Ilkogretim Online - Elementary Education Online, Year; Vol 20 (Issue 2): pp. 559-566
http://ilkogretim-online.org
doi: 10.17051/ilkonline.2021.02.61

Snake –Mongoose Principle

Dr. Shobha Lal, Professor of Mathematics and Computing, Department of Science and Technology Jayoti Vidyapeeth Women's University, Jaipur, dr.lalshobha@gmail.com

Abstract:"If a snake moves on a surface and if a Mongoose comes before it then a neck to neck fighting starts finally snakes dies, it happens same in case of wave communication and Network related cases that bears different level of wavelets as unseen force".This is Snake-Mongoose Principle as inventor and author of this paper claims. To exhibit and demonstrate, an identity and some supper position result of Differential equation may be taken in to account. To justify the fact a small short of identity $(k^2+1)^2-(k^2-1)^2= 4k^2$may be taken. Here, this Simple application of taken identity leads to a very mould and convergent logic supposed as an important tool for any wave communication dealing with wave problem under problem under different Domain.Corresponding nodes used in the communication Network, where constructive and Destructive fringes collide, finally fightingover and Mongoose leads as a result in the right hand side of the identity may clearly explains ***the Snake*-Mongoose Principle**. Identity that may be taken for the consideration to this principle is $(k^2+1)^2-(k^2-1)^2= 4k^2$, where k is any real value of real time framework that allows the network coming forward one by one representing different curves in geometrical nature and try to hamper one another during overlapping. Higher order differential equations are of great significance in this study. A final nod is supposed to be located during the insertion of different practical value in a stipulated period.

Keywords: Snake, Mongoose, Identity, Network, Inter fringes, Higher order differential equation.

I. INTRODUCTION:

In the end, Snake and Mongoose movement has interested common researchers for quite a while because of their proposed numerical moving. Little bit battling bear such countless stories and has become a subject of incredible interest as one of the critical instances of delicate bio propelled mechanical technology if there should be an occurrence of a snake [1]. So Researcher accept that that this is another and late worldview in automated science whereby motivation is looked for from nature to supply robots with new abilities regarding smoothness and flexibility and display something new for the execution of new standard [5].

Examination is on that how the manner in which snakes move has been the subject of fundamental works by Gray in these early investigations had portrayed the sophiscated idea of mechanics and wave hypothesis basic snake motion inside intently fitting channels and on a surface within the sight of outside push-focuses yet the battling of a feline with such snake is our reason for worry for the examination [9]. So far the movement of wave and their arrangement is worry that co relates the strong action just as powers sent by snakes to varieties of stakes among which they move has been estimated [6].Thought some examination alone on the movement of a snake had been made in abroad also early hypothetical investigations can be found in the Russian writing, and the references cited in that are some help to break down that the reality deliberately [1]. As per an investigation a beam of center had been gone to the significance of frictional anisotropy between snakes' ventral skin and level surfaces on which they move alone for the snake invigorating both trial and hypothetical examination. Indeed, it is grounded that fairness of grating coefficients in longitudinal and parallel ways prompts no net forward movement in adulatory motion as wave molecule move from one piece of a hub to the next piece of Anti hub as Cat side [1].

The previous encounters and related thoughts that frictional anisotropy assumes a part in snake velocity was advanced quite a while in the past in the designing writing and most eminently had been a lot of lucid by the bigger perusers one should zero in on crafted by Hirose in his fundamental work on mechanical snake-like headway of a snake [1]. Here, it become applicable to specify that Hirose was among the first to understand the capability of natural motivation in planning robots by considering snake-like locomotors and controllers however my new arranged example of study will one day compose another section in the examination Net work and correspondence, I am certain. In the innovative advances, where in this field have prompted the improvement of models for snake robots created with an ever increasing number of jointed dynamic portions and it is obvious agreement that now and again this is prompting the utilization of continuum hypotheses however the atomic viewpoint yet to be examined everywhere .Hence each other model can likewise be put to acclimate our some later commitments Cosse rodent models that were utilized for the mechanics of slim adaptable robots and portrayed as deformable poles, as had been talked about in the start of the paper [6].

