جـــامـعـة الـــشـرق الأوسـط
MIDDLE EAST UNIVERSITY
Amman - Jordan

Article Reformatting Algorithm for Multiple Journal Template

خوارزمية تعديل المقالات العلمية للمجلات متعددة القوالب

Prepared by

Sayel Mohammad Ali Fayyad

Supervisor

Dr. Hesham Abusaimeh

A Thesis Submitted in Partial Fulfillment of the Requirements for the Master Degree in Computer Science

Department of Computer Science

Faculty of Information Technology

Middle East University

Jan. 2019

Authorization

I, **Sayel Mohammad Ali Fayyad**, hereby authorize Middle East University to supply copies of my thesis to libraries, organizations or individuals when required.

Name: Sayel Mohammad Ali Fayyad

Date: 27 / 01 / 2019.

Signature: 

Examination Committee Decision

This thesis titled (***Article Reformatting Algorithm for Multiple Journal Template***)
Was discussed and certified on. 27/1/2019

Dr. Hesham Abusaimah	**Supervisor**	.....
Prof. Hamza Al-Sewadi	**Internal Examiner**	 5-2-2019
Dr. Sara Tedmori	**External Examiner**	 6-2-2019

Acknowledgment

First, I give thanks, praise to Allah for his mercy, and reconcile and for granting me knowledge, confidence, patience to pass this Master thesis successfully.

Also, I owe a great gratitude for those who inspired me throughout this venture to express my thanks to my thesis supervisor Dr. Hesham Abusaimeh for the complete guidance throughout the thesis stages, and for the critical assistance in designing and proceeding the methodology of my research. I would also like to express my appreciation to the Middle East University and Department of Computer Science where I spent great times.

The Researcher
Sayel M. Fayyad

Dedication

This study dedicated to my whole family and friends;

To my Father, to the spirit of my Mother, my wife, my sons: Mohammad and Qais, and my daughters: Dalia, Reham, Samah, Luma, Natali, and Elina

My sweetest brothers and sister, who are one part of my life.

The Researcher
Sayel M. Fayyad

Table of Contents

Subject	Page
Title	I
Authorization	II
Examination Committee Decision	III
Acknowledgment	IV
Dedication	V
Table of Contents	VI
List of Figures	VIII
List of Abbreviations	IX
English Abstract	X
Arabic Abstract	XI
Chapter One: Introduction	1
1.1 Introduction	2
1.2 Definitions	3
1.3 Overview of text templates	3
1.4 Problem statement	4
1.5 Questions of the study	4
1.6 Objectives of the study	5
1.7 Contribution and significance of the research	5
1.8 Scope of the study	6
1.9 Study limitations	6
1.10 Thesis outline	6
Chapter Two: Theoretical Background and Literature Review	7
2.1 Introduction	8
2.2 Theoretical background	8
2.3 VB.NET	9
2.4 Types of text format	11
2.4.1 LATEX	11
2.4.2 Microsoft Word	12
2.4.3 PDF	13

2.5 Tools used in simulation 13
2.5.1 Oracle and VM virtual box 13
2.5.2 Python and Spyder3 14
2.5.3 Ubuntu 14
2.5.4 PYPDF2 14
2.6 Journals templates 14
2.6.1 Elsevier Journal: Sound and Vibration Journal (JSV) 14
2.7 Scientific Journals 16
2.8 Literature review 18
2.9 Summary of literature Review 21
Chapter three: Methodology and the Proposed Model 22
3.1 Methodology 23
3.2 The proposed System 23
Chapter four: Simulation Results and Discussion 26
4.1 Results 27
4.1.1 Code for converting PDF to a data set 27
4.1.2 Code for cleaning data set 29
4.2 VB.NET simulation interface 32
4.3 Results of VB.NET simulation 35
4.3.1 IEEE format 35
4.3.2 Elsevier formatting 39
4.4 Results discussion 43
Chapter five: Conclusions and Recommendations 45
5.1 Conclusions 46
5.2 Recommendations 47
References 48

