جامعة فيلادلفيا

المشروع رقم (1)

Design, Build, and Test a Hybrid Cooling System for Crash Helmet

الفائز بالجائزة الاولى لنقابة المهندسين الاردنيين (2018)
شعبة الهندسة الميكانيكية
على مستوى الجامعات الحكومية والخاصة

الطالب: بلال شحادة
بإشراف
الاستاذ الدكتور منذر عبـيد

ABSTRACT

In this current work, a designed hybrid cooling system is proposed which combines a phase change material (PCM) aimed to absorb the excess heat from the user's head and thermoelectric technology (TEC) amid to cool the PCM in order to compensate the cold temperature lost when cooling the users head. This combination solved a major problem found in previous research studies, the limited usage time for the PCM pouch. The simulation in stand-still condition predicted a heatsink temperature of about 80°C and a cooling temperature for the head around 24°C. For moving conditions, the heat sink temperature reached 50°C and the cooling temperature for the head reached 24°C. The simulation showed the need of cooling the heat sink to obtain maximum performance. Experimentally, the system has been built and it was guided by the predictions, and tested with an infrared (IR) camera. Testing outcomes showed good results and no overheating in any part of the system by recording a temperature of 25°C for the heat sink in stand-still condition

and 19.5°C in moving conditions as designed. Therefore, it can be concluded that the designed system has worked successfully and improves the comfortability while wearing a crash helmet.

Cooling Helmet Final assembly

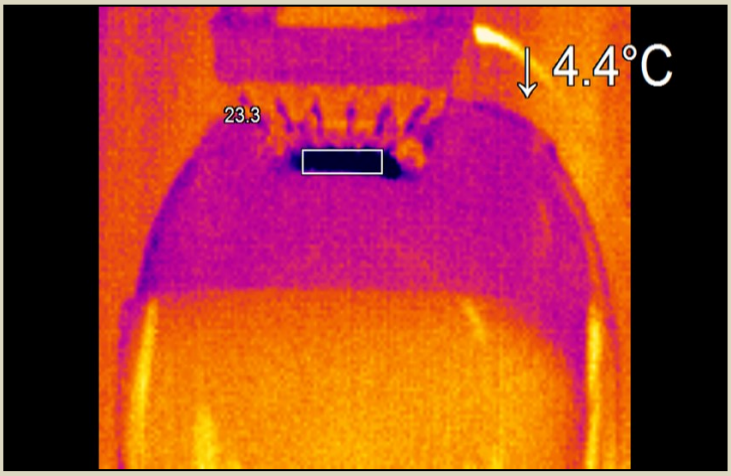

Fig. 1 Average temperature measured from the Peltier module

Fig. 2 Testing the system on a person

المشروع رقم (2)

An Off-Road Rubber Tracked Ground Vehicle (TGV) for Rugged Terrain Conditions

الطالب: محمد مهدي الصغير

باشراف الاستاذ الدكتور منذر عبـيد

ABSTRACT

The work in this paper proposes a unified approach which involves the design, manufacture, and test an off-road rubber tracked ground vehicle for rugged terrain conditions. The proposed vehicle overall design consists of rubber tracking system, main chassis, power train and transmission system,, steering system, suspension system and the vehicle body.. Two major components were developed and designed successfully: these were the main chassis and the rubber tracking system. Their proposed design can be considered simple, easy to manufacture and cheap compared with what is available in the literature. The dimensions of the designed rubber tracking system are; contact length of $1700mm$, track height of $850mm$, and track width of $380mm$. The overall proposed design weight of the vehicle is $14.714kN$ of $3500mm$ length, $2000mm$ width, $1550mm$ height with minimum ground clearance of $200mm$. A 165 hp Subaru gasoline engine was selected for this work. In this work, parts of the vehicle were manufactured such as the main chassis, rubber tracking system, steering system, other parts were selected such as the engine and transmission system, suspension system, braking system, exhaust and fuel systems. The vehicle was tested and after several trials, it was performing successfully.