Perusers would more energized the guideline as the agent is attempting to bring before globe for the turn of events and upgrade of Network innovation and Communication twisting wing in incitement method of study by the writing on snake-like velocity examined above in a model framework like the one utilized with regards to adulatory swimming by comprising of a planar inextensible flexible pole to a picture like emblematic way and that can handle its unconstrained arch ,if that matter of wave come for thought. By the Concept of movement of a dynamical systemTravelling rushes of unconstrained ebb and flow can place the framework moving when the climate applies requirements or powers that forestall the bar being twisted wherever as indicated by its unconstrained bend [1].

The movement of fish-like or snake-like living creatures can be portrayed on this guideline in the accompanying manner. The job of the hard dividers of the channel is to a specific degree played by the medium encompassing the body. For instance, in the instance of these living beings moving in a fluid medium the job of the channel dividers is played by the liquid, which because of its inactivity (when followed up on quickly enough) doesn't essentially move from the underlying situation inside the time during which there happens a generous move of the body legitimate. On account of snakes proceeding onward land the suitable simple of the channel is more convoluted. To begin with, the job of the channel dividers can be played by the grass stems if the movement happens in thick grass. Besides, it is conceivable that when a snake is moving along its body hub the grinding is a lot more modest than when it is moving oppositely to it. There are likewise various different theories, yet they have small bearing on the principle task of this paper [10].A plane linkage consisting of two, three, or more bodies can move along ahorizontal surface in different directions using internal control torques createdby the actuators placed at the joints. The mechanisms have a simplestructure and can use, in fact, only one actuator. Various modes of motionsare described, and sufficient conditions are derived which ensure thepossibility of the locomotions. Displacements, speed, and the required controltorques are estimated. Optimization of the average speed of linkageswith respect to their geometrical and mechanical parameters is carried out.Computer simulation of the motion of linkages confirms theoretical considerationsand estimates. The proposed principle of snake-like locomotionscan be useful for mobile robots, especially for small ones [12].

Dynamic friction was investigated by a microtribometer. The ventral scales demonstrated anisotropic frictional properties. To analyze the role of the stiffness of underlying layers on the frictional anisotropy, two different types of scale cushioning (hard and soft) were tested. To estimate frictional forces of the skin surface on rough substrates, additional measurements with a rough surface were performed. Frictional anisotropy for both types of scale cushioning and rough surfaces was revealed. However, for both types of surface roughness, the anisotropy was stronger expressed in the soft-cushioned sample. This effect could be caused by (1) the stronger interaction of the microstructure with the substrate in soft-cushioned samples due to larger real contact area with the substrate and (2) the composite character of the skin of this snake species with embedded, highly ordered fiber-like structures, which may cause anisotropy in material properties [13].

The snakes' epidermis is comprised of diVerent layers with the deepest called the layer germinativum. The external layers, which are restored during shedding, are, from the inside, - mesos-, -layer, and Oberhäutchen. The Oberhäutchen, essentially comprising of -keratin, is in direct contact with the climate. It is notable that the Oberhäutchen has a Wne surface design called microornamentation (Leydig 1873; Ruibal 1968), whose subtleties were portrayed by before creators with the utilization of electron microscopy (Hoge and Souza Santos 1953; Price 1983; Bea and Fontarnau 1986; Fontarnau and Bea 1987; Stille 1987; Chiasson et al. 1989;

Chiasson and Lowe 1989; Cost and Kelly 1989; Price 1990). Elements of the reptile and snake microornamentation have been recently talked about in the writing [14].

Limbless animals are thin and adaptable, empowering them to use strategies for velocity that are on a very basic level unique from the more normally contemplated flying, swimming, strolling, and showing used to comparatively estimated limbed or finned living beings. These techniques can be pretty much as proficient as legged movement (1) and in addition are especially adaptable while moving over lopsided landscape or through restricted hole, for which the ownership of appendages would be a hindrance [15].

