J. Basic. Appl. Sci. Res., 2(6)6268-6276, 2012

ISSN 2090-4304
Journal of Basic and Applied Scientific Research
www.textroad.com

Design and Analysis of a Novel UFO

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ABSTRACT

This paper explores a possible design for a Biomass Jet Engine propulsion based UFO. The proposed UFO consists of four main parts: 1) Saucer shaped light weight body 2) an areogel-helium based lifting system, 3) a Biomass Jet Engine, and 4) a central system which able the UFO to fly as a self-control system which can communicate with a ground station to transmit its data and a control system as well. The weight is considered as the main factor to achieve a lightweight design. The specifications of all parts of the UFO are briefly described in detail. Due to powerful biomass Jet engine of the UFO and turbulence in the outputs of the high pressure air, it was predicted there would be a significant vibration in the main body and an uneven rotation of UFO as well. A controller is needed to control to address the vibration of the UFO and keep the angular speed of the UFO in a constant value. This controller is a fuzzy based system accepts the wind pressure data of the output of the Jet Engine as fuzzifid values of high, medium, and low and control the output of high pressure air of the biomass jet Engine causing helicopter stability without vibration and a constant rotation of UFO as well. Moreover, to predict the performance of the UFP by the proposed controller, simulations of simulations of movement of the UFO in x, y, z direction are carried out. The obtained results reveal the effectiveness of the proposed UFO topology, and the proposed control system.

KEYWORDS: UFO, Biomass Jet Engine, UAV, fuzzy controller.

INTRODUCTION

The famous Roswell, New Mexico UFO 'saucer' crash is an important event in the history of UAV technology. The Bob Lazar who claims to have been involved in back engineers a saucer type craft at the S4 area near Area 51 in Nevada after this crash. After several researches it becomes evident that the field propulsion system is used in the UFOs.

The conventional UAVs are under technology progress. But, the field propulsion system which is used in UFOs is differing from propulsion system of the conventional UAVs and aircraft completely. Furthermore, the lifting system of the UFO which based on the antigravity mechanism is completely different with the lifting system of connectional airshaft and balloons. Although both the propulsion and lifting mechanism of UFOs seem be too complex to construct a real UFO, but we can use another types of lifting and propulsion concept to design and manufacture and UFO.

The tail refers to the tail's shape part of conventional manned or unmanned aircraft. The tail prevents vibration of flying object during flying. The for example the rotor at the tail of a helicopter helps it to change its direction of flying [1]. The tail causes to a higher cost and weight, limitations in aerodynamic design, and displacement of gravity center of flying system [2]. Even the coaxial helicopter which employs two rotors which are rotating in contrast, also need tail [3]. In best knowledge of author, there is rare literature about tailless high speed airplane.

Thus, it is essential to work on the UFO topology which is without tail to alleviate to drawbacks of conventional aircrafts.

In this paper, a novel UFO is proposed. This helicopter benefits a lighter than air based lifting system and Biomass Jet Engine propulsion system. The proposed UFO has a saucer shaped boy which allows it to have high speed flight as seen in Fig .1.

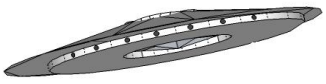

Fig. 2. The saucer shape main body of the UFO

The proposed design is based on mathematical foundation. There are many details in designing an UFO. The efforts of this paper will focus on a possible an aerogel based-lifting system and a Biomass Jet Engine based system for propulsion system in hopes to inspire others to fill in the details.

Thus the scientific contributions of this paper can be summarized as follows:

1. A new stable UFO by aerogel based lifting system and propulsion with Biomass Jet Engine is proposed.
2. An effective controller to stabilizing the UFO without any vibration during flight is designed.
3. The UFO is modeled using multi-body dynamic approach.

The rest of this paper is organized as follow: In section 2, the main components of the proposed topology for the UFO are descried. In section 3, the UFO is modeled using multi-body approach. In section 4, the fuzzy controller to eliminate the vibration of the UFO as well as maintaining the UFO angular speed in a constant value is proposed and designed. In section 5, by using the developed multi body dynamic model in section 5, the simulation to predict the controller performance is carried out. The vibration and angular speed of UFO in term of all components of UFO in controlled and uncontrolled condition are presented. Finally, section 6 presents conclusion and perspective.