List of Figures

Chapter No. Figure No.	Contents	Page
Figure 2.1	Text attributes can be reformatted by some given C++ code	9
Figure 2.2	.NET Framework	11
Figure 2.3	Sound and Vibrations Journals' template	16
Figure 3.1	The Flowchart of the proposed model	24
Figure 4.1	The Original PDF file segment of the paper	28
Figure 4.2	Original results of running code 1.	29
Figure 4.3	Code2 script.	31
Figure 4.4	Accuracy of the text testing depending on KNN	32
Figure 4.5	VB.NET Simulation Interface	33
Figure 4.6	Specifying the format for each part of the paper	34
Figure 4.7	Text inserting with comp.% before and after and the formatted test.	34
Figure 4.8	Export results to a word page file.	35
Figure 4.9	(a) IEEE journals required format, (b) fonts of text used in the paper, and (c) font of entire documents	36
Figure 4.10	Paper Sample Before Reformatting	37
Figure 4.11	Paper After Reformatting and Comp.%	37
Figure 4.12	Final Output Paper	38
Figure 4.13	Elsevier Journal Format Example	39
Figure 4.14	Reformatting paper results using the proposed model upon Elsevier journal	40
Figure 4.15	The Final Output Paper of the Second Sample.	41
Figure 4.16	Converting of a paper containing figures	42
Figure 4.17	Comparing Reformatting Time (in hours) Between Traditional and Proposed System	43
Figure 4.18	Compatibility Comparison Between Manual Method and The Proposed System.	44

List of Abbreviations

Abbreviations	Meaning
VB.NET	Visual Basic.NET
VM	Virtual Machine
MS	Microsoft
IEEE	Institute of Electrical and Electronic Engineer
GUI	Graphical User Interface
OOP	Object Oriented Programming
IDE	Integrated Development Environment
CLR	Common Language Runtime
TEX	Tech
LATEX	Lay-Tech
JSV	Journal of Sound and Vibrations
EFTA	European Free Trade Association
STEPS	Sequential Transformation by Example Programming System
KNN	K-Nearest Neighbor
COMP.%	Compatibility Percent

Article Reformatting Algorithm for Multiple Journal Template

Prepared by

Sayel Mohammad Ali Fayyad

Supervisor

Dr. Hesham Abusaimeh

Abstract

This study presents a proposed system to improve articles' reformatting upon scientific journals instructions and templates. The manual reformatting method used by authors and editors needs so much time and efforts, the proposed system is semi-automatic system reducing both time and efforts to a considerable rates. A VB.NET interfaces and utilities are used here to construct a reformatting algorithm of articles sent to journals to be published which included a strict format instructions for authors. The proposed system achieved good results comparing to manual or traditional methods by reducing the time needed to reformat the articles by 66% and increasing the percent of compatibility between the article and the journal format or template to an acceptable rates, which reaches to a range of 95% to 99%.

Keywords: Templates, text, VB.NET, algorithm, reformat, articles, scientific journals, and compatibility.

خوارزمية تعديل المقالات العلمية للمجلات متعددة القوالب

إعداد

صايل محمد علي فياض

إشراف

الدكتور هشام ابو صايمة

الملخص

تعرض هذه الدراسة نظامًا مقترحًا لتحسين صياغة المقالات العلمية حسب إرشادات وقوالب المجلات العلمية. إن طريقة إعادة الصياغة اليدوية المستخدمة من قبل المؤلفين والمحررين تحتاج إلى الكثير من الوقت والجهد، والنظام المقترح هو نظام شبه أتوماتيكي يقلل من الوقت والجهد إلى معدلات كبيرة. يتم استخدام واجهات VB.NET والأدوات المساعدة هنا لإنشاء خوارزمية إعادة صياغة المقالات المرسلة إلى المجلات التي سيتم نشرها والتي تضمنت تعليمات تنسيق صارمة للمؤلفين. حقق النظام المقترح نتائج جيدة مقارنة بالطرق اليدوية أو التقليدية من خلال تقليل الوقت اللازم لإعادة صياغة المقالات بنسبة 66٪ وزيادة النسبة المئوية للتوافق بين الورقة العلمية وقالب المجلة إلى معدلات مقبولة، والتي وصلت إلى مدى من 95 ٪ إلى 99 ٪.

الكلمات المفتاحية: قوالب، نص، VB.NET، خوارزمية، إعادة صياغة، مقالات، مجلات علمية، التوافق.