Limbless terrestrial animals propel themselves by sliding their bellies along the ground. Although the study of dry solid-solid friction is a classical subject, the mechanisms underlying friction-based limbless propulsion have received little attention. We review and expand upon our previous work on the locomotion of snakes, who are expert sliders. We show that snakes use two principal mechanisms to slither on flat surfaces. First, their bellies are covered with scales that catch upon ground asperities, providing frictional anisotropy. Second, they are able to lift parts of their body slightly off the ground when moving [16].

In this paper, we have attempted to take apart the job of the different exogenous and endogenous dynamical factors that portray these developments in an until now neglected setting: undulation on an anisotropic frictional climate that doesn't take into account cross over slip. Our numerical model, which prompts a nonlinear limit esteem issue, represents the part of an inactive aggregate viscoelasticity of the tissue, a functioning second subject to certain physiological limitations and a basic frictional law that represents the connection of the slim life form with the climate [17].

We examine a diminished model to figure the movement of slim swimmers which move themselves by engendering a bowing wave along their body. Our methodology depends on the utilization of resistive power hypothesis for the assessment of the thick powers and forces applied by the encompassing liquid, and on discretizing the kinematics of the swimmer by addressing its body through a verbalized chain of N inflexible connections fit for planar distortions [18].

In this paper we study a numerical model of one-dimensional swimmers playing out a planar movement while completely inundated in a thick liquid. We demonstrate presence and uniqueness of the arrangement of the conditions of movement driven by shape changes of the swimmer. Additionally, we demonstrate a controllability result indicating that given any pair of beginning and last states, there exists a past filled with shape changes to such an extent that the subsequent movement takes the swimmer from the underlying to the last state [19][20].This paper considers the kinematics of hyper-repetitive (or "serpentine") robot motion over lopsided strong landscape, and presents calculations to actualize an assortment of "walks". The investigation and calculations depend on a constant spine bend model which catches the robot's naturally visible math. Two classes of walks, in view of fixed waves and voyaging influxes of component distortion, are presented for hyper-excess robots of both consistent and variable length. We additionally outline how the movement calculations can be utilized to design the control of items which are gotten a handle on in a limb like way [21].

In this paper, we present a bound together unique displaying approach of (lengthened body) continuum robots. The robot is displayed as a mathematically accurate pillar constantly activated through a functioning strain law. When remembered for the mathematical mechanics of velocity, the methodology applies to any hyperredundant or persistent robot that is dedicated to control and additionally motion. Besides, by the misuse of the idea of the subsequent model of being a persistent rendition of the Newton-Euler model of discrete robots, a calculation is recommended that is equipped for registering the inner control forces (and additionally powers), just as the inflexible net movements of the robot [22].This paper presents the powerful displaying of a persistent three-dimensional swimming eel-like robot. The displaying approach depends on the "mathematically accurate shaft hypothesis" and on that of Newton-Euler, as it is notable inside the advanced mechanics local area. The proposed calculation permits us to figure the robot's Galilean development and the control forces as an element of the normal inner twisting of the eel's body[23].In contrast to customary inflexible connected robots, delicate mechanical controllers can twist into a wide assortment of complex shapes because of control inputs and gravitational stacking [24]. This paper presents another methodology for displaying delicate mechanical controllers that fuses the impact of material nonlinearities and conveyed weight and payload [25]. The model is mathematically precise for the enormous shape, shear, twist, and augmentation that frequently happen in these controllers. The model depends on the mathematically careful Cosserat bar hypothesis and a fiber strengthened model of the air muscle actuators [26][27]. The model is approved tentatively on the OctArm V controller, indicating under 5% normal blunder for a wide scope of incitation pressing factors and base directions when contrasted with practically half normal mistake for the steady curve model recently utilized by scientists [28][29].

