

Accepted Manuscript

Hyperbolic relaxation of the 2D Navier–Stokes equations in a bounded domain

Alexei Ilyin, Yuri Rykov, Sergey Zelik

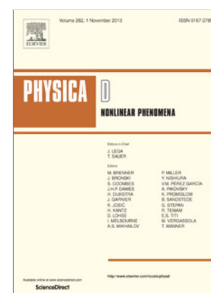
PII: S0167-2789(17)30361-5
DOI: <https://doi.org/10.1016/j.physd.2017.09.008>
Reference: PHYSD 31950

To appear in: *Physica D*

Received date: 30 June 2017
Revised date: 22 September 2017
Accepted date: 26 September 2017

Please cite this article as: A. Ilyin, Y. Rykov, S. Zelik, Hyperbolic relaxation of the 2D Navier–Stokes equations in a bounded domain, *Physica D* (2017), <https://doi.org/10.1016/j.physd.2017.09.008>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.



HYPERBOLIC RELAXATION OF THE 2D NAVIER-STOKES EQUATIONS IN A BOUNDED DOMAIN

ALEXEI ILYIN², YURI RYKOV² AND SERGEY ZELIK^{1,2}

ABSTRACT. A hyperbolic relaxation of the classical Navier-Stokes problem in 2D bounded domain with Dirichlet boundary conditions is considered. It is proved that this relaxed problem possesses a global strong solution if the relaxation parameter is small and the appropriate norm of the initial data is not very large. Moreover, the dissipativity of such solutions is established and the singular limit as the relaxation parameter tends to zero is studied.

CONTENTS

1. Introduction	2
2. Preliminaries	4
3. Key dissipative estimate	6
Step 1. Estimates for w : weak norms	7
Step 2. H^2 -estimates for u .	9
Step 3. Parabolic estimates for Au	10
Step 4. Completion of the proof	11
4. Attractors and their singular limit as $\varepsilon \rightarrow 0$	13
5. Generalizations and concluding remarks	20
5.1. Hyperbolic relaxation of the NS equations in 3D	21
5.2. The case of 1D Burgers equation	21
5.3. Finite propagation approximation of the Navier-Stokes problem	24
5.4. Connection with viscoelastic fluids	24
References	25

2000 *Mathematics Subject Classification.* 35B40, 35B45.

Key words and phrases. Navier-Stokes equations, hyperbolic relaxations, singular perturbations, attractors.

A.I. and Yu. G. acknowledge financial support from the Russian Science Foundation (grant no. 14-21-00025) and S.Z.'s research is supported by the Russian Science Foundation (grant no. 14-41-00044) and the RFBR grant 15-01-03587. The authors would also like to thank Varga Kalantarov for many stimulating discussions.

Download English Version:

<https://daneshyari.com/en/article/8256201>

Download Persian Version:

<https://daneshyari.com/article/8256201>

[Daneshyari.com](https://daneshyari.com)