrow$ S \gg Sp

\textbf{Original}

\[

\begin{equation}

M_2 + Sp \rightarrow (u + t) = If + fu – Uf

\end{equation}

\]

\textbf{PDE}

\[

\begin{equation}

$\rho u +|u|_{H^0} \rightarrow \left[\frac{\partial u}{\partial t} + (u \cdot \nabla)u \right] = (\Delta u + \Delta p .etc)+ (u \cdot t \cdot E^\infty) – Uf (x,t) $

\end{equation}

\]

=$f+(u \cdot t \cdot E^\infty)$

\textbf {Why can’t we just shift to If can defeat Uf without the help of Lp}

\beginitemize

\text (We have to add Lp with If to show it can defeat Uf as without Lp Uf can absorb If with it's strange force even if it would be stronger than it(e.g which we see in black holes),so if we Lp (a huge boundary than S) the Uf can be defeated easily.)

\textbf{To further prove using my Theory}

Let domain as $\mathbb{R}^3$ (infinite space) to show as a concept which can be/should be took for more to \textbf{uncover the mysteries of space}.

\section*{Lemma 1}

\textbf{\underline{Statement}}

Let \(u(x,t) \) be a velocity field evolving over$ \mathbb{R}^3 \times (0,\infty)$and let the initial motion be smooth, i.e.,

\[

U(x,0) = fu(x,0)

\]

Then, under the symbolic framework where (we know):

\begin{itemize}

\item[(i)] fu represents smooth (Uniform) fluid motion.

\item[(ii)] nfu represents unstable (non-uniform) or potential to singularity.

\item[(iii)] If is the \underline{Internal Force} while f is \underline{External Force} \end{itemize}

If at any time \(t\), the internal force \(If(x,t)\) dominates the external force \(F(x,t)\),

Then any transition to instability of nfu will eventually return to a smooth fu.

Thus ensuring the persistence or return of smoothness over time.

\textbf{Proof:} We will do by applying:

\begin{itemize}

\item[(i)] Initial Condition,

\item[(ii)] External Disturbance,

\item[(iii)] Role of Internal Force, and \item[(iv)] Dominance Assumption.

\end{itemize}

\textbf{(i) Initial Condition:} \\

Let’s assume that at time t_0, the fluid is smooth, i.e.,

\[

U(x, t_0) = fu(x, t_0) \]

This implies the flow has stable pattern, no singularity, and the derivative fields are bounded.

\textbf{(ii) External Disturbance:} \\

An external force ${F}(x,t)$ may act on fluid, disturbing the uniform motion. \\ This leads to appearance of instability, which we can state as: $nfu(x,t)$.

\textbf{(iii) Role of Internal Force (If):} \\

The internal force If (e.g., pressure gradient, kinetic viscosity, part in vorticity) wants to resist deformation and turbulence.

\textbf{(iv) Dominance Assumption:} \\

Suppose at some point when time $t_1 > t_0$,

\[

If(x,t_1) > F(x,t_1)

\]

According to my theory, this triggers the symbolic transition:

\[nfu(x,t_1) \xrightarrow{If > F} fu(x,t_2)

\]

\section{Therefore:}

\textit{Smoothness is restored after disturbance in this condition. Any temporary turbulence (etc) will recede and reverse to (full) smooth flow showing If is dominant.}

\vspace{1cm}

\section {Lemma 2}

\textbf{Statement:}

Let $u(x,t) \in \mathbb{R}^3$ be a velocity field of an incompressible fluid with smooth initial data

\[\begin{equation}

U(x,0) = f(x,0)

\end{equation}

\]

Suppose that for some finite time interval $[t_1.t_2,t_3]$, the external force $F(x,t)$ dominates the internal force $If(x,t)$ that leads to S(x,t), i.e.,

\[\begin{equation}

F(x,t) \gg If(x,t) \Rightarrow S(x,t), \quad \text{for } t \in [t_1, t_2,t_3]

\end{equation}

\]

\hfill (Here $S(x,t)$ is denoted as singularity.)

\vspace{0.5cm}

Then if the fluid remains bounded in energy norm and internal force system regains dominance after t_3,with the help of Laws of physics the system will return to smoothpath(fu) over time. This demonstrates restoration of smoothness even after external chaos to singularty.

\text (here laws of physics is interpreted as to refer the power of the space or our world where it follows strict physical laws.)