Chapter One

Introduction

Chapter One
Introduction

1.1 Introduction

Templates are ready text formatting tools to convert some given text from any text style to a specific or required text format. This conversion is time-consuming operation when some author needs to convert his/her essay or article into some specific style upon the journal requirements. Many authors find the reformatting process of their articles being submitted to the journals difficult and time consuming task, it was found from the interviews and observations with many authors submit and reformat their papers to scientific journals that this process needs about 10 to 15 hours as an average. In this thesis, the main aim is to create some ready reformatting system that enables the authors, writers, and editors to change their own papers in any format to the required format of specific journal. Microsoft office in all of its applications offers a kind of formatting of texts, but the user should change it manually, i.e. step by step for example: the font should be 12, new times roman, bold…etc. These modifications are time consuming processes, need hard working, boring, and delay the processing of jobs. In this work, such problems will be covered, and the users' task in the new proposed system is to define settings of the new paper format in the user interface and then upload his article as required format or choose the needed format for the title, abstract, headings, regular paragraphs, figures captions, tables title, and citation of references and references list formats, and after that, the article will be formatted upon these required format. The proposed algorithm is responsible for making required modifications, and some suitable programs like VB.net program will be

used to check and then classify the articles received by the journals by determining the compatibility percent and after that sending them to be modified (according to the proposed algorithm) depending on the closest from the required format for the journal.

1.2 Definitions

It is important at the beginning to clarify the exact meaning of the common terms used in the field of the study as briefly defined in the following:

- **-Text templates:** a ready format which can change the format of any word text to a customized one.
- **-Templates algorithms:** algorithms that are used by editing and documentation systems or software to change the format of any piece of text.
- **-Formatting:** some required style of a given piece of text including font, upper and lower cases, italic, regular…etc.

1.3 Overview of text templates

Templates as mentioned above are ready text formatting to change the format or style of a given text in short time period and with less effort. A style is a set of formatting instructions. When the style is applied, MS word will format the text according to how that style has been defined. For example, the style is used to make heading text large and bold. It is possible to apply formatting simply by selecting the text and using the tools on the Home tab – this is known as direct formatting. However, it takes time, particularly if several attributes to be applied, and different selections are needed every time. Using styles ensures that the formatting is consistent throughout the document.

Styles can save the time in changing the document's appearance – modifying a style changes all the text formatted with that style. Using styles also lets the user to take advantage of powerful features such as tables of contents, multilevel list numbering, style sets, themes and the navigation pane. MS word contains dozens of built-in styles ready to be used immediately. The most useful of these are the Heading styles. Such styles can be modified to suit the required format, and one can even create customized styles for special formatting.

1.4 Problem Statement

Every author tries to submit an article online using the web site of some scientific journal, this submission has sequential processes, needs some specific information in each stage, and in the pre-, or post- processes: the article should have a specific and accurate format upon the author instructions needed for that journal. Converting any article upon journals' format is a very hard job; time consuming process, and may not be an accurate operation. Also scientific journals having the same problem with reformatting, the editors and reviewers find reformatting of articles submitted to the journal an exhausting process and needs a follow up and tracing to insure that the article has the right formats. So the proposed system will overcome all these problems and offers a fast, easy, and high accuracy in reformatting the articles upon the format of the journals.

1.5 Questions of the Study

This research is aimed to look for answering the following questions:

1. How much time and effort will this system save to the researchers and authors during articles submission to the scientific journals?
2. How this system will help journals in publishing processes?

3. What is the accuracy of the output template related to the real templates required?

1.6 Objectives of the Study

The objectives of this work are:

- improving the methods used in texts reformatting for texts specially Microsoft word texts.

-using some suitable program applications in constructing an automatic or semi-automatic system in classifying and checking up if articles are according to the required format of the journal (any journal) or not.

-serving the authors and journals in reformatting the submitted papers upon a specific formats or styles.

-Converting some given text as .DOC or .PDF or any other format to a data-set and making a cleaning to such data set using oracle VM and Python in order to be ready to a next step to be reformatted.

1.7 Contribution and significance of the research

1. Journals apply strengthened instructions on submitted papers to have a specific styles and formats includes: the font size, line spacing, font type, bold or italic, figures captions, tables titles, ….etc. such modifications need time, effort, and they are in nature boring operations, using the suggested system these difficulties will be reduced to an acceptable rates, the author or the editor will make such things or operations just in few minutes.
2. Improving the performance of text reformatting system to reduce time required and increase the compatibility percent between the input text and the journals style.

1.8 Scope of the study

The proposed system will be applied for texts produced by Microsoft word or any other applications having texts as a product. The main field that will be applied is in scientific journals and magazines.

1.9 Study limitations

The proposed system deals with Microsoft word texts and cannot treat or deal with LATEX or other forms of texts because MS word texts accepts modifying and reformatting easily.