II. METHODOLOGY:

In the below figure, see the fighting of a Mongoose and asnake, both the figure represent separately two different functions in the form of intersecting or non- intersecting. Above taken Identity and the number K is one of the tool to associate with the concept of principle of differential equation. Molding of or rolling the wavelets of a wave either in the Communication or in the LAN will put the existence of the formation of nod and antinodes in the wave communication. Energy may not be conserved; it has been the evident fact. A parabolic curve as the snake take during the fighting with the Mongoose and a semi straight line shape as snaketake during the fighting are here for the understanding of the principle to the readers.

Let us see the general equationof 2nd degree in x and y as [8]

$ax^2+2hxy+by^2+2gx+2fy+by^2+c=0$

Under different condition like

A >c or a<c

We can understand the fighting or non fighting scene of a snake andMongoose.

FIG-1FIG-2

With the help of above equation of 2^{nd} degree and values of constants as have been discussed.

For the various shapes and sizes of the capacities and their charts beneath referenced outcomes can likewise be taken into the thought. As it is the apparent actuality that the capacities f1(x) = cos2x, f2(x) = sin2x, f3(x) = sec2x, f4(x) = tan2x are directly subject to the span (— p/2, p/2) since [4]

$c_1 \cos^2 x + c_2 \sin^2 x + c_3 \sec^2 x + c_4 \tan^2 x = 0,$

when $c_1 = c_2 = 1$, $c_3 = -1$, $c_4 = 1$. We used here
$\cos^2 x + \sin^2 x = 1$ and $1 + \tan^2 x = \sec^2 x$.

A set of functions $f_1(x), f_2(x), \ldots, f_n(x)$ is linearly dependent on an interval if at least one function can be expressed as a linear combination of the remaining functions

III. Result and Discussion:

A Result of Super Position Principle-Non Homogeneous Equations:

Let us consider the relation as stated below [3]

Y_{p1}, y_{p2}, y_{p3} ,----------,y_{pk} be k particular solutions of the Non-Homogeneous Linear nth order differential equation on an interval I corresponding, in turn, to k distinct functions g1,g2,g3,---,gn, that is, let us consider that y_{Pi} denotes a particular solution of the corresponding differential equation

$A_n(x).y^n+A_{n-1(x)}y^{n-1}+A_{n-2(x)}\, y^{n-2}+\text{------------}+A_{1(x)}\, y^1+A_{0(x)}y=G_{i(x)}$.------------- (1)

Where i=1,2,3,,-----,k

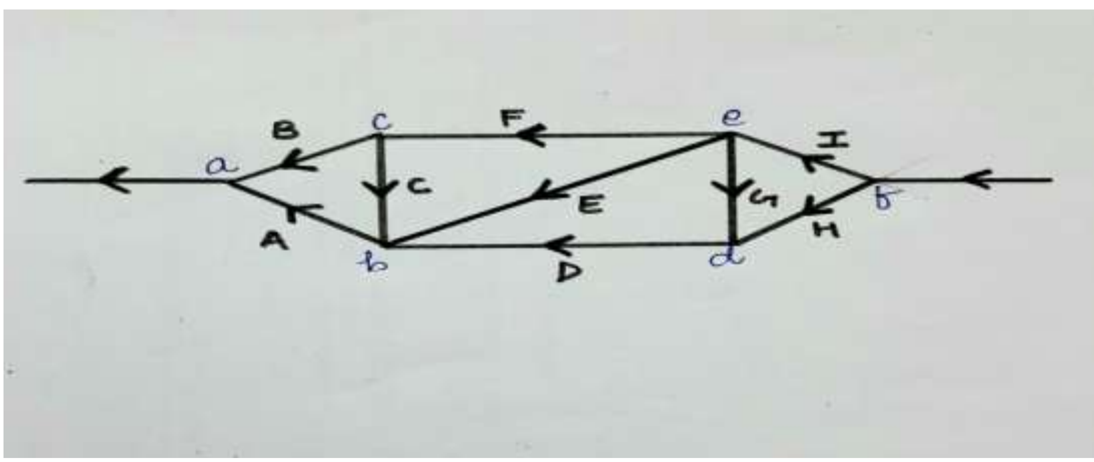
Then

$Y_p= y_{p1(x)}+y_{p2(x)}+\text{--------}\ \text{--}+y_{pk(x)}$. -------------------------(2)