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PROPOSED TOPOLOGY

The proposed topology for the UFO consists of four main parts of saucer shaped boy, lifting system, and propulsion system, which are described in following.

A. Saucer Shaped Body

The main body is designed as saucer shaped body, which is an aerodynamic fuselage body, as seen in Fig 2. Since the proposed UFO is considered as remote piloted, any space for the any pilot is not considered.

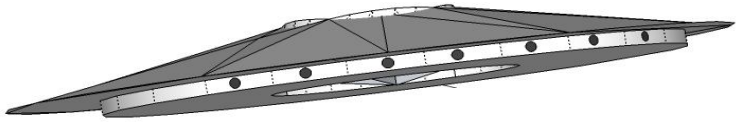

Fig. 2. The saucer shape main body of the UFO

B. Lifting System

The lifting system of the UFO is provided using the lither than air object, aerogel. The cylindrical shape of the aerogel is shown in Fig. 3. The geometric dimensions of the lifting system were also indicted.

The used aerogel in the lifting system is the dry, low-density, porous, solid framework of a gel isolated in-tact from the gel's liquid component. Aerogels are open-porous and have pores in the range of less than 1 to 100 nanometers (billionths of a meter) in diameter and usually is less than15 nm.

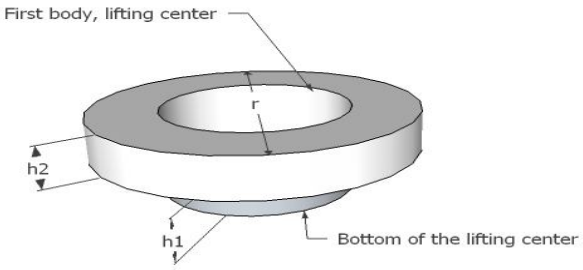

Fig. 3. The lifting system of the UFO, a cylindrical shaped aero-gel

The center of the cylindrical system is filled with helium gas is used. Both the aerogel and the helium gas provide bouncy to keep the UFO at a specific height. Based on the temperature of the helium gas, the height of flying of UFO can be changed and controlled. It should be noted that the aerogel is very effective insulation for heat prevent unwanted changing the temperature of the gas which is inside itself. The volume of the aerogel and the helium gas would be chosen so that it could provide enough buoyancy to lift the UFO.

C. Propulsion System

Although a magnetic field propulsion system need a high technology to construct, a Jet Engine based propulsion system can significantly be effective for such design. Since the lifting system keeps the UFO in floating state, all the generated energy by the propulsion system will be devoted for movement of the UFO in horizontal axis. The Biomass Jet Engine benefits the chemical energy in the Biomasses. The generated heat by the biomass will be used for both the concentration of the air to a high pressure air and generation of electricity. The operation of the Biomass Jet Engine is similar to conventional Jet Engines. The generated electrical energy will be used for the electrical systems in the UFOs.

The Biomass Jet Engine is located at the center of a six sided aerogel structure that is due to light weight nature of aerogel and its high heat insulation characteristic as well. Several tubes conducting the high pressure gas to the outputs.

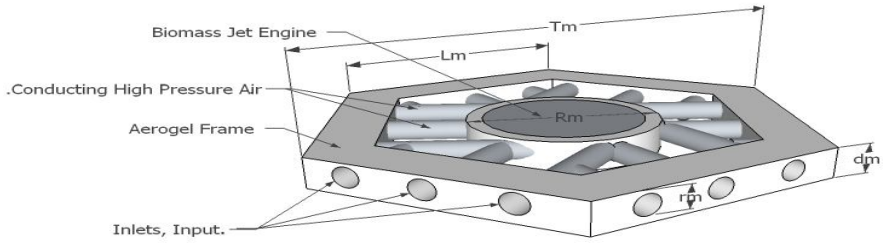

Fig. 4. Biomass Jet Engine framed in six sided aerogel structure

Also, by using another six sided aerogel structure and several tubes the output of the jet engine will be expanded. As seen the Jet engine is located at the centre of another six sided structure made of aerogel as show in Fig. 5. As the outputs of the jet engine increase control of the UFO flight becomes easier and more effective.

