

## A Demonstration of the $\text{\LaTeX}2_{\epsilon}$ Class File for the Journal of Partial Differential Equations

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**Abstract.** This paper describes the use of the  $\text{\LaTeX}2_{\epsilon}$  jpde.cls class file for setting papers for the *Journal of Partial Differential Equations*.

**Key Words:**  $\text{\LaTeX}2_{\epsilon}$

**AMS Subject Classifications:** 52B10, 65D18, 68U05, 68U07

**Chinese Library Classifications:** O175.27

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### 1 Introduction

This paper is described how to use the jpde.cls class file for publication in the *Journal of Partial Differential Equations*. The jpde.cls class file preserves much of the standard  $\text{\LaTeX}2_{\epsilon}$  interface so that authors can easily convert their standard  $\text{\LaTeX}2_{\epsilon}$  article style files to the jpde style.

### 2 Preparation of Manuscript

The Title Page should contain the article title, authors' names and complete affiliations, and email addresses of all authors. The Abstract should provide a brief summary of the main findings of the paper.

References should be cited in the text by a number in square brackets. Literature cited should appear on a separate page at the end of the article and should be styled and punctuated using standard abbreviations for journals (see Thomson ISI list of journal abbreviations). For unpublished lectures of symposia, include title of paper, name of sponsoring society in full, and date. Give titles of unpublished reports with "(unpublished)" following the reference. Only articles that have been published or are in press

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Equations should be typewritten whenever possible and the number placed in parentheses at the right margin. Reference to equations should use the form "Eq. (2.1)" or simply "(2.1)." Superscripts and subscripts should be typed or handwritten clearly above and below the line, respectively.

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### 3 Mathematical Formulas (Examples)

In [1] it was claimed that there always exists a minimizer; however, the statement of Theorem 2.1 is incomplete. In this note we present the full statement, with a detailed proof.

The theorem stated in [1] holds as long as the number of electrons is below a certain critical value. The correct statement for the theorem in [1] is:

**Theorem 3.1** (Existence of minimizers). *Given  $v \in C^\infty(\overline{\Omega})$ , and  $K_{WT} \in L^2_{loc}(\mathbb{R}^3)$ , consider the problem*

$$\inf_{u \in \mathcal{B}} F[u], \quad (3.1)$$

where  $F$  and  $\mathcal{B}$  are

$$\begin{aligned} F[u] = & \frac{1}{2} \int_{\Omega} |\nabla u|^2 - \frac{7C_{TF}N^{2/3}}{25} \int_{\Omega} u^{10/3} + \frac{4C_{TF}N^{2/3}}{5} \int_{\Omega} |u|^{5/3} (K_{WT} * |u|^{5/3}) \\ & + \frac{N}{2} \int_{\Omega} u^2 \left( \frac{1}{|\mathbf{x}|} * u^2 \right) - \frac{3}{4} \left( \frac{3N}{\pi} \right)^{1/3} \int_{\Omega} u^{8/3} \\ & + \int_{\Omega} u^2 \varepsilon(Nu^2) + \int_{\Omega} v(\mathbf{x}) u^2(\mathbf{x}) d\mathbf{x}, \end{aligned} \quad (3.2)$$

and

$$\mathcal{B} = \left\{ u \in H_0^1(\Omega) \mid u \geq 0, \int_{\Omega} u^2 = 1 \right\}. \quad (3.3)$$

In (3.2), the set  $\Omega$  is open and bounded, and star-shaped with respect to 0;  $\varepsilon$  is defined as

$$\varepsilon(Nu^2) = \begin{cases} \frac{\gamma}{1 + \beta_1\sqrt{r_s} + \beta_2r_s}, & r_s \geq 1, \\ A\ln(r_s) + B + Cr_s\ln(r_s) + Dr_s, & r_s \leq 1, \end{cases} \quad (3.4)$$

where  $r_s = (4\pi Nu^2/3)^{-\frac{1}{3}}$ ; the parameters used are  $\gamma = -0.1423$ ,  $\beta_1 = 1.0529$ ,  $\beta_2 = 0.3334$ ,  $A = 0.0311$ ,  $B = -0.048$ , and  $C = 2.019151940622 \times 10^{-3}$  and  $D = -1.163206637891 \times 10^{-2}$  are chosen so that  $\varepsilon(r)$  and  $\varepsilon'(r)$  are continuous at  $r = 1$ .