\text {Proof:}

\text (We will do by applying

(i) Initial Smooth state
(ii) External Disturbance phase
(iii) Boundary energy condition
(iv) Return of internal stability
(v) Smoothness recovery

= \section{(i)Initial Smooth State:}

$u(x,0)=fu(x,0),with u \in C\infity(\mathbb{R}^3)$

\section{(ii) External disturbance phase:}

For$ t \in [t_1,t_2]$,external force dominates : $F(x,t) \gg If(x,t)$

$fu \xrightarrow {F(If} nfu \xrightarrow {F\gg If} S

\section {(iii) Bounded energy condition:}

Suppose that Kinetic remains finite

$\int_{\mathbb{R}^3} |u(x,t)|^2 \, dx < \infty, \forral t $

\section {(iv)Return of Internal State Viscosity}

Let

\[

\text If(x,t) + Lp -\textbf{UF}(x, t) \text{ again}

\]

\[

\text {(Lp is Laws of physics)}

\]

Here, {UF}(x,t) is unrecognised force which is seen in singularity.

.

For $t > t_3$

According to my theory's logic,

\[\begin{equation}

S \xrightarrow{\text{Lpt + If - Uf}} f

\end{equation}

\]

(v) Smoothness recovery: The restoring internal force gradually aligns the velocity gradient, reducing ∇u, bringing back regularity.

To further rigourously, prove by energy norm.

\textbf{Energy Norm:}

\textbf{Assume:}

\begin{enumerate}

\item The fluid starts smooth ($u(x,0) = f(x,0)$)

The velocity field is divergence free ($\nabla \cdot u = 0$)

\textbf{(2) The total fluid energy is defined as:}

\[

$E(t) = \int_{\mathbb{R}^3} |u(x,t)|^2 \,dx $

\]

\textbf{Lemma 1}

\textit{If internal force } $IF(x,t)$ \textit{dominates the external force } $F(x,t)$, \textit{then any unstable motion influenced by } $F(x,t)$ \textit{will return to } $fu(x,t)$ \textit{restoring smoothness. Accordingly, the fluid prevents energy blow-up and prevents singularity.}

We will prove this by using:

(i) Initial Smoothness

(ii) During Evolution

(iii) Prevention of Blow-up

[(i)] \textbf{Initial Smoothness:}

Since $u(x,0) = Fu(x,0)$, the initial energy norm is finite:

\begin{equation} $E(0) = \int_{\mathbb{R}^3} |u(x,0)|^2 \, dx < \infty $

\end{equation}

(ii) \textbf{During Evolution:}

(a) Over time, external force F may apply, possibly creating non-uniform behavior in $u(x,t)$.

(b) However, by Lemma 1 statement that however $IF > F$, the fluid flow returns from $nfu \rightarrow fu$.

\subsection {(iii) Prevention of Blow-up}

\item[(a)] The possibility of infinite energy (i.e., $E(t) \rightarrow \infty $) comes only if velocity becomes unbounded.

\item[(b)] But Lemma 1 ensures smoothness returns, presuming $[u(x,t)] \rightarrow \infty$.

\item[©] Thus, energy is always bounded by a finite constant depending on initial data force terms.
\end{itemize}

Therefore,

\textit{At all future times t, even if nfu arises, transitions back to fu, in this condition} So:

\[\begin{equation}

$E(t) = \int_{\mathbb{R}^3} |u(x,0)|^2 \, dx < \infty, \forral t $

\end{equation}

\[

\subsection {Lemma 2}

Let:

\[\begin{equation}

\nabla \cdot u = 0 \quad \text{(Incompressible)}

\end{equation}

\]

Total kinetic energy (energy norm) of the fluid under this condition be:

$\frac{1}{2} \int_{\mathbb{R}} |u(x,t)|^2 \, dx $

\Section{Phase 1: Before Disturbance (fu phase)}

\begin{itemize}

\item Internal force (IF) dominates = smooth motion (fu).

\item Energy is stable or slowly dissipating due to viscosity, i.e.,

\end{itemize}

\[\begin{equation}

$\frac{dE}{dt} = \int v|\nabla u|^2 \, dx + \int u \cdot If \, dx $

\end{equation}

\]

\section {Phase 2: Disturbance (Only phase where F > IF)}

\begin{itemize}

\item External force dominates $\Rightarrow$ turbulence begins

\end{itemize}

\[\begin{equation}

\frac{dE}{dt} = - \left(v \int |\nabla u|^2 \, dx + \int u \cdot f \, dx \right)

\end{equation}

\]

\subsection {But}

My assumption is: the energy never becomes infinite, i.e.,

\[

$E(t) < \infty \quad \forall t,$ \text{ even during disturbance}

\]

Isolated energy would \textbf{never} turn infinite as we can’t prove any object possessing infinity. So from here, energy is formulated following UF.