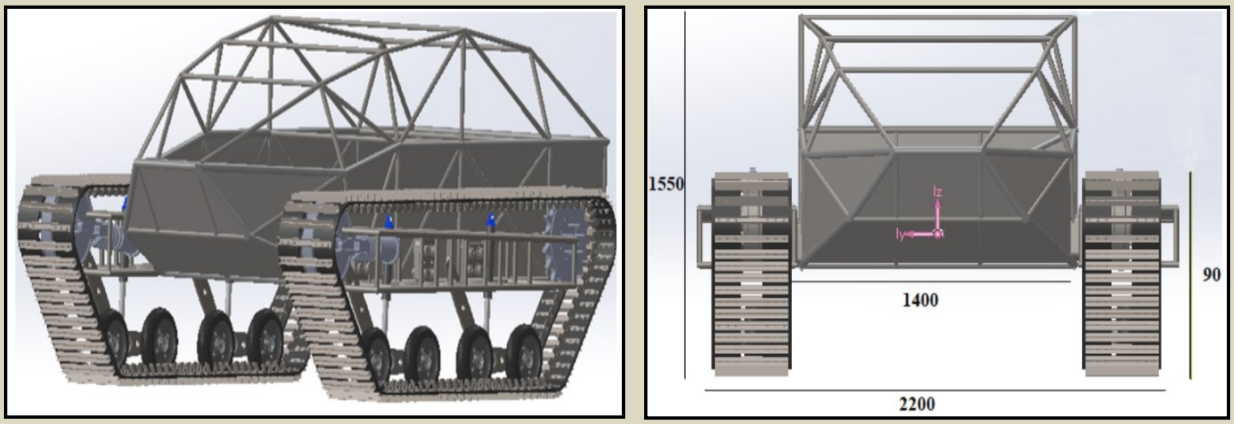

Fig. 1 Isometric and front view of rubber tracking vehicle final design

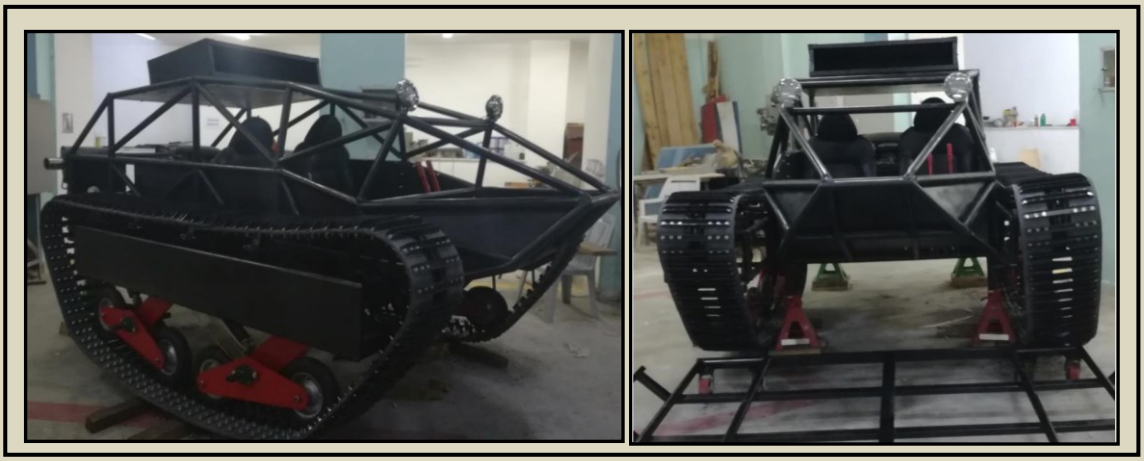

Fig. 2 Multiple views of TGV under construction

Fig. 3 Run test of TGV in the field

المشروع رقم (3)