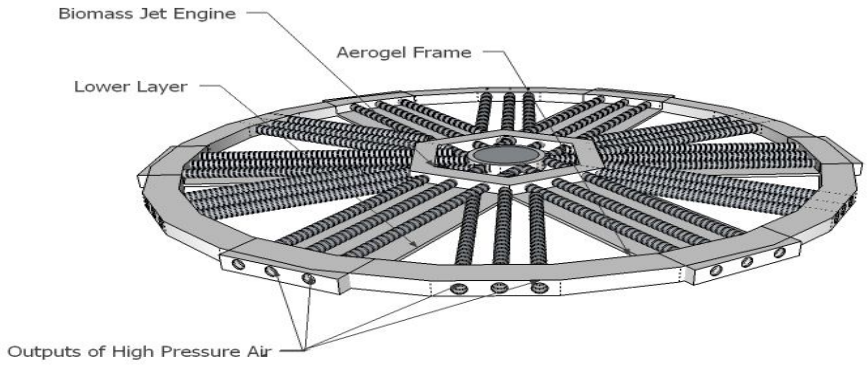

Fig. 5. Biomass Jet Engine frame expanded in a larger six sided aerogel structure

Jet engines move the UFO forward with a great force that is produced by a tremendous thrust and causes the UFO to fly very fast. The engine sucks air in at the front. A compressor raises the pressure of the air using the generated energy by the biomass. The compressor is made up of fans with many blades and affixed on a shaft compressing the air. The compressed air is then sprayed with gas obtained from biomass and an electric spark lights the mixture. The burning gases expand and blast out through the outputs, at the back of the UFO. As the jets of gas shoot backward, the engine and the UFO thrust forward.

It should be noted that, based on movement direction the UFO, some of the turbines will be output and other will be input to generated the population system.

Due to the aerodynamic turbulence between the outputs, there will be a slight unwanted force will act at arbitrary direction cause to vibration of the UFO. Thus, to stabilize the UFO, a controller is required.

MODELING OF THE UFO

To develop an algorithm for satiability of robot performance as well as prediction of its dynamic performance a multi-body approach is used.

The UFO is considered as several bodies including the main body, right and left blades of the lower and upper rotors, and right and left arms of the balancer. It should be noted that most of bodies are fixed together without any revolute. Hence, they considered as one body. The join type between the rotors and main boy is revolute type. In the Fig. 6, all the bodies and the corresponding coordinates and the reference coordinate are shown.

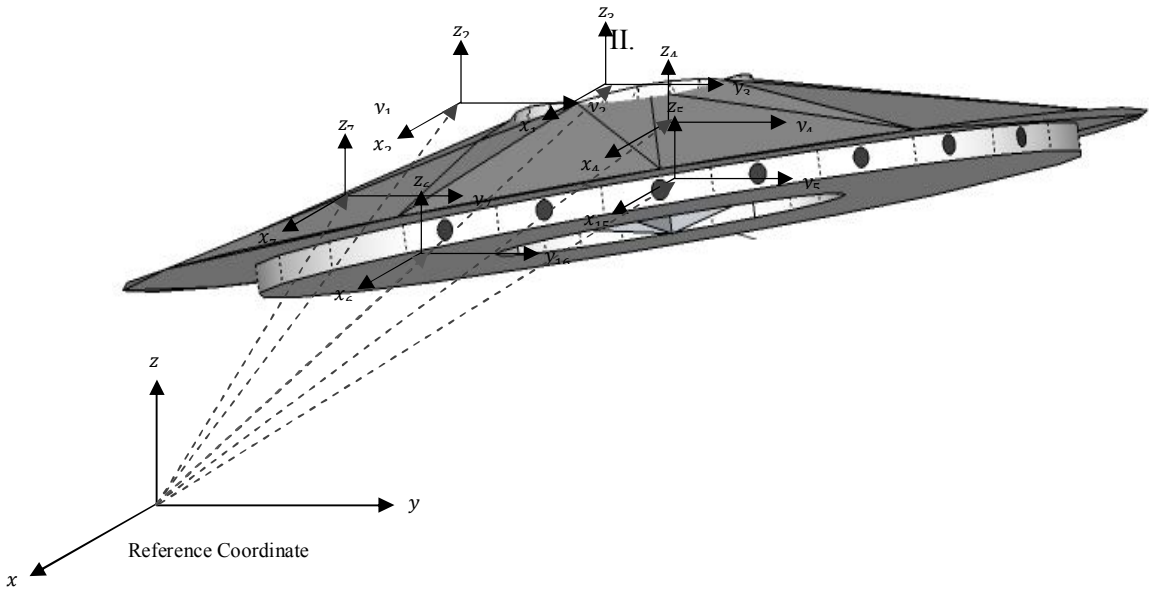

Fig. 6. The several bodies and Cartesian Coordinates associate with them.