Is a particular solution of

$A_n(x).y^n+A_{n-1(x)}y^{n-1}+A_{n-2(x)}\, y^{n-2}+\text{------------}+A_{1(x)}\, y^1+A_{0(x)}y=G_{1(X)}+G_{2(X)}+\text{------}G_{K(X)}$-------------(3)

If we take an electric circuit and consider that between two nodes there is a network of electrical connection working for charge flow as wavelets. Without any loss of generality, we can see the following example in the following picture between nodes numbered **f** and **a,** [2]



Allow us to consider in the middle of the hubs f and a there is voltage distinction is constrained and subsequently s there is a current moving from f to a. Allow us to say that a current i0 is streaming into hub f and streaming out of hub an as demonstrated by the bolts as demonstrated above, for accommodation to help my rationale in the guideline as an overall way, Here, we ought to assume that we are given data about the obstruction of each edge appeared in the figure . It has involved worry that the current i0 appropriate itself over the organization [2]

There is no deficiency of over-simplification in expecting that the organization contains no circle that there is all things considered one edge between any two given hubs and that the organization is associated. It is wonderful where we arrange the edges in a discretionary style. Each edge has a hub the head and another as tail. To make it understood , b is the head and c the tail of the edge C in the above picture. Note that the direction of an edge is without bias to the positive course of genuine.

Now, the Identity $(k^2+1)^2-(k^2-1)^2= 4k^2$can universalize the concept of Snake **–Mongoose Principle.**

If a snake moves on a surface and if a Mongoose comes before it then a neck to neck fighting starts finally snakes dies, it happens same in case of mathematical identities as throughout the regular cancellation whether it's a left hand cancellation or right hand cancellation principle of that covers all the Algebraic and Transcendental functions generating results. Simple application of an identity leady to a very mould and convergent logic that is supposed as an important tool of any wave communication dealing with different numerical problem**.**

IV. Conclusion and Future Work:

(1) At least 48 types of vertebrates in 14 families and six orders are known to eat venomous snakes. Of these, several species of opossums, two hedgehogs, some mongooses, severalmust lids, and a few skunks may eat venomous snakes routinely [32]

(2) As a gathering, these ophiophagous vertebrates lack diagnostic morphological attributes. All things being equal, their only shared variations for ophiophagy appear to comprise in the ability to oppose the poisonous impacts of venomous snakebite.

(3) Molecular characteristics that present toxin obstruction include toxin-killing serum proteins and versatile changes envenom-focused on substrate or legend atoms. Of these, toxin-killing serum proteins, which are dependable for transferrable invulnerability and can be utilized to shield non-safe species from envenomation, have gotten the most attention from biomedical researchers.

(4) Toxin-killing serum proteins confined and sequenced to date from both ophiophagous opossums and mongooses show high succession homology with humanα1B-glycoprotein. Most are snake-toxin metalloproteinase inhibitors, however one restrains phospholipids A2myotoxins.

(5) Examples of versatile changes in toxin targeted molecules remember amino-corrosive replacements for mongoose nicotinic acetylcholine receptor that repress restricting by-neurotoxins in elapid toxins, and amino-corrosive substitutions in opossum von Will brand Factor (vWF) that arehypothesized to debilitate the connection between vowandcoagulopathic C-type lections in pit viper venoms.

(6) Although numerous components of toxin resistance have been distinguished in some ophiophagous well evolved creatures, the proteomic intricacy of most snake toxins recommends that many extra instruments of toxin obstruction remain tobe found[32].

(7) At least 48 types of warm blooded creatures in 14 families and sixorders are known to eat venomous snakes. Of these, several species of opossums, two hedgehogs, some mongooses, severalmust lids, and a few skunks may eat venomous snakes routinely.

