A Demonstration of the LaTeX 2ε Class File for the Analysis in Theory and Applications

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Abstract. This paper describes the use of the LaTeX 2ε ata.cls class file for setting papers for the *Analysis in Theory and Applications*.

Key Words: LaTeX 2ε

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

Chinese Library Classifications: O175.27

1 Introduction

This paper is described how to use the ata.cls class file for publication in the *Analysis in Theory and Applications*. The ata.cls class file preserves much of the standard LaTeX 2ε interface so that authors can easily convert their standard LaTeX 2ε article style files to the ata 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.

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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*

$$\inf_{u \in \mathcal{B}} F[u], \tag{3.1}$$

where F and $\mathcal{B}$ are

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

and

$$\mathcal{B} = \left\{ u \in H^1_0(\Omega) \,\middle|\, u \geq 0, \int_\Omega u^2 = 1 \right\}. \tag{3.3}$$

In (3.2), the set Ω is open and bounded, and star-shaped with respect to 0; ε is defined as

$$\varepsilon(Nu^2) = \begin{cases} \dfrac{\gamma}{1+\beta_1\sqrt{r_s}+\beta_2 r_s}, & r_s \geq 1, \\ A\ln(r_s)+B+Cr_s\ln(r_s)+Dr_s, & r_s \leq 1, \end{cases} \tag{3.4}$$

where $r_s = \left(4\pi Nu^2/3\right)^{-\frac{1}{3}}$; 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

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

2. If $N > N_0$ then

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

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

$$\int_{\mathbb{R}^3} u_0^2 = 1, \tag{3.7}$$

and consider the rescaling

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

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

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

Define

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

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 $\delta \to 0$, 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

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

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. □

4   Header Information

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

```
\documentclass[mathpazo]{ata}

\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 ata@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

ata.cls makes the full functionality of $\mathcal{A}_{\mathcal{M}}\mathcal{S}$TEX available. We encourage the use of the align, gather and multline environments for displayed mathematics.

5.2 Cross-referencing

The use of the LaTeX cross-reference system for figures, tables, equations and citations is encouraged.

Acknowledgments

The author would like to thank ....

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