The configuration of each body in the space can be exclusively expressed by six coordinates; three coordinates have for its location in the space and three Cartesian coordinate for its angular position by means of EULER parameters [5]. Thus, configuration of body of i is presented with configuration vector of y_i:

$$y_i = \begin{bmatrix} r_i \\ p_i \end{bmatrix} \qquad (1)$$

Where, $r_i = [x_i, y_i, z_i]$ is location vector in Cartesian, and p_i is the Euler parameters vector. Consequently, translational and acceleration vectors of body of i respectively are:

$$\dot{y}_\iota = \begin{bmatrix} \dot{r}_\iota \\ \dot{\omega}_\iota \end{bmatrix} \qquad (2)$$

$$\ddot{y}_\iota = \begin{bmatrix} \ddot{\iota} \\ \ddot{\omega}_\iota \end{bmatrix} \qquad (3)$$

The equation of motion of each multi body system with its dynamic constraints, which is result of connection of bodies together, is described as:

$$\Phi = \Phi(y) = 0 \qquad (4)$$

Where function Φ is expressing of the body movement constraint, and x is the vector of body configuration including n_c numbers of equations:

$$y = \begin{bmatrix} y_1 \\ y_2 \\ \vdots \\ y_n \end{bmatrix} \qquad (5)$$

By derivation of eq(4), the velocity constraint can be expressed as:

$$\dot{\Phi} = D\dot{y} = 0 \qquad (6)$$

The second derivative provides acceleration constraint:

$$\ddot{\Phi} = D\ddot{y} + D\dot{y} = 0 \xrightarrow{yields} D\ddot{y} = -D\dot{y} \qquad (7)$$

Where, D is the Jacobean Matrix of body constraints. The most important factor which limit the Matrix D is the geometric dimension of the saucer shaped body of the UFO which are shown in Fig. 7.

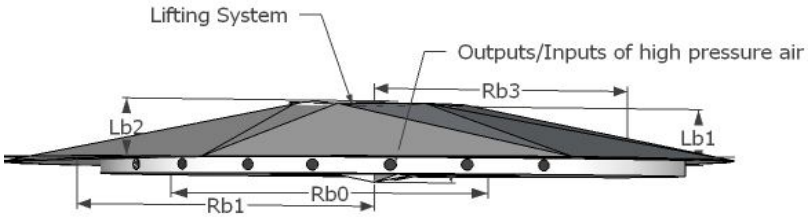

Fig. 7. The geometric dimension of the saucer shaped body of the UFO.

For simplicity, we show the $-D\dot{y}$ by γ thus, Eq(7) can be written as:

$$D\ddot{y} = \gamma \qquad (8)$$

By solving the motion equation with its body constraint based on the Newton laws, the motion of robot bodies can be predicted.
Since the acted force on a system may include external, internal and inertia forces, motion equation with its constraint is expressed as:

$$\boldsymbol{M}\ddot{y} = f_{ex} + f_{int} \qquad (9)$$

Where, $\ddot{q}$ includes $6 \times n$ number of transnational and angular accelerations corresponding to the n number of bodies.
Also, f_{ex} and g_c include the external and internal forces, respectively:

$$f_{ex} = \begin{bmatrix} f_{ex1} \\ f_{ex2} \\ \vdots \\ f_{exn} \end{bmatrix} \qquad (10)$$

Where, g_i is:

$$f_{exi} = \begin{bmatrix} f_i \\ {n_i}^* \end{bmatrix} \qquad (11)$$

Where f_i is a vector which includes the actuator, damper, spring, and weight forces:

$$f_{int} = {f_i}^a + {f_i}^s + {f_i}^d + {f_i}^g = {f_i}^a u + k(d - d_0)u0 + c\dot{d}u + \begin{bmatrix} 0 \\ 0 \\ -ym_i \end{bmatrix} \qquad (12)$$

