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# Erratum to "Method of Analytical Resolution of the Navier-Stokes Equations" [Open Journal of Fluid Dynamics Vol.13 No.5, (2023) 226-231

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## Abstract

The original online version of this article (Jean Luc Wendkouni Tougma (2023) Method of Analytical Resolution of the Navier-Stokes Equations. Volume 13, 226-231 https://doi.org/10.4236/ojfd.2023.135017 was published with one method missing in Results and Discussion section. The author wishes to add a new section as follows.

## Keywords

Erratum

## 1. Results and Discussion 2

Then Navier Stokes equations become $\nu = \alpha$ the viscosity constant:

$$\frac{\partial \boldsymbol{v}}{\partial t} + (N-10)\sum_{n=1}^{+\infty}\frac{v^{500n+2}}{n!} - 10^{-2}\sum_{p=0}^{N-10} pv = \boldsymbol{f} + \alpha\nabla^2\boldsymbol{v} - \frac{1}{\rho}\nabla P \quad (1)$$

$$\frac{\partial \boldsymbol{v}}{\partial t} + (N-10)\sum_{n=1}^{+\infty}\frac{v^{500n+2}}{n!} - \frac{(N-10)(N-9)}{2\times10^2}v = \boldsymbol{f} + \alpha\nabla^2\boldsymbol{v} - \frac{1}{\rho}\nabla P \quad (2)$$

Let $v = h(t)g(r)$ with $r \in \{x, y, z\}$ a coordinate:

$$\frac{1}{h}\frac{\partial \boldsymbol{h}}{\partial t} + (N-10)\sum_{n=1}^{+\infty}\frac{v^{500n+1}}{n!} - \frac{(N-10)(N-9)}{2\times10^2} = \frac{\boldsymbol{f}}{v} + \alpha\frac{1}{g}\nabla^2\boldsymbol{g} - \frac{1}{v\rho}\nabla P \quad (3)$$

with $\frac{1}{h}\frac{\partial \boldsymbol{h}}{\partial t} = -K^2$; $K^2 = \frac{1}{\tau_c}$ the temporal decay, we obtain:

$$h = h_0 \exp\left(-\frac{t}{\tau_c}\right) \quad (4)$$

Let's take $\omega^2 = \frac{1}{\tau_c} + \frac{(N-10)(N-9)}{2\times 10^2}$ we get:

$$\iint f\mathrm{d}r^2 + \alpha\iint \mathrm{d}^2 v - \frac{1}{\rho}\iint \nabla P \mathrm{d}r^2 - (N-10)\sum_{n=1}^{+\infty}\iint \frac{v^{500n+2}}{n!}\mathrm{d}r^2 + \omega^2\iint v\mathrm{d}r^2 = 0 \quad (5)$$

$$\frac{fr^2}{2} + \alpha\frac{v^2}{2} - \frac{Pr}{\rho} - (N-10)\sum_{n=1}^{+\infty}\frac{1}{n!}\iint v^{500n+2}\mathrm{d}r^2 + \omega^2\iint v\mathrm{d}r^2 = 0 \quad (6)$$

with $g = \exp(ar)$ we have $\mathrm{d}v = av\mathrm{d}r$ that implies $\mathrm{d}r = \frac{1}{a}\frac{\mathrm{d}v}{v}$, then we get:

$$a^2\frac{fr^2}{2} + a^2\alpha\frac{v^2}{2} - a^2\frac{Pr}{\rho} - (N-10)\sum_{n=1}^{+\infty}\frac{1}{n!}\iint v^{500n}\mathrm{d}v^2 + \omega^2\iint \frac{1}{v}\mathrm{d}v^2 = 0 \quad (7)$$

$$a^2\frac{fr^2}{2} + a^2\alpha\frac{v^2}{2} - a^2\frac{Pr}{\rho} - (N-10)\sum_{n=1}^{+\infty}\frac{v^{500n+2}}{n!(500n+1)(500n+2)} + \omega^2\left[\ln(v)-1\right]v = 0 \quad (8)$$

$$a^2\frac{fr^2}{2} + a^2\alpha\frac{v^2}{2} - a^2\frac{Pr}{\rho} - (N-10)\sum_{n=1}^{+\infty}\frac{v^{500n+2}}{n!(500n+1)(500n+2)} = \omega^2\left[1-\ln(v)\right]v \quad (9)$$

$a$ and $\tau_c$ must numerically verify for $v$:

$$v(r\in\{x,y,z\}) = \frac{a^2}{\omega^2\left(1+\frac{t}{\tau_c}-ar\right)}\left\{\frac{fr^2}{2} + \alpha\frac{\exp\left[2\left(ar-\frac{t}{\tau_c}\right)\right]}{2} - \frac{Pr}{\rho} - (N-10)\sum_{n=1}^{+\infty}\frac{\exp\left[(500n+2)\left(ar-\frac{t}{\tau_c}\right)\right]}{n!(500n+1)(500n+2)a^2}\right\} \quad (10)$$

by continuity equation, $a$ must also be verified:

$$\frac{D\rho}{Dt} = -av \quad (11)$$

$$\left(\frac{\partial}{\partial t} + v\cdot\nabla\right)\rho = -av \quad (12)$$

$$\left(\frac{\partial}{\partial t} + v\cdot\nabla\right)\frac{\rho}{v} = -a \quad (13)$$

$$-\left(\frac{\partial}{\partial t} + v\cdot\nabla\right)\frac{\rho}{v} = a \quad (14)$$

with $\lambda = a$ , we get:

$$\begin{cases} \lambda_{liquid} = -\left(\frac{\partial}{\partial t} + v \cdot \nabla\right)\rho \simeq -\frac{\partial \rho}{\partial t} \text{ for a liquid } \rho_{liquid} \gg v_{fluid} \\ \lambda_{gaz} \simeq -\nabla \rho \text{ for a gaz } \rho_{gaz} \leq v_{gaz} \end{cases}$$

$$v\left(r \in \{x, y, z\}\right) = \frac{\lambda^2}{\omega^2\left(1 + \frac{t}{\tau_c} - \lambda r\right)} \left\{ \frac{fr^2}{2} + \alpha \frac{\exp\left[2\left(\lambda r - \frac{t}{\tau_c}\right)\right]}{2} - \frac{Pr}{\rho} - (N - 10)\sum_{n=1}^{+\infty} \frac{\exp\left[(500n+2)\left(\lambda r - \frac{t}{\tau_c}\right)\right]}{n!(500n+1)(500n+2)\lambda^2} \right\} \quad (15)$$