Quad Bike for All Terrain conditions

الطالب: نور الدين خليفة

الطالب: مصطفى سمير ابو شنينة

باشراف الاستاذ الدكتور منذر عبـيد

ABSTRACT

The main objective of work is to design, build and test a quad bike (ATV) rugged for terrain conditions (deep snow, mud, sand, and rocks). This project is carried out at Philadelphia University (PU)/ Mechanical Engineering workshops. Knowledge and understanding of vehicle dynamics , Vehicle chassis design , suspension design , steering design , vibration and statics analysis and off-road vehicle engineering are becoming increasingly important, thus making engineers better qualified to perform their jobs in agriculture, construction, and military. This project is an engineering learning by doing exercise and undergraduate engineering students should receive on-hands and soft skill experience with these techniques to assist them in their future career. Furthermore, the significant feedback received from employers in industry stated that graduates need to be knowledgeable on vehicle dynamics and off-road vehicle, and computer-related aided methods. This project is meant to supply engineering students with these techniques as a response to that feedback. It is important to recognize that the design of quad bike must involve the study of material structure, suspension dynamics, internal combustion engine, and selection of materials, transmission system, brake system, electrical system and the requirements for manufacturing. All of these procedures must be followed to reach an optimum design. The tracked vehicle was equipped with 33 hp Honda black shadow VT 600 engine and quad bike contact length of 1.92m, track height of 1.32 m, and track width of 1.49. The overall dimensions of the proposed vehicle minimum ground clearance is

0.3037m. The construction of the quad bike consisted of a chassis, power transmission system, steering system, suspension system and transmission. This project is considered as an educational, practical, and training exercise on Mechanical Engineering principles for the undergraduate and graduate students. Also, it is a high performance engineering project for engineering students to acquire design concepts in automotive field, engineering skills, and the freedom to express their creativity and imagination. Finally, this project will develop experience, skills, and professionalism as “hands-on engineers", and hopefully to enhance automotive industry in Jordan.

Fig. 1 Quad bike construction

Fig. 2 Final quad bike assembly

Fig. 3 Testing the quad bike

المشروع(4)

Formula Car Project (PU-44)

الفائز بالجائزة الثانية لنقابة المهندسين الاردنيين (2016)

شعبة الهندسة الميكانيكية

على مستوى الجامعات الحكومية والخاصة

الطالب: عمر القواسمة — باشراف

الطالب: وليد ابو غزي — **الاستاذ الدكتور منذر عبـيد**

الطالب: نور ابو كاشف — **الدكتور قتيبة الخشالي**

الطالب: احمد عودة — **الدكتورة شذى عمورة**

ABSTRACT

This current project is carried out at Philadelphia University (PU), and describes the work associated with the design, build, and test a Formula Student racing car in order to compete at Formula Student. This car must be a single seat car with an engine displacement not exceeding 610 cc. It is important to recognize that the design of a formula student racing car must involve the study of material structure, aerodynamics, suspension dynamics, internal combustion engine, selection of materials and the requirements for manufacturing. All of these procedures must be followed to reach an optimum design. The challenge to teams is to develop a vehicle that can successfully compete in all the events (static and dynamic) described in the FSAE Rules. This project is considered as an educational, practical, and training exercise on Mechanical Engineering principles for the undergraduate and graduate students. Also, it is a high performance engineering project for engineering students to acquire design concepts in automotive, engineering skills, and the freedom to express their creativity and imaginations. Finally, this project

will develop experience, skills and professionalism as “hands on engineers", and hopefully to enhance automotive industry in Jordan.

Fig. 1 Formula student car at UK formula student event

Fig. 2 Judge committee at UK formula student event

المشروع(5)

Experimental Investigation Using Ferro-Nanofluids (Fe_3O_4) for Heat Transfer Enhancement in Heated Tube

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ABSTRACT

The effects of various magnetic field intensity on heat transfer enhancement, hence an increase in Nusselt number (Nu), in a horizontal pipe heated with constant heating flux of 420W for different turbulent flow rates Fe_3O_4/water nanofluids were experimentally investigated. Fe_3O_4/water nanofluids of different volume concentrations of 1.2, 0.6, 0.3 vol.% will be used as the test fluid. Experiments were conducted for Reynolds number range of $2180<Re<9160$ and for three different magnetic field intensity 15.1, 30.3, 45.5 mT. Initial results using Fe_3O_4/water nanofluid of 1.2 vol.% showed that Nu increases in the presence and absence of a magnetic field compared with water. Also, Nu increases with higher values of Re for aforementioned nanoofluid concentration and water. However, in the absence of a magnetic field, the average increase in Nu for Fe_3O_4-nanofluids was 16.7% relative to water, while, the average increase in Nu was 8.8%, 13.1%, and 23.9% under the application of magnetic field intensity of 15.1, 30.3, 45.5 mT relative to the absence of magnetic field, respectively. Based on that, it can be concluded that in the presence of magnetic field using Fe_3O_4-nanofluids, higher values of Nu is achieved and consequently an increase in heat transfer rate. These preliminary results can be useful for enhancing heat

transfer in many engineering applications such as heat exchangers and electronic devices.