Then, there exists  $N_0 > 0$  such that:

1. If  $N < N_0$  then  $\exists u^* \in \mathcal{B}$  such that

$$F[u^*] = \min_{u \in \mathcal{B}} F[u]. \quad (3.5)$$

2. If  $N > N_0$  then

$$\inf_{u \in \mathcal{B}} F[u] = -\infty. \quad (3.6)$$

*Proof.* The second part of the theorem was proved in [2, 3]. We outline the proof here for completeness. Since  $0 \in \Omega$ ,  $\exists \delta_0 > 0$  such that  $B(0, \delta_0) \subset \Omega$ . Consider a compactly supported function  $u_0 \in C_0^\infty(B(0, 1))$ , such that

$$\int_{\mathbb{R}^3} u_0^2 = 1, \quad (3.7)$$

and consider the rescaling

$$u_\delta(\mathbf{x}) = \frac{1}{\delta^{3/2}} u_0\left(\frac{\mathbf{x}}{\delta}\right), \quad 0 < \delta < \delta_0. \quad (3.8)$$

Then  $u_\delta \in \mathcal{B}$ , and

$$F[u_\delta] = \frac{1}{\delta^2} \left( \frac{1}{2} \int_{\Omega} |\nabla u_0|^2 - \frac{7C_{TF}N^{2/3}}{25} \int_{\Omega} u_0^{10/3} \right) + \mathcal{O}\left(\frac{1}{\delta}\right). \quad (3.9)$$

Define

$$A_0 = \inf_{u \in H_0^1(\Omega), \|u\|_2=1} \frac{\int_{\Omega} |\nabla u|^2}{\int_{\Omega} u^{10/3}} > 0. \quad (3.10)$$

Then if  $A_0/2 < 7C_{TF}N^{2/3}/25$ , we can choose  $u_0$  so that the leading term in (3.9) is negative, and when  $\delta \rightarrow 0$ , the desired result follows.

For the existence of minimizers, assume that  $N$  is such that  $A_0/2 > 7C_{TF}N^{2/3}/25$ . By Lemma 3.1, there exist  $C > 0$ ,  $\delta > 0$  such that

$$\begin{aligned} F[u] &\geq \frac{1}{2} \int_{\Omega} |\nabla u|^2 - \left( \frac{7C_{TF}N^{2/3}}{25} + \delta \right) \int_{\Omega} u^{10/3} - C \\ &\geq \left( \frac{1}{2} - \frac{1}{A_0} \left( \frac{7C_{TF}N^{2/3}}{25} + \delta \right) \right) \int_{\Omega} |\nabla u|^2 \geq \tau \int_{\Omega} |\nabla u|^2 - C, \end{aligned} \quad (3.11)$$

where  $\tau > 0$ . Therefore the functional is coercive, and the result follows from now from standard arguments in the Calculus of Variations, involving the Sobolev Embedding, and the Rellich-Kondrachov compactness theorem.  $\square$

## 4 Header Information

The heading for any file using jpde.cls is like this;

```
\documentclass[mathpazo]{jpde}

\begin{document}

\title{Make the Title in Title Case}

\author[An Author et.~al]{First Author\affil{1},
Second Author\affil{2}\comma\corrauth
and Third Author\affil{1}}

\address{\affilnum{1}\ Address for first and third authors \\\
\affilnum{2}\ Address for second author}

\emails{{\tt jpde@global-sci.org} (A.~Author), {\tt
second@author.email} (S.~Author), {\tt third@author.email}
(T.~Author)}

\begin{abstract}
Text here, no equation, no citation, no reference.
\end{abstract}

\ams{list here}
\clc{list here}
\keywords{list here}

\maketitle

\section{First Section}

\end{document}
```

## 5 Some Remarks

### 5.1 Mathematics

jpde.cls makes the full functionality of  $\mathcal{A}\mathcal{M}\mathcal{S}\mathcal{T}\mathcal{E}\mathcal{X}$  available. We encourage the use of the `align`, `gather` and `multline` environments for displayed mathematics.

### 5.2 Cross-referencing

The use of the  $\mathcal{L}\mathcal{A}\mathcal{T}\mathcal{E}\mathcal{X}$  cross-reference system for figures, tables, equations and citations is encouraged.

## Acknowledgments

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