**COVER LETTER FOR SUBMISSION OF NEW MANUSCRIPTS**

Subject: **SUBMISSION OF NEW MANUSCRIPT FOR EVALUATION**

I am enclosing herewith a manuscript entitled “[**A study of critical point instability of micro and nano beams under a distributed variable-pressure force in the framework of the fractional non-linear nonlocal theory**]” submitted to “**[Archives of Mechanics]**” for possible evaluation.

With the submission of this manuscript I would like to undertake that the above mentioned manuscript has not been published elsewhere, accepted for publication elsewhere or under editorial review for publication elsewhere; and that my Institute’s **[Urmia university]** representative is fully aware of this submission.

Select Type of Submitted manuscript:

* Original Article
* Review Article
* Mini-Review
* Short Communication
* Clinical Article
* Perspective
* Editorial
* Any other (specify the type of manuscript)

For the Editor-in-Chief, I would like to disclose the following information about the project:

The research project was conducted under the supervision of:

**[Professor Ghader Rezazadeh, Dr. Habil. Eng. Wojciech Sumelka and Professor Xiao-Jun Yang]**

whom, they published more than 400 scientific paper and books in the field of NEMS and MEMS and also application of fractional nonlocal theory in different mechanical and other fields problems. For instance:

* Rezazadeh, Ghader, Ahmadali Tahmasebi, and Mikhail Zubstov. "Application of piezoelectric layers in electrostatic MEM actuators: controlling of pull-in voltage." *Microsystem technologies* 12.12 (2006): 1163-1170.
* Rezazadeh, Ghader, Ahmadali Tahmasebi, and Mikhail Zubstov. "Application of piezoelectric layers in electrostatic MEM actuators: controlling of pull-in voltage." *Microsystem technologies* 12.12 (2006): 1163-1170.
* Sumelka, W., R . Zaera, and J. Fernández-Sáez. "One-dimensional dispersion phenomena in terms of fractional media." *The European Physical Journal Plus* 131.9 (2016): 320.
* Sumelka, Wojciech, Tomasz Blaszczyk, and Christian Liebold. "Fractional Euler–Bernoulli beams: Theory, numerical study and experimental validation." *European Journal of Mechanics-A/Solids* 54 (2015): 243-251.
* X.-J. Yang, Local Fractional Functional Analysis and Its Applications, Asian Academic Publisher, HongKong, 2011
* X. -J. Yang, Advanced Local Fractional Calculus and Its Applications, World Science Publisher, New York, 2012
* X. -J. Yang, D. Baleanu, H. M. Srivastava, Local Fractional Integral Transforms and Their Applications, Acedmic Press, Elsevier, 2015
* C. Cattani, H.M. Srivastava, X.-J. Yang, Fractional Dynamics, De Gruyter Open, 2016

And more recently we published

Rahimi, Z., Sumelka, W., and Yang, Xiao-Jun. ”LINEAR AND NON-LINEAR FREE VIBRATION OF NANO BEAMS BASED ON A NEW FRACTIONAL NON-LOCAL THEORY”. Engineering Computations, · January 2017,DOI: 10.1108/EC-07-2016-0262

I would also like to share the following information with Editor-in-Chief

For quick understanding about the importance of the project following are the significant findings of my submitted article?

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| Because of the difference of experimental data and classic theoretical results in nano and micro scale the nonlocal theory could be effective because of presence of nonlocal parameter to consider small scale effects. From the other hand, application of fractional calculus in mechanical models, called fractional models (FMs), make them to be more flexible than integer ones forasmuch they can conclude all of integer and non-integer operators. In other word, FMs let us to use more potential of mathematics to modeling physical phenomena due to use of both integer and fractional operators to present a better modeling of problems which this make them to be more flexible and powerful. Therefore, in the present work, a new fractional nonlocal model is presented which is the general form of Eringen nonlocal theory. The simple form of the theory make it to be used in different complex mechanical problem therefore we use it to model static pull-in phenomena of nano beams and make a comparison between the presented theory, Eringen nonlocal theory and Classical theory. |

How findings of this research work are unique in their nature?

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| Although FMs makes the instrument modeling more flexible and powerful, the solution of the governing equations based on them are difficult due to integral form of the mostly used definitions like Caputo, Riemann–Liouville and Grunwald-Letnikov. In the present work, a nonlocal constitutive relation has been investigated using the Conformable fractional derivative definition. This model is the general form of Eringen nonlocal elasticity and can be easily used in different simple or complex problems forasmuch the governing equations have simple form and can be easily solved by numerical solutions, which have been used for equations with integer derivatives.  For the first time application of fractional calculus in the field of NEMS pull-in instability is presented and static pull-in phenomena of nano beams is studied. The obtained results compared with Eringen nonlocal theory, Classical theory, and experimental data. |