1.10 Thesis outline

This thesis is composed of five chapters, in chapter one an introduction for the proposed system is presented, and then some definitions were included, in addition to problem statement, questions of the study, objectives of the study and its significance and finally its scope. In chapter two a theoretical background is demonstrated, and literature review is performed including all last related studies. In chapter three the methodology and the approach that will be used in this study is discussed and a flow chart explaining the working steps of the proposed system is presented. Chapter four will demonstrate the results of the study applied on many samples of papers and journals and a discussion of such results. Chapter five concluding the final benefits, advantages, disadvantages, and obstacles faced the study.

Chapter Two

Theoretical Background and Literature Review

Chapter Two

Theoretical Background and Literature Review

2.1 Introduction

A brief but comprehensive theoretical background will be described first in this chapter. It covers the definition of Templating algorithms, and text formatting. Then, a literature review of Templating and text formatting will be performed.

2.2 Theoretical Background

There are few automatic Templating algorithms that can change the text automatically from font to font; texts' font can be changed directly and manually in many software applications like Microsoft word, PowerPoint and other Microsoft office family. But till now there are few trials to make an automatic text font conversion with different requirements. In the studied cases of the scientific journals especially the Elsevier journals and to be more specific Sound and Vibration Journal, IEEE journals or any other journals there is a specific template which should be strictly followed in order to accept the paper in its first submission phase. Such text styles or formats of the submitted papers need a lot of effort and time and it may at the end not be useful because the paper may be rejected. No automatic text formatting algorithms till this moment may be used to convert the uploaded online text fragments or online data base from style to another. The following figure shows a text formatting algorithm for some given text to change the kind or font style, size and weight. Figure 2.1 shows some text attributes that can be changed by using some C++ algorithm, the figure shows just the attributes can be converted not the original code of reformatting (Reminnyi, 2017).

.guide-description block

```
.guide-description {
    font-family: “Arial, Helvetica, sans-serif”;
    font-style: italic;
    font-weight: normal;
    font-size: 18pt;
    line-height: 1.3;
    color: #868687 ; /* guide description  color */
    position: relative;
    left: 100px; /* guide description position from left */
    width: 390px; /* guide description width */
    top: 500px; /* guide description position from top */
}
```

Figure 2.1: Text attributes can be reformatted by some given C++ code (Sasha Reminnyi, 2017)

2.3 VB.NET

Visual Basic was first designed in early 1960s. The main idea to design this language is to make it easy for college students to learn and use. The language first started as a part of the FORTRAN language but eventually they started creating a new language called BASIC. This basic language became so popular because it was easy to use. In mid 1970s -1980s it became so popular that it is being shipped with microcomputers. Microsoft converted it from shell scripting to a visual programming by adding QuickBasic. In 1991 Microsoft released VB1.0. This language brought evolution to high-level languages (Alomari, 2015). VB language eventually has kept evolving and, nowadays, it is a main part of a .NET framework. Also, other languages like C# is highly influenced by Visual Basic. Microsoft started on creating a .net framework and with the first version of .net framework they released new

version of visual basic which is known as visual Basic.Net. By the time, VB has known enhancements and we currently have visual basic 2013 as the current version in .net framework 4.5 (Alomari, 2015).

Strengths and Weaknesses and application areas:

- Application Area: Visual basic is now a part of a .NET framework. So, the developer can use VB.net to create windows, Web and console applications. Developers can create large powerful high quality applications using VB.NET. Depending upon their needs, programmers can choose one of the options mentioned above to develop the application. VB.NET is widely used for in-house applications.

-Advantages of VB.NET:

VB.NET provides a rich GUI support and OOP concepts which makes it a competitive language to develop an interactive applications. VB.net has modern interface style which gives a good and simple look to developer to develop an application. It uses static type checking which analyze the source code and gives error like Immediate Syntax error, like missing characters, using wrong keywords. Ability to compile and run with in the IDE. It has Customization capabilities which allows user to highly customize IDE appearance. One of the interesting advantages of VB is its simplicity. It is an easy-to-learn language. VB is a component integration language which utilizes Microsoft component object model that allows any system part to be bolted onto program easily (Alomari, 2015).