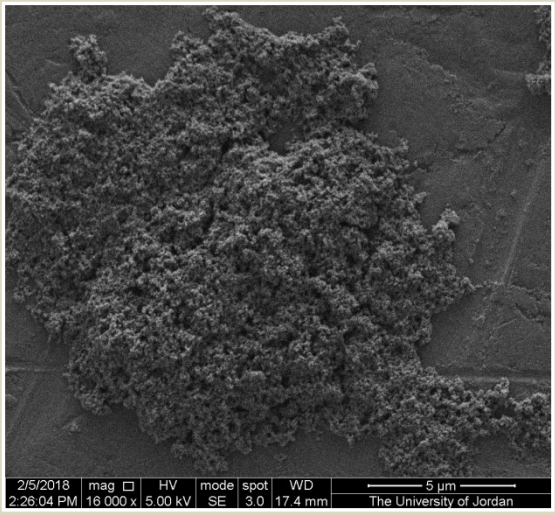

Fig. 1 Scanning electron microscope (SEM) image of Nano-Magnetite at 16000X magnification

Fig. 2 Experimental rig

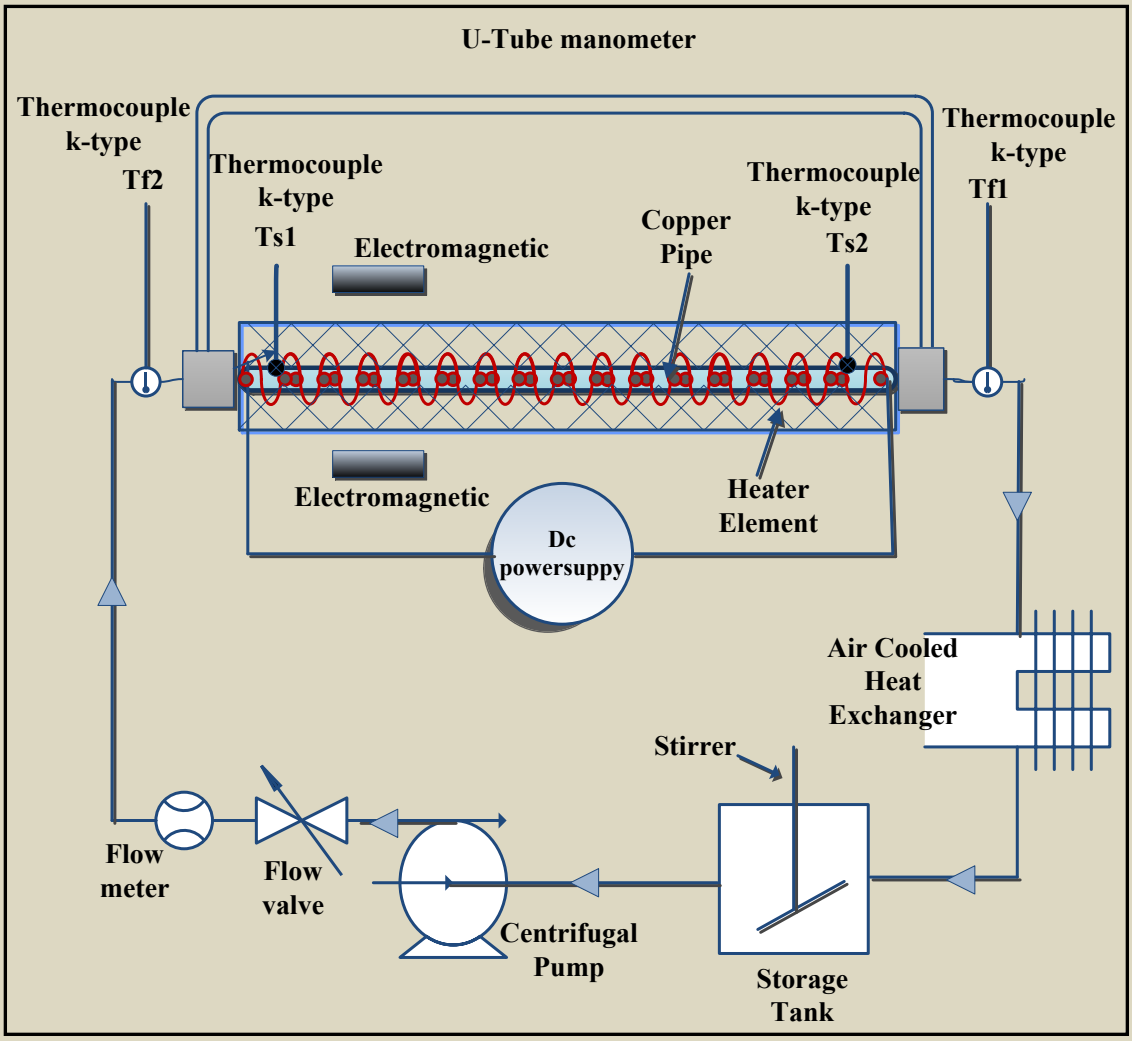

Fig. 3 Schematic diagram of the test rig

المشروع(6)

Cooling of Photovoltaic (PV) Panels Using Two Types of Nanofluids, Titanium Oxide (TiO_2) nanofluid in Water -Polyethylene Glycol mixture and Aluminum Oxide (Al_2O_3) nanofluid in Water-Cetyltrimethylammonium Bromide mixture

الطالب: احمد العطيات

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ABSTRACT

In this experimental work, water and two types of nanofluids at different mass flow rates (mL/min) were used as a cooling medium for three photovoltaic (PV) cells of 50W power output, namely; Titanium Oxide (TiO_2) nanofluid in Water-Polyethylene Glycol mixture and Aluminum Oxide (Al_2O_3) nanofluid in Water-Cetyltrimethylammonium Bromide mixture of different concentrations (0.01, 0.05, 0.1 wt.%), respectively. The experimental investigation of cooling PV cells was carried out by incorporating two heat exchangers of aluminum rectangular cross section (1cm H x 1cm W) fixed at the back surface of each PV cell. Solar irradiance distribution analysis, fluid flow characteristics regime, thermal performance analysis, electrical performance analysis, and power hydraulic performance of TiO_2 and Al_2O_3 nanofluids used a cooling medium at the studied range of concentrations and flow rates as well as water and without cooling were all investigated. Results showed that two flow types exists; Laminar flow prevails up to a flow rate less or equal to 1000mL/min, while turbulent flow exists for a flow rate above that. This was confirmed by the (*fRe*) product values of flow. Also, the presence of nanoparticles has a big effect on decreasing the average PV cell surface temperature compared with that