Where, $\boldsymbol{u}$ is a unity vector between each two bodies:

$$\boldsymbol{u} = \frac{d}{d} \quad (13)$$

$$d = r_i + s_i - (r_j + s_j),\ d = \sqrt{d^T d} \quad (14)$$

It can be shown that the three internal forces are result of body interactions using the Lagrange coefficient principle, which can be expressed as:

$$\boldsymbol{g_c} = \boldsymbol{D^T}\gamma \quad (15)$$

Thus, using eq(15), the eq(9) can be rewritten as:

$$\boldsymbol{M}\ddot{y} + \boldsymbol{D}^T\gamma = \boldsymbol{f_{ex}} \quad (16)$$

The expanded form of eq (16) is:

$$\begin{bmatrix} M & -q^T \\ D & O \end{bmatrix}\begin{bmatrix} y \\ \lambda \end{bmatrix} = \begin{bmatrix} f_{ex} \\ r \end{bmatrix} \quad (17)$$

Where, M is the mass matrix includes mass and inertia tensors of the bodies:

$$M = [M_1, M_2, \dots, M_n] \quad (18)$$

Where M_i is:

$$M_i = \begin{bmatrix} M_i I & O \\ O & j_i \end{bmatrix} \quad (19)$$

AEROSTATIC ANALYSIS

Since the main body provide bouncy to support itself and the generator, we should select enough volume to provide adequate buoyancy to overcome the complete weight of the UFO to stay it aloft. The buoyancy and weigh force are shown in the free body diagram representation of the UFO as shown in Fig. 8.

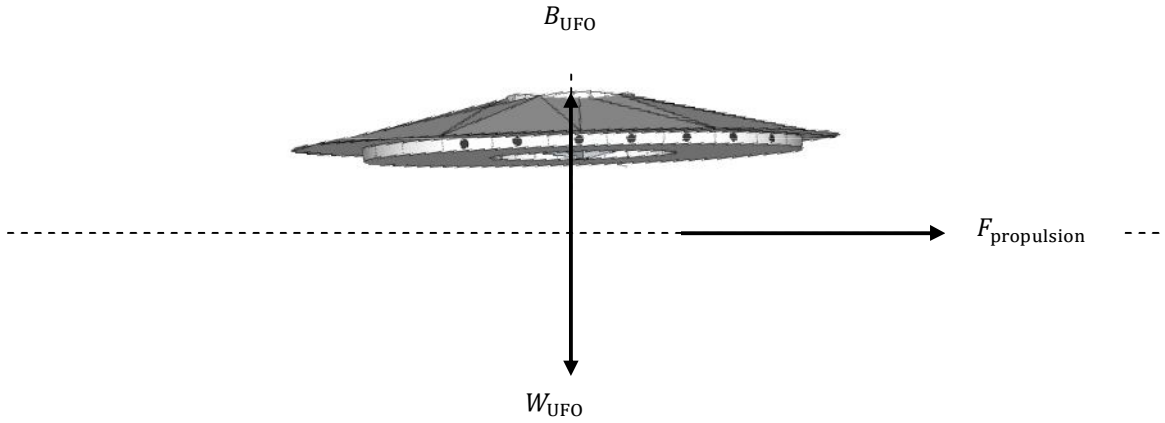

Fig. 8. Free body diagram of the UFO

In other word the buoyancy should exceeds the weigh:

$$B_{\text{UFO}} > W_{\text{UFO}} \quad (20)$$

To find $Vol_{main\ body}$ we should solve above equation in critical state:

$$B_{\text{UFO}} = W_{\text{UFO}} \quad (21)$$

To solve above equation both the bouncy and weigh of the AFCWEGS must be found. UFO several parts. Thus, weigh and bouncy of the whole system is sum of weight and bouncy of due to each part:

$$W_{\text{UFO}} = W_{Saucer\ Shape\ Body} + W_{Biomass\ Jet\ Engine} + W_{Lifting\ System} + W_{Electrical\ System} \quad (22)$$

$$B_{\text{UFO}} = B_{Saucer\ Shape\ Body} + B_{Biomass\ Jet\ Engine} + B_{Lifting\ System} + B_{Electrical\ System} \quad (23)$$

A. Bouncy of each Parts

We should find weigh and bouncy due to each of parts of the UFO:

1) Saucer Shape Body

The saucer shaped body consists of several layers. On the thick layers is aerogel. Thus, the buoyancy associate with the aerogel is:

$$B_{Saucer\ Shape\ Body} = g(\rho_{air} - \rho_{aerogel})V_{Saucer\ Shape\ Body} \quad (24)$$

Where $V_{Saucer\ Shape\ Body}$ is the volume of each of air rotor, ρ_{air} and $\rho_{aerogel}$ are the densities of air and aerogel respectively and g is gravity acceleration ($9.8^{m}/_{s^2}$).