\textbf{This shows the sign of recovery}

\section{Return of smoothness(By If+Lp\gg Uf \rightarrow fu)}

After the unstable phase (nfu) a recovery begins only when Internal force (If) combines with Laws of physics to overcome the influence of the unrecognised force(Uf)

/text {Let’s model this as:}

$If(x,t)+Lp(x,t) \gg Uf (x,t)$

This inequality signifies the dominance of structured internal dynamics and physical laws over external chaotic disturbances

\section{Stellar Evolution as a Fluid Dynamics Metaphor}

The evolution of stars — from stable (fu) to unstable (nfu) states and finally back to universal balance (via collapse or explosion) — acts as a metaphor for fluid dynamics in cosmology.

\subsection{Path I: $fu \rightarrow nfu \rightarrow fu$ (Stable Remnant Path)}

\textbf{Example:} Betelgeuse (Massive star, ~ 15–$20\,M_\odot$)

\textbf{Proof of path:}

\begin{itemize}

\item fu: Betelgeuse burns hydrogen and helium.

\item nfu: Core builds iron $\rightarrow$ outer layer pressure increases $\rightarrow$ pre-supernova chaos.

\item fu: Core collapses $\rightarrow$ supernova $\rightarrow$ forms a neutron star.

\end{itemize}

\textbf{Interpretation:}

\begin{enumerate}

\item The star is reborn in a new stable form after chaos.

\item Energy is ejected, but balance is restored.

\end{enumerate}

\subsection{Path II: $fu \rightarrow nfu \rightarrow Sp$ (Leading to Singularity)}

\textbf{Example:} Eta Carinae (Supermassive star, $>100\,M_\odot$)

\textbf{Proof of path:}

\begin{itemize}

\item fu: Giant star burns energetically $\rightarrow$ breaks initial stability.

$ \item nfu: Intense fusion+instability \rightarrow gains more mass than support.$

\item S: Core collapses beyond escape velocity $\rightarrow$ blackhole forms

\end{itemize}

/textbf{Interpretation:}

(i) Star fails to stabilize after chaos
(ii) Gravitational singularty is formed a point of no return

\subsection{path 3:}$ Lp + If – Uf \rightarrow fu $(Return of Smoothness)

\text (This is a concept)

Proof of the path:Lp+If-Uf: A star whose If is supported by space where all fundamental laws of physics supporting it which becomes greater than unknown force of black hole due to larger boundary of dual(If+Lp)

fu: The black hole stabilizes to blank/a huge neutron star/a supernovae.etc

\textbf{Additional Information about black holes}

\beginitemize

\item (i)The fluid in path of nfu creates always temporary leakages

\item (ii) For black hole it must be partial permanent leakage where can lead to other dimensions. For example if we open a window out from a airplane in air the air attracts us like the blackhole at Uf attracts stars,objects.etc. Like we fall on the ground,we are at different environment(from the environment of aeroplane to environment of Earth)

\item (iii) So if see in this logic as many physical phenomenons of our surroundings connect to astrological level phenomenon(e.g: The human eye and The eye of Nebula) so Black holes must be a pathway to other dimensions or universes

\enditemize

\section {Navier-Stokes Millennium Problem: Global Smoothness}

To prove the Navier-Stokes problem (millennium one), we need to show \textbf{global smoothness}.

\subsection {Domain and Setup}

\begin{itemize}

\item[(i)] \textbf{Domain:} Let $\Omega\subset mathbb {R}^3$ be a bounded smooth domain representing Earth.

\item[(ii)] \textbf{Time:} $t \in \mathbb{R} \cap (0, \infty)$

\item[(iii)] \textbf{Velocity Field:} $u(x, t)$ with $\|u\| \geq 0$

\item[(iv)] $ I \frac{1}{2} > 0$

\text{(v) Forcing Term: } $f(x,t) \in \hat{L}^2(\hat{a}_{H})$

\]

\end{itemize}

Here only lemma 1 will work because viscosity in If is always in higher amount than F in any form, so we don't need Lemma 2.

\subsection {Lemma 1: Stability Cycle Lemma}

\textit{If F acts on If, the path will become nfu but will return to fu if If $\geq$ F.}

Symbolically,

\[

$fu \xrightarrow{\text{f(If)}} nfu \xrightarrow{If> F} \Rightarrow fu $

\]

\section{PDE Formulation with Symbolic Energies}

We can now modify classic Navier to symbolic heat/energy components blending my theory.