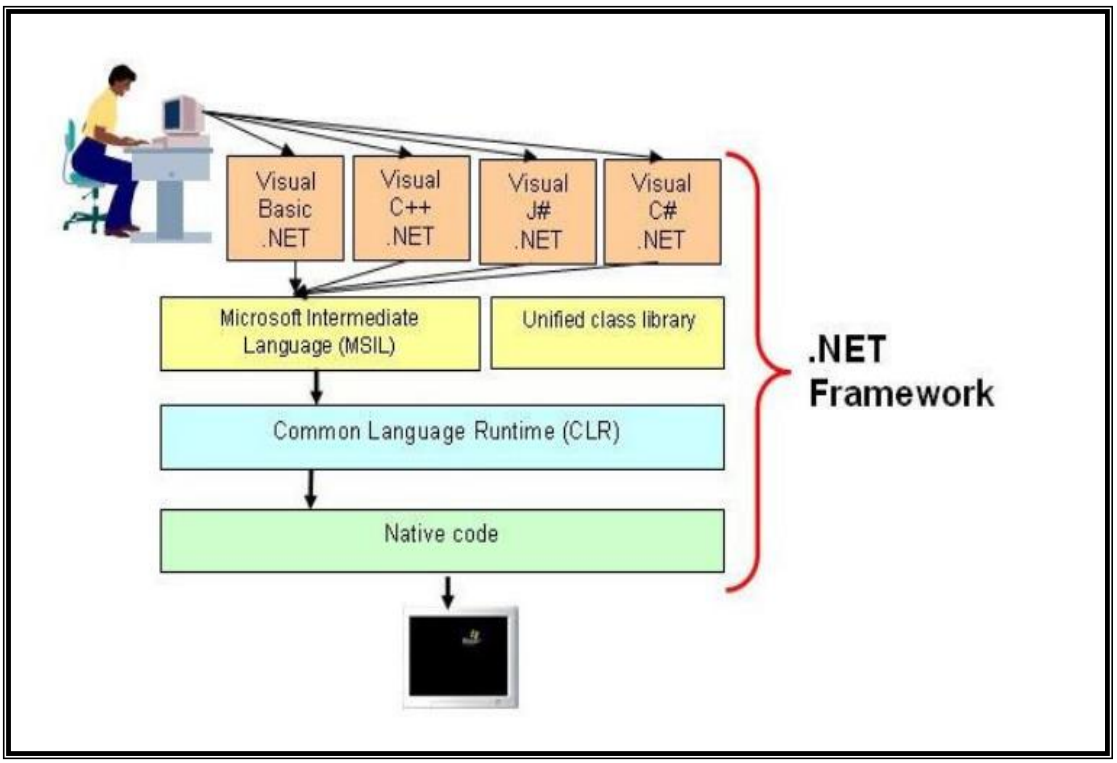


Figure 2.2: .NET framework (Alomari et al., 2015)

As can be noticed from Figure 2.2, languages using .net framework compile the code in the same way. For example the code written in visual basic language first gets converted into Microsoft intermediate language. This code gets transferred to CLR which is common language runtime for .net framework and then converted into machine native code (Alomari et al., 2015).

2.4 Types of text formats

2.4.1 LATEX

TEX is the typesetting language upon which LATEX is built. It was designed and written by Donald Knuth especially for math and science. TEX is pronounced “Tech,” similar to “Bach.” TEX is portable. It is available for most computers and is used all over the world. TEX documents can be moved easily from one system to another, as long as the required

fonts are on both systems. TEX comes with its own set of fonts, called “Computer Modern,” used by default. These fonts exist in a variety of styles, including serif, sans serif, typewriter (fixed pitch), and an extensive set of mathematical symbols. It’s also possible to use other font families, such as Times, Palatino, etc. TEX is also a programming language, making it possible to create commands that simplify its use.

LATEX is a TEX macro package, originally written by Leslie Lamport that simplifies the use of TEX. All the above features of TEX, including portability, also apply to LATEX. LATEX is pronounced either “Lay-tech” or “Lah-tech”. Most LATEX commands are “high-level” (such as chapter and section) and specify the logical structure of a document. The author rarely needs to be concerned with the details of document layout, concentrating instead on the content.

To use LATEX, you first create a plain ASCII text file with any text editor. In this file typed both the text of the document and the LATEX commands to format it, then typeset the document, usually by clicking a button on a toolbar or selecting a menu item (Academic and Research Computing, 2007).

2.4.2 Microsoft Word

Microsoft Word is a word processing tool for creating different types of documents that are used in work and school environments. The appearance of Microsoft Word 2016 is similar to Word 2010 and Word 2013, but with more enhanced features. MS Word can be used to:

- Create professional-looking documents that incorporate impressive graphics such as charts and diagrams.
- Give documents a consistent look by applying styles and themes that control the font, size, color, and effects of text and the page background.

- Store and reuse ready-made content and formatted elements such as cover pages and sidebars.
- Create personalized e-mail messages and mailings to multiple recipients without repetitive typing.
- Make information in long documents accessible by compiling tables of contents, indexes, and bibliographies.
- Safeguard your documents by controlling who can make changes and the types of changes that may be made, removing personal information, and applying a digital signature.