2) Biomass Jet Engine

Although any lighter than air gas is not used in the biomass jet engine, the buoyancy due to the six sided aerogel made of aerogel, and is surrounding the engine, should be considered:

$$B_{Bimass\ Jet\ Engine} = g(\rho_{air} - \rho_{aerogel})V_{Six\ sided\ Structure} \quad (25)$$

3) Lifting System

The provide buoyancy by the lifting system is sum of buoyancy due to the helium gas and the aerogel:

$$B_{Saucer\ Shape\ Body} = g(\rho_{air} - \rho_{gas})V_{Helium\ gas} + g(\rho_{air} - \rho_{aerogel})V_{Aerogel} \quad (26)$$

B. Weights of each Part

1) Saucer Shaped Body

The weight of the main body is $W_{Main\ body}$ which a great share of it is due to the layer covered the body.

2) Biomass Jet Engine

Since the Biomass Jet Engine consists of a central jet engine and several tubes which are surrounded by six sided aerogel structures, the weight of this part will be:

$$W_{Biomass\ Jet\ Engine} = W_{Sinx\ Sided\ Aerogel} + W_{tubes\ and\ central\ engine} \quad (27)$$

3) Lifting System

The weight of the lifting system is the smallest portion of the weight of the UFO:

$$W_{Lifting\ System} = W_{Helium\ gas} + W_{Aerogel} \quad (28)$$

C. Net-Wight and Buoyancy of AHWEGS

Overall weight of the UFO can be obtained by add weight of all the part to the Saucer shape body weight:

$$W_{\text{UFO}} = W_{Saucer\ shape\ body} + W_{Helium\ gas} + W_{Aerogel} + W_{Sinx\ Sided\ Aerogel} + W_{tubes\ and\ central\ engine} \quad (29)$$

$$B_{\text{AHWEGS}} = (\rho_{air} - \rho_{aerogel})V_{Saucer\ Shape\ Body} + g(\rho_{air} - \rho_{aerogel})V_{Six\ sided\ Structure} + g(\rho_{air} - \rho_{gas})V_{Helium\ gas} + g(\rho_{air} - \rho_{aerogel})V_{Aerogel} \quad (30)$$

By combination the equation of total weighs and buoyancy, the needed volume for the aerogel structure of the lifting system will be:

$$V_{Aerogel} = W_{Main\ body} + W_{Helium\ gas} + W_{Aerogel} + W_{Sinx\ Sided\ Aerogel} + W_{tubes\ and\ central\ engine} - g(\rho_{air} - \rho_{aerogel})V_{Saucer\ Shape\ Body} + g(\rho_{air} - \rho_{aerogel})V_{Six\ sided\ Structure} + g(\rho_{air} - \rho_{gas})V_{Helium\ gas} / g(\rho_{air} - \rho_{aerogel}) \quad (31)$$

The volumes in the developed formula can be easily obtained using the geometric dimension of the UFO.

UFO FLIGHT CONTROLLER

To achieve stability by minimum vibration, two methods of fuzzy and neural network have been proposed [7-8]. But, due to novelty of this UFO and its complex turbulence in outputs of its jet engine, to have a high stability in the flight, we proposed a fuzzy based control mechanism. This controller accepts the wind pressure data in outputs o the Jet Engine of the UFO, as high and, medium, and low levels, and controls the output flow of high pressure air, results in a significant stability in movement during the flight. The conceptual diagram of the controller is shown in Fig. 9.