(8) As a gathering, these ophiophagous well evolved creatures lack diagnostic morphological qualities. All things considered, their only shared variations for ophiophagy appear to comprise in the ability to oppose the harmful impacts of venomous snakebite.

(9) Molecular characteristics that give toxin obstruction include toxin-killing serum proteins and versatile changes envenom-focused on substrate or legend atoms. Of these, toxin-killing serum proteins, which are

dependable for transferrable insusceptibility and can be utilized to shield non-safe species from envenomation, have gotten the most attention from biomedical researchers.

(10) Toxin-killing serum proteins confined and sequenced to date from both ophiophagous opossums andmongooses show high grouping homology with humanα1B-glycoprotein. Most are snake-toxin metalloproteinaso inhibitors, yet one 7) Within Mammalia, toxin opposition appears to have evolved just in species that regularly go after, or that are routinely went after by, venomous snakes. The apparent absence of this characteristic among warm blooded creature's not straightforwardly included inpredatory associations with snakes might be expected to metabolic constraints on the development of poison inhibitors and the need to keep up metabolic usefulness of toxin targeted molecules[32]

Available data proposes that toxin resistanceevolved just a single time among opossums, likely during the lateMiocene in South America, when that landmass was isolated from other land masses by open seaways. In spite of the fact thatthespatiotemporal setting in which toxin opposition evolved in different gatherings is hazy, the characteristic is so generally distributed among mongooses and must lids as to propose that it mighthave been genealogical to the crown clades of the two families and could have assumed a part in their initial diversification.

Previously the subject principally of biomedical research, toxin obstruction is a complex tropic adaptationthat merits consideration from transformative scientists. In particular, the likelihood that toxin safe ophiophagesmay essentially affect snake-toxin evolution deserves more extensive examination [32].

Limitation: Validation of this principle is limited till the application of algebraic identity taken and higher order differential equation.

REFERENCES:

[1] Trivedi D, Rahn CD, Kier WM, Walker ID. 2008. Soft robotics: biological inspiration, state of the art, and future research. Appl. Bionics Biomech. 5, 99–117.

[2] Kim S, Laschi C, Trimmer B. 2013. Soft robotics: a bio-inspired evolution in robotics. Trends Biotechnol. 31, 287–294.

[3] Gray J. 1946. The mechanism of locomotion in snakes. J. Exp. Biol. 23, 101–120.

[4] Gray J, Lissmann HW. 1950. The kinetics of locomotion of the grass-snake. J. Exp. Biol. 26, 354–367

[5] Bekker MG. 1956. Theory of land locomotion. Ann Arbor, MI: University of Michigan Press

[6] McNeil Alexander R. 2003. Principles of animal locomotion. Princeton, NJ: Princeton University Press.

[7] Jayne BC. 1988. Muscular mechanisms of snake locomotion: an electromyographic study of lateral undulation of the Florida banded water snake (*Nerodiafasciata*) and the yellow rat snake (*Elaphe obsoleta*). J. Morphol. 197, 159–181.

[8] Moon BR, Gans C. 1998. Kinematics, muscular activity and propulsion in gopher snakes. J. Exp. Biol. 201, 2669–2684.

[9] Lavrentyev MA, Lavrentyev MM. 1962. On a principle for creating a tractive force of motion. J. Appl. Mech. Tech. Phys. 4, 6–9

[10] Kuznetsov VM, Lugovtsov BA, Sher YN. 1967. On the motive mechanism of snakes and fish. Arch. Ration. Mech. Anal. 25, 367–387

[11] Chernousko FL. 2003. Snake-like locomotions of multilink mechanisms. J. Vib. Control 9, 235–256.

[12] Chernousko FL. 2005. Modelling of snake-like locomotion. Appl. Math. Comput. 164, 415–434.