2.4.3 PDF

PDF is a cross-platform file format developed by Adobe. PDF is the native file format for files accessed and modified using Adobe Acrobat. Documents from any application can be converted to PDF. PDF documents retain the original appearance/layout/print quality independent of the files native application and platform. Adobe can be used to make minor changes to a PDF file.

2.5 Tools used in simulation

Many tools used in simulation of this study, includes the following:

2.5.1 Oracle Virtual Machine- Virtualbox

Oracle VM VirtualBox is defined as cross-platform virtualization software that offers to the user the tools to extend the existing computer to run multiple operating systems at the same time. It was designed for IT professionals and developers, Oracle VM VirtualBox can run on multiple operating systems like: Windows, Mac OS X, Linux and Oracle Solaris

systems and is ideal for testing, developing, demonstrating and deploying solutions across multiple platforms on one machine. Oracle VM VirtualBox contains many innovative features that can deliver tangible business benefits such as: significant performance improvements; a more powerful virtualization system; and a wider range of supported guest operating system platforms.

2.5.2 Python and spyder3

Python is an extremely usable tool, high-level programming language which is quickly becoming a standard as scientific computing useful tool. It has many specifications like: it is an open source, completely standardized across different platforms (Windows / MacOS / Linux), immensely flexible, and easy to use and learn.

2.5.3 Ubuntu

Ubuntu is an operating system (OS) consisting of open and free source software. With Ubuntu the user can surf the web, read email, and create documents, spreadsheets and more. Ubuntu gives the user the power and flexibility for business, education and home use. Ubuntu is easy to be installed, free of viruses, and perfect for laptops, desktops and servers.

2.5.4 PyPDF2

PyPDF2 is a pure-python PDF library capable of splitting, merging together, cropping, and transforming the pages of PDF files. It can also add custom data, viewing options, and passwords to PDF files. It can retrieve text and metadata from PDFs as well as merge entire files together.

2.6 Journals templates

2.6.1 Elsevier Journal: Sound and Vibration Journal (JSV)

This journal is an international journal, it is one of the Elsevier group-class one, it has its own format system in word and LATEX, if an author submit an article for this journal, one of its requirement to be published is to be according to its format. The required format for this journal is found on its website under “guide for authors” icon. One of the instructions for preparing the article upon instructions of this journal like: Editors reserve the right to adjust style to certain standards of uniformity. For the main text (including Abstract), a minimum font size of 11 pt and a minimum line spacing of 18 pt are appropriate. Authors should adopt a consistent hierarchy of headings to assist the typesetter; this can be done in LaTeX using Elsevier's document class 'elsarticle'. Authors using other software should try to follow JSV style, as far as it is reasonably possible. Other example on its instructions:

-Equations should be referred to as Eq. (1), Eq. (2) etc.

-Conclusions The main conclusions of the paper should be presented in a conclusions section, which should not form a subsection of the discussion or results, but should stand alone.

Keywords: Immediately after the abstract, provide a maximum of 6 keywords, using American spelling and avoiding general and plural terms and multiple concepts (avoid, for example, 'and', 'of').

- Abbreviations: Abbreviations that appear in the abstract and the body of the text should be defined when they first appear. Ensure consistency of abbreviations throughout the article. These are examples of a long list of instructions to prepare in the article which needs a big effort and time.

So there is a need for a new system to help researchers, writers, and editors to reformat automatically their works with low effort and short time.

These are ready templates of some scientific journals helping the authors to rewrite their papers in the accepted format of the journal which is one of the conditions to accept the paper for publishing in most of scientific journals. Figure 2.3 shows one of these templates.

This is a specimen a_b title*,**

Jos Migchielsen[a,1,*], CV Radhakrishnan[b,2], CV Rajagopal[c,1,3]

[a] *Elsevier B.V., Radarweg 29, 1043 NX Amsterdam, The Netherlands*
[b] *Sayahna Foundations, JWRA 34, Jagathy, Trivandrum 695014, India*
[c] *STM Document Engineering Pvt Ltd., Mepukada, Malayinkil, Trivandrum 695571, India*

Abstract

In this work we demonstrate a_b the formation Y_1 of a new type of polariton on the interface between a cuprous oxide slab and a polystyrene micro-sphere placed on the slab. The evanescent field of the resonant whispering gallery mode (WGM) of the micro sphere has a substantial gradient, and therefore effectively couples with the quadrupole 1*S* excitons in cuprous oxide. This evanescent polariton has a long life-time, which is determined only by its excitonic and WGM component. The polariton lower branch has a well pronounced minimum. This suggests that this excitation is localized and can be utilized for possible BEC. The spatial coherence of the polariton can be improved by assembling the micro-spheres into a linear chain.