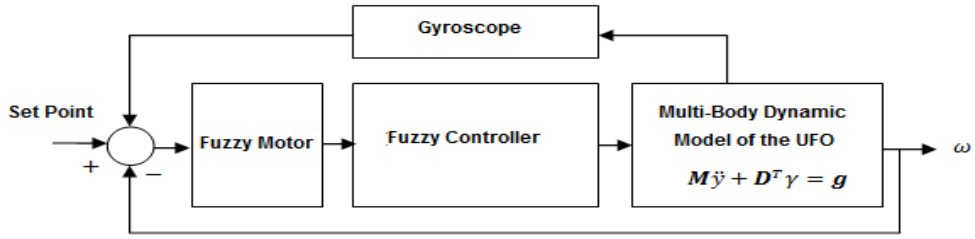

Fig. 9.Proposed fuzzy-based Control scheme

The gyro is a fundamental component in UFO which able it to have a stable flight. The gyro is typically used to eliminate unwanted movements on the yaw axis. The gyro sense any unwanted rotation around the yaw axis, correcting the orientation of the UFO. In absence of the gyro, UFO eventually tends to drift and rotate. The gyroscope senses any change in yaw, correcting it using a controller [4].

FUZZIFICATION

The accepted high pressure air data of the Jet Enegin outputs for fuzzy controller should be fuzzifide to five levels of very low, low, medium, high, and very high. [6 and 7] This fuzzification is being carried out using a fuzzy motor based on the defined fuzzy rules which are summarized in Table I.

TABLE I
THE DEFINED FUZZY RULES FOR FUZZY CONTROLLER

E/V	Very- low	Low	Medium	High	Very high
Low	Low	Low	Medium	Medium	High
Medium	Medium	Medium	Medium	High	High
High	Medium	High	High	High	High

Also, the membership function is with distribution is shown in Fig. 10

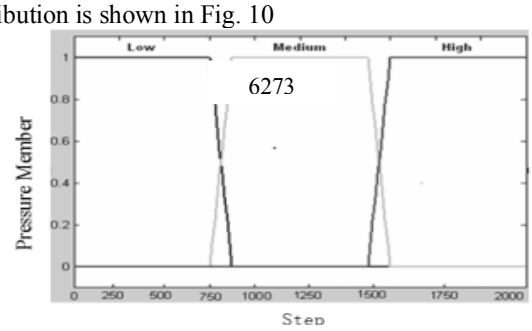

Fig. 10.The membership function

SIMULATIONS

In order to verify the proposed UFO topology as well as the designed control schemes in previous section, simulations for both the UFO angular speed and its vibration during the flight are carried out. For simplicity of simulation, only three conditions including low, medium, and high speeds are considered. The performance of the controller in controlling the angular speed of UFO in each of these conditions is simulated in following.

D. Low Velocities of the UFO

In low velocities, the controller controls the angular speed of the UFO so that with a liner trend reach its set points as shown in Fig. 11.

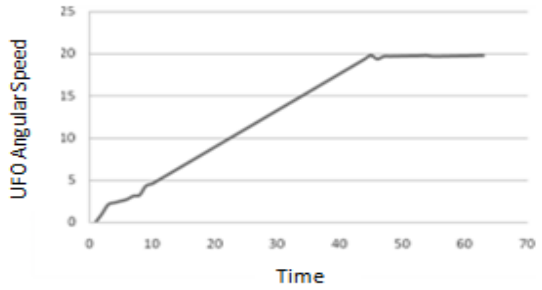

Fig. 11. The angular speed of UFO with proposed controller in lower velocities of the UFO

E. Medium Velocities of the UFO

In medium velocities, the simulation show angular speed of the UFO increase in linear trend, but a small overshoot can be seen in Fig. 12. The overshoot magnitude is not exceeds the sent point value.

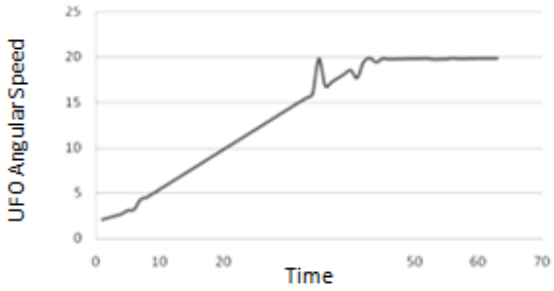

Fig. 12. The angular speed of the UFO with proposed controller medium velocities of the UFO

F. High Velocities of the UFO

In high velocities, simulation shows a slight oscillation at the first ten seconds. But, similarly, the angular speed of the UFO increase in linear trend, without any over shoot to reach the set point as shown in Fig. 13.