[13] Baum MJ, Kovalev AE, Michels J, Gorb SN. 2014. Anisotropic friction of the ventral scales in the snake *Lampropeltis getulacaliforniae*. Tribol. Lett. 54, 139–150.

[14] Berth RA, Westhoff G, Bleckmann H, Gorb SN. 2009. Surface structure and frictional properties of the skin of the Amazon tree boa *Corallushortulanus* (Squamata, Boidae). J. Comp. Physiol. A 195, 311–318.

[15] Hu DL, Nirody J, Scott T, Shelley MJ. 2009. The mechanics of slithering locomotion. Proc. Natl Acad. Sci. USA 106, 10081–10085.

[16] Hu DL, Shelley MJ. 2012. Slithering locomotion. In *Natural locomotion in fluids and on surfaces*, vol. 155 (eds S Childress, A Hosoi, WW Schultz, J Wang), pp. 117–135. The IMA Volumes in Mathematics and its Applications. Berlin, Germany: Springer.

[17] Guo ZV, Mahadevan L. 2008. Limbless adulatory propulsion on land. Proc. Natl Acad. Sci. USA 105, 3179–3184.

[18] Alouges F, DeSimone A, Giraldi L, Zoppello M. 2013. Self-propulsion of slender micro swimmers by curvature control: N-link swimmers. Int. J. Nonlinear Mech. 56, 142–147.

[19] Dal Maso G, DeSimone A, Morandotti M. 2014. One-dimensional swimmers in viscous fluids: dynamics, controllability, and existence of optimal controls. ESAIM, Control Optimization Calc. Var. 21, 190–216

[20] Hirose S. 1993. Biologically inspired robots: snake-like locomotors and manipulators. Oxford, UK: Oxford University Press

[21] Chirikjian GS, Burdick JW. 1995. The kinematics of hyper-redundant robot locomotion. IEEE Trans. Robot. Autom. 11, 781–793

[22] Boyer F, Shauna A, Mathieu P. 2012. Macro continuous dynamics for hyper redundant robots: application to kinematic locomotion bioinspired by elongated body animals. IEEE Trans. Robot. 28, 303–317.

[23] Boyer F, Porez M, Khalil W. 2006. Macro-continuous computed torque algorithm for a three-dimensional eel-like robot. IEEE Trans. Robot. 22, 763–775.

[24] Trivedi D, Lotfi A, Rahn CD. 2008. Geometrically exact models for soft robotic manipulators. IEEE Trans. Robot. 24, 773–780

[25] Renda F, Cianchetti M, Giorelli M, Arienti A, Laschi C. 2012. A 3D steady-state model of a tendon-driven continuum soft manipulator inspired by the octopus arm. Bioinspir. Biomim. 7, 025006

[26] Rucker DC, Jones BA, Webster RJ III. 2010. A geometrically exact model for externally loaded concentric tube continuum robots. IEEE Trans. Robot. 26, 769–780

[27] Chrispell JC, Fauci LJ, Shelley M. 2013. An actuated elastic sheet interacting with passive and active structures in a viscoelastic fluid. Phys. Fluids 25, 013103

[28] Antman SS. 2005. Nonlinear problems of elasticity, vol. 107 New York, NY: Springer

[29] Alouges F, DeSimone A, Lefebvre A. 2008. Optimal strokes for low Reynolds number swimmers: an example. J. Nonlinear Sci. 18, 277–302

[30] Alouges F, DeSimone A, Heltai L, Lefebvre A, Merlet B. 2013. Optimally swimming stokesian robots. Discrete Continuous Dyn. Syst. B 18, 1189–1215.

[31] DalMaso G, DeSimone A, Morandotti M. 2011. An existence and uniqueness result for the motion of self-propelled microswimmers. SIAM J. Math. Anal. 43, 1345–1368.

[32] Robert S. Voss1,Sharon A. Jansa. 2012. Snake-venom resistance as a mammaliantrophic adaptation: lessons from didelphid marsupials. Voss, R. S., &Jansa, S. A. (2012)*., 87(4), 822–837.*