of pure water. Furthermore, the results showed that the temperature reduction is a function of nanoparticle weight fraction and flow rate and Al_2O_3 nanofluid, for all concentrations and flow rates considered in this study, achieves the best reduction in PV cell surface temperature compared with that of TiO_2 nanofluid and water. It was found that with the increase of flow rate and concentration, the temperature difference ($T_{without\ cooling}$-$T_{medium\ cooling}$) is increased. Also, the effect of solar irradiance and ambient temperature was investigated and it was found that at the same flow rate, the ($T_{without\ cooling}$-$T_{medium\ cooling}$) was increased with an increase in solar irradiance and reduced with increase in ambient temperature. Also, It was observed that thermal performance in terms of heat transfer enhanced with the presence of nanoparticles compared with water and Nusselt number of Al_2O_3 nanofluid was the highest, for all concentrations and flow rates considered in this study, compared with that of TiO_2 nanofluid and water. Regarding electrical performance, Power and efficiency of cooled PV cell is enhanced compared with no cooling. However, power and efficiency is increased with the increase of concentration and flow rate. Best results were achieved for Al_2O_3 nanofluid at the concentration and flow rates considered. Finally, it was observed that power hydraulic performance increases with the increase of the flow rates and concentrations for all working fluids. Also, power hydraulic performance of Al_2O_3 nanofluid is the best among the other two working fluids. Therefore, it can be concluded that Al_2O_3 nanofluid is more efficient in pumping power required to transfer the required flow rate through the cooling channel than TiO_2 nanofluid and water.