Sa,

Where:

\begin{itemize}

\item $\hat{h}$: Re-released

\item Uhi: Energy added by stabilizing viscosity

\item Nuh: Turbulence-inducing energy

\item $E \cdot \hat{A} \cdot \hat{A} \cdot E \cdot \hat{\nabla}$: Symbolic time-energy norm metric for universal repetition

\item $\hat{u} \cdot \hat{A} \cdot \hat{A} \cdot E \cdot \hat{\nabla}$: Symbolic expression for timeenergy-driven dispersion

\item $\hat{a} \hat{\nabla} p$: Pressure origin/increase of time

\end{itemize}

\[\begin{equation}

$H \left[\frac{\hat{A} \Pi u + t \left(u \hat{A} \cdot \hat{\partial} \Pi \right) u}{\partial \Pi t} \right] = \hat{A} \partial \Pi t’ + tf_{L2} + (\Delta u \hat{A} \cdot t \hat{A} \cdot E \hat{\partial} \Pi) + (\nabla h - \nabla u h)$

\end{equation}

\subsection{Energy-Based Proof of Smoothness}

Step 1: Let \|u(x,t)\| be the velocity field. Energy norm:

$E(t) = \frac{1}{2} \int_{\Omega} |u(x,t)|^2 \, dx$

Where:

\begin{itemize}

\item Ω = Earth domain

\item $\ |u|^2$ = Kinetic energy density

\end{itemize}

\textbf{[This one is a new equation for $K(t)$; if it is ok or not, it needs experts review]}

\subsection{Step 2:}

Let:

\begin{itemize}

\item Ma = \text{Mass of the fluid}

\item Kv = \text{Kinetic viscosity}

\end{itemize}

Then, equation for kinetic energy:

\[\begin{equation}

K(t) = Kv \cdot (Ma)

\end{equation}

\]

This equation shows:

\textbf{Kinetic:}

The energy is the result of kinetic viscosity acting on mass of any object/fluid.

\medskip

The energy in the fluid I state doesn’t follow what Lyapunov stated.

\subsection{Lyapunov:}

\emph{``If energy decays, the path will be stable; if energy increases, it will turn to singularity/destruction.’’}

\subsection{I state:}

\emph{``If energy is stable, the path will be stable. But if it’s not, it will lead to chaos. I state this cause all objects have energy and in any form’’}

\text(As we know all objects possess energy so my statement holds)

=

\[

\text{Energy(in fluid} = \text{The Fluid}

\]

\text{But we can apply what Lyapunov stated on the POV of F :}

\begin{itemize}

\item If energy of F increases, it(the path)will lead to singularity (F greater than If)item If energy of F decays, the path will be stable. (F looser than If)

\end{itemize}

\textbf{Further proof}

\textit{In fluid}

\[

$\frac{dE}{dt} = 0$ \quad \text{(showing no disturbance)}

\]

\textbf{Interpretation:} \\

System is in control. \\

Motion is stable and smooth. \\

Which also shows for $E(\text{If})$:

\[

- $\frac{dE}{dt} > 0 \quad $\text{(Energy is rising)}

\]

\textbf{Interpretation:}

(System is loosing control

$(Motion is becoming chaotic) \leftarrow which shows nfu)$

(But,

System will turn to stability(controls itself by viscosity in If=

\begin{equation}

$\frac{dE}{dt}=0) $

=\textbf{No blow up on Earth: Since with the help of viscosity in If(internal force) always dominance over F in Earth’s environment}

\section{Example: Atmospheric Jet Stream Disturbance}

\textbf{fu-nfu-fu}\\

\textbf{fu : Jet stream}\\

\textit{Represents uniform fluid motion in a bounded system (smooth and stable)}

\subsubsection*{Description:}

\begin{enumerate}[label=(\roman*)]

\item Smooth, stable wind flow in the upper atmosphere

\item Maintains consistent direction and velocity

\item Balanced energy distribution

\end{enumerate}

\textbf{nfu:} Sudden heating in the Arctic / global warming

\subsubsection*{Description:}

\begin{enumerate}[label=(\roman*)]

\item Jet stream starts meandering

\item Forms eddies, turbulence, and cyclones

\item Chaotic, non-linear changes in fluid motion

\item Energy distribution becomes non-uniform

\end{enumerate}

\vspace{0.5em}

\textit{Chaos emerges – motion loses regularity, fluid becomes unstable}

\section{fu: Reformation of New Jet Stream Pattern}

\textit{Represents a return to stabilized motion, though possibly with altered structure}

\subsubsection*{Description:}

\begin{enumerate}[label=(\roman*)]

\item After disturbance passes, energy dissipates

\item Jet stream reorganizes into a new quasi-stable state

\item May not return to original path but reaches new equilibrium

\end{enumerate}

\end{table}