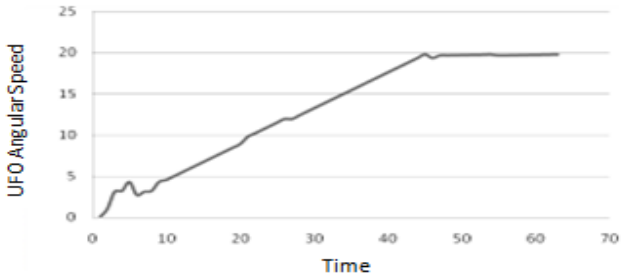

Fig. 13. The angular speed of UFO with proposed controller in High Velocities of the UFO

Also, to check the feasibility of the proposed topology and effectiveness of the control scheme a simulations for assessment the vibration of the UFO. The gyroscope data include variation of each components of x,y, and z of the Aare simulated using MATLAB software package. To evaluate performance of the proposed control scheme two simulations are considered. The first simulation is assessment of the UFO vibration in all the three directions of x , and z of main body of UFO without any controller. The results of these simulations are recorded in Fig. 14, 15, 16.

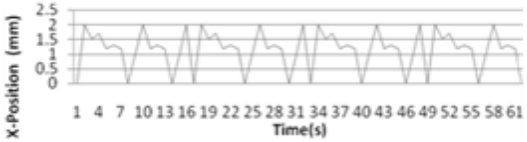

Fig. 14. Variation of x amplitude during flight of the uncontrolled UFO

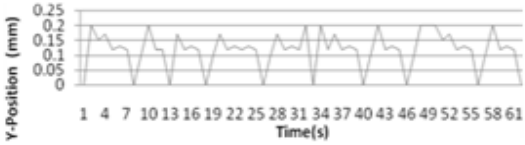

Fig. 15. Variation of y amplitude during flight of the uncontrolled UFO.

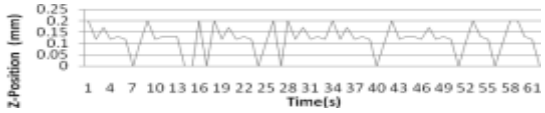

Fig. 16. Variation of z amplitude during flight of the uncontrolled UFO

The second simulation is assessment of the UFO vibration in all the three directions of x, y , and z with the proposed controller. The results of this simulation are recorded in Fig. 17, 18, and 19.

Fig. 17. Variation of x amplitude during flight of the controlled UFO

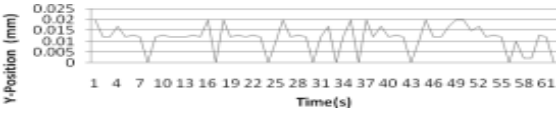

Fig. 18. Variation of y amplitude during flight of the controlled UFO

Fig. 19. Variation of z amplitude during flight of the controlled UFO

To evaluate the effect of the controller on the flight vibration, we defined a vibration index. This index is express as:

$$RMS = \sqrt{\frac{1}{t_2 - t_1}\int_{t_1}^{t_2} x^2 + y^2 + z^2 dt}. \qquad (32)$$

Thus, RMS Values f x, y, z components are computed over 60 seconds, for both the Controlled and uncontrolled UFO, and are summarized in Table. II.

TABLE II, RMS VALUES F x, y, z COMPONENTS ARE COMPUTED FOR BOTH THE CONTROLLED AND UNCONTROLLED UFO

Component	RMS Value Without Controller	RMS Value With the Controller
x	2.5mm	0.11 mm
y	50 mm	0.14 mm
z	150 mm	0.28 mm

CONCLUSION

The paper outlines a novel UFO topology. The main components of the proposed UFO were described in detail. A fuzzy based controller scheme to avoid vibration of the UFO for higher stability is proposed. Moreover, to predict the performance of the UFO with and without the controller it was modeled using multi body approach. By using the obtained multi body dynamic model for the UFO several simulations are carried out. Obtained experimental data demonstrate the effectiveness of the proposed helicopter topology and its fuzzy controller as well. The proposed design is based on mathematical foundation. There are many details in designing an UFO. The efforts of this paper will focus on a possible an aerogel based-lifting system and a Biomass Jet Engine based system for propulsion system in hopes to inspire others to fill in the details.

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