Fig. 1 Actual experimental setup

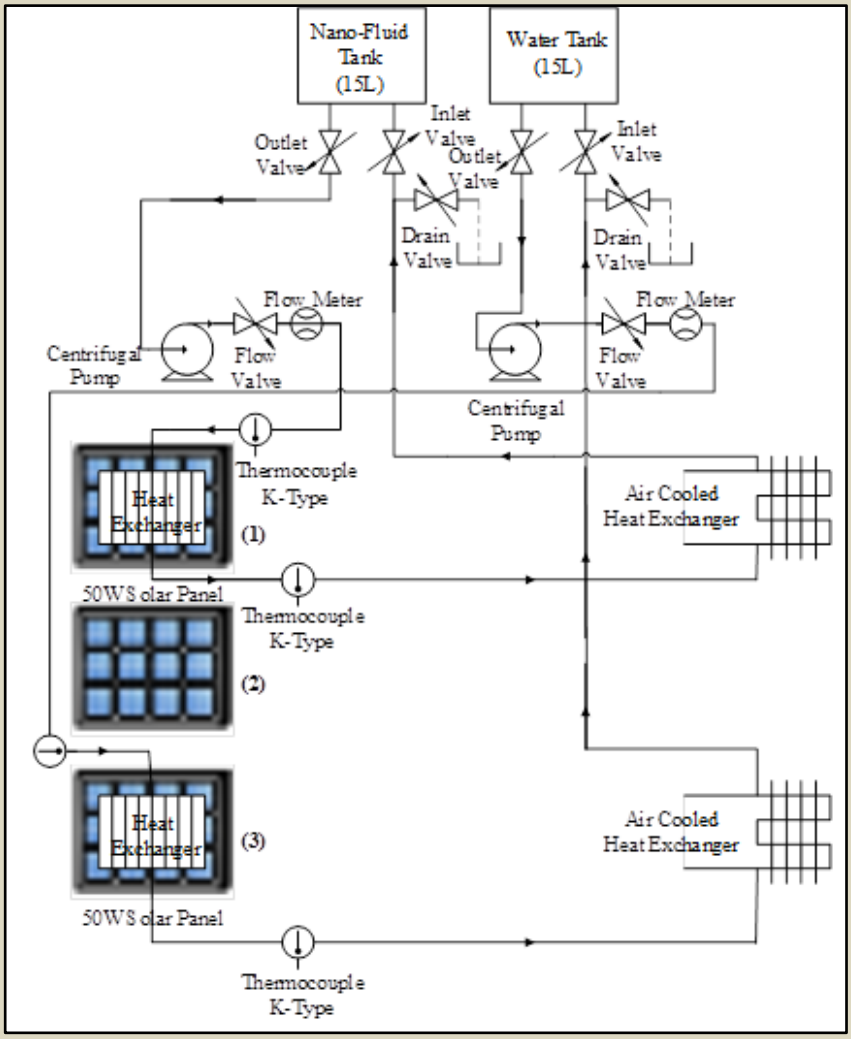

Fig. 2 Schematic diagram of the experimental setup

المشروع(7)

A Study of Structural Vibration of a Multi-story Building Subjected to Ground Motion

الطالب: احمد السيلاوي عابد

باشراف

الاستاذ الدكتور عدنان داود

ABSTRACT

A three story building subjected to ground motion in the form of harmonic displacement is analyzed theoretically and experimentally. The theoretical investigations are performed by the construction of computer programs using MATLAB 14 software. The programs predict, numerically, the vibration amplitudes of the floors due to ground motion before and after the attachment of a tuned, damped, vibration absorber (mass-spring-damper system). An experimental set-up for the building is fabricated and tested to measure the displacement amplitudes of the floors under the above mentioned excitation. A comparison between theoretical and experimental results of Eigen modes is done. The comparison shows good agreements. A vibration absorber in the form of a compound pendulum is designed and tested theoretically and experimentally. The tuning of attached vibration absorber to the first eigenvalue of the three floor building model approve a good attempt in reducing the vibration amplitudes of the different floors. The tuning of the vibration absorber to the second and the third eigenvalues demonstrate poor benefits in reducing the vibration amplitudes of the floors. Effects of mass ratio and damping ratio (arbitrary and optimum) of absorber on the effectiveness of the absorber are demonstrated. Considerable amplitudes reduction factors are noted theoretically and experimentally. The reduction factor obtained with absorber optimum damping ratio is found to be much better than those obtained with arbitrary damping ratio. The discrepancies between

theoretical and experimental results are attributed to the bad quality (low cost) of accelerometers and acquisition hardware used in experiments.