Keywords: quadrupole exciton, polariton, WGM, BEC
JEL: 71.35.-y, 71.35.Lk, 71.36.+c

1. Introduction

Although quadrupole excitons (QE) in cuprous oxide crystals are good candidates for BEC due to their narrow line-width and long life-time there are some factors impeding BEC [1, 2]. One of these factors is that due to the small but non negligible coupling to the photon bath, one must consider BEC of the corresponding mixed light-matter states called polaritons [3]. The photon-like part of the polariton has a large group velocity and tends to escape from the crystal. Thus, the temporal coherence of the condensate is effectively broken [4, 5]. One proposed solution to this issue is to place the crystal into a planar micro-cavity [6]. But even state-of-the-art planar micro-cavities can hold the light no longer than 10 μs. Besides, formation of the polaritons in the planar cuprous oxide micro-cavity is not effective due to quadrupole origin of the excitons

Figure 2.3: Sound and Vibrations Journals' template

2.7 Scientific journals

The number of scientific journals is estimated to be in tens of thousands in all sciences. Depending on UNESCO science report: between 2008 and 2014, the number of scientific

articles catalogued in the Science Citation Index of Thomson Reuters' Web of Science grew by 23%, from 1 029 471 to 1 270 425. Growth was strongest among the upper middle-income economies (94%), primarily driven by growth in Chinese publications (151%). USA was the single largest country of origin, with 321 846 scientific articles in 2014, or 25.3% of world total, down from 28.1% in 2008, whereas China's share climbed from 9.9% to 20.2% over the same period. As a group, the 28 member states of the European Union are the most productive worldwide. Scientists authored 432 195 scientific articles, more than a third of world total (34%), representing 847 articles per million inhabitants. However, the four countries comprising the European Free Trade Association (EFTA, namely Liechtenstein, Iceland, Norway and Switzerland) had a higher publication density than the European Union. Together, they produced 2 611 articles per million inhabitants. Home to 0.9% of the world's researchers, EFTA countries co-authored 2.8% of the world's scientific articles, more than the share of Africa as a whole (2.6%). Iran nearly doubled its share of world publications to 2% in 2014, with 25 588 articles, comparable to the world shares of the Arab States (2.4%), Russian Federation (2.3%) and Turkey (1.9%). Scientific articles by Malaysian authors grew by 251% between 2008 and 2014, to reach 9 998, or 331 articles per million inhabitants, around three times the average of Asia as a whole. Japan remained a major source of scientific publishing in 2014 (73 128 articles, or 5.8% of the world total) but it is one of the rare countries where output has declined (by 4.1% since 2008). Another example of this trend is Venezuela, where scientific output declined by as much as 28% between 2005 and 2014. (UNESCO report, 2018). The samples taken in this study will be about ten samples including different ranks of the journals and different science areas.

2.8 Review of Related Literature

Bhunia, Bhunia, Banerjee, Konwer, Bhowmick, Roy,and Pal, (2017) Proposed a Convolutional Recurrent Generative model to solve the word level font transfer problem. This network system was able to convert the font style of any printed text images from its current font to the required font. The network was trained end-to-end for the complete word images. Thus, it eliminates the necessary pre-processing steps, like character segmentations. The model was extended to conditional setting that helps to learn one-to-many mapping function. One of advantages of this model architecture was it can be used in the Generator that efficiently deals with the word images of arbitrary width. The proposed architecture was the first work which can handle images of varying widths. The new method was compared with some of the state-of-the-art methods for image translation. The performance of the system on the same dataset was proved by its ability to learn the font distributions.

Shetty, and Heraje, (2017) This study aimed to recognize the printed characters in a given input image and extract it. It included detecting the character and recognizing it from an image. Optical character recognition for the formatted English text is done. The Machine Learning technique is used where the system is initially trained for all the alphabets and numbers of the English language along with the desired output. Finally the accuracy of the system is plotted according to the output obtained.

Taqdir, and Uttarhanica (2016) discussed using the handwritten English characters as information and after that procedure the character after that train the neural network algorithm and afterward recognize the pattern so that changed character to an improved adaption. HCR technique changes over pictures into editable format. This technique changes over pictures in the form of documents such as edit, modify and store date for long period. This method includes pre-processing, segmentation, Feature Extraction, Classification and Recognition etc.

Reul, and Dittrich, and Gruner, (2016) provided the first documentation system of a high quality digitization process applied to an early printed book. The system including preprocessing, layout analysis and text recognition was illustrated in detail using the example of 'Der Heiligen Leben', which was printed in Nuremberg in 1488. For each step the required time expenditure was recorded. Operation of character recognition yielded excellent results both on character (97.57%) and word (92.19%) level. Realistic estimates for the human effort necessary for full text extraction from incunabula can be derived from this study.

Vijayarani, and Sakila, (2015) Applied template matching technique for scanned document images which contains characters (both uppercase and lowercase) and also numbers. To perform the comparison operation of the template image with the input image Performance Index method was used and it is compared with the normalized cross correlation and cross correlation methods. Different types of comparisons were done in this work such as: comparing single character from a word, sentence and paragraph; and also compared multiple characters (words) from a word, sentence and paragraph.

Kumar and Bhatia (2013) they considered many types of handwriting styles from different persons are considered to be processed. In the practical image acquisition systems and conditions, shape distortion is common processes because different people's handwriting has different shape of characters. The process of recognizing character recognition in this work has been divided into 2 phases. In the first phase, Image preprocessing is done in which image is firstly converted into binary form based on some threshold value obtained through Otsu's method. The next step was to remove the noise which was done using median filter. Then such feature extraction took place which was done here through Fourier descriptor method using Fourier transform and correlation between template made through training data and test data is obtained. A multilayer feed forward neural network is created and trained through

Back Propagation algorithm. After the training, testing is done to match the pattern with test data. Results for various convergence objective of neural network are obtained and analyzed.

Yessenov , Tulsiani , Kanpur, Menon, and Miller (2013) presented STEPS, a programming system for processing structured and semi-structured text by example. STEPS users create and manipulate hierarchical structure by example. In a between-subject user study on fourteen computer scientists, STEPS compares favorably to traditional programming. It was found that that STEPS is faster than other alternatives, at least for computer science graduate students and post docs. It also became clear that STEPS can be improved in terms of the way in which it displays the inferred operations and set of possible operations, both of which have been addressed by previous work.

Bencze, and Fark, and Hatala, and Jeszenszky (2006) presented a web-based address system application that generated customized PDF documents using LATEX template documents. The application was hosted on some server and users can access its functions using a web browser. The working LATEX system had to be installed only on the server side. User registered can manage the own address book. They can upload LATEX templates and can generate multiple PDF documents from the template. Templates were customized to each selected recipient, substituting the appropriate address book data element into them. An example application might be an invitation card or a letter that must be sent to different recipients. Also, users can create simple documents (e.g. letters) using built in templates and a simple web-based document editor

2.9 Summary of literature review

The last review includes many paper that really don’t treat the problem of the current study directly i.e. there is no paper of the last studies hit the problem of the current study, they concentrate on image processing of some words or letters, try to discover word error detector plug in application, layout analysis and text recognition, developing a unified framework to discover semantic relations in order to enhance traditional content similarity measure for text clustering, presented a web-based address system application that generated customized PDF documents using LATEX template documents. Also, some others try to compare some scanned texts and images, others proposed a Convolutional Recurrent Generative model to solve the word level font transfer problem, and recognized the printed characters in a given input image and extracting it. In all of these studies, there is no concentration on texts formatting or reformatting and texts format comparisons to find a percent of compatibility between the written text format and a required text format. The last reviewed papers will be taken as the base for the current study, and a suitable programming language or application is chosen to get more efficient way to develop the new method of classifying, checking, and reformatting texts into a required style.

Chapter Three

Methodology and the Proposed System

Chapter Three
Methodology and the Proposed System

3.1 Methodology

The need for new approach or system to reformat the articles submitted to the journals is crucial. The submitted articles upon the proposed system will be classified using a special program designed by VB.NET application for this purpose, the classification will include determining the percentage of compatibility, if this percent is low or medium or less than 95% the text should be reformatted upon the journal requirements or instructions. Else it is accepted (as a format not final acceptance by the journal).

3.2 The Proposed System

In this work an interface using VB.NET software application is used to enable the user (either an authors or the editors) to upload the manuscript on the system, and then the system will check the article and classify it upon its closest from the required journal format. After checking compatibility percent the article may be sent to be reformatted upon journals instructions. Figure 3.1 shows the flowchart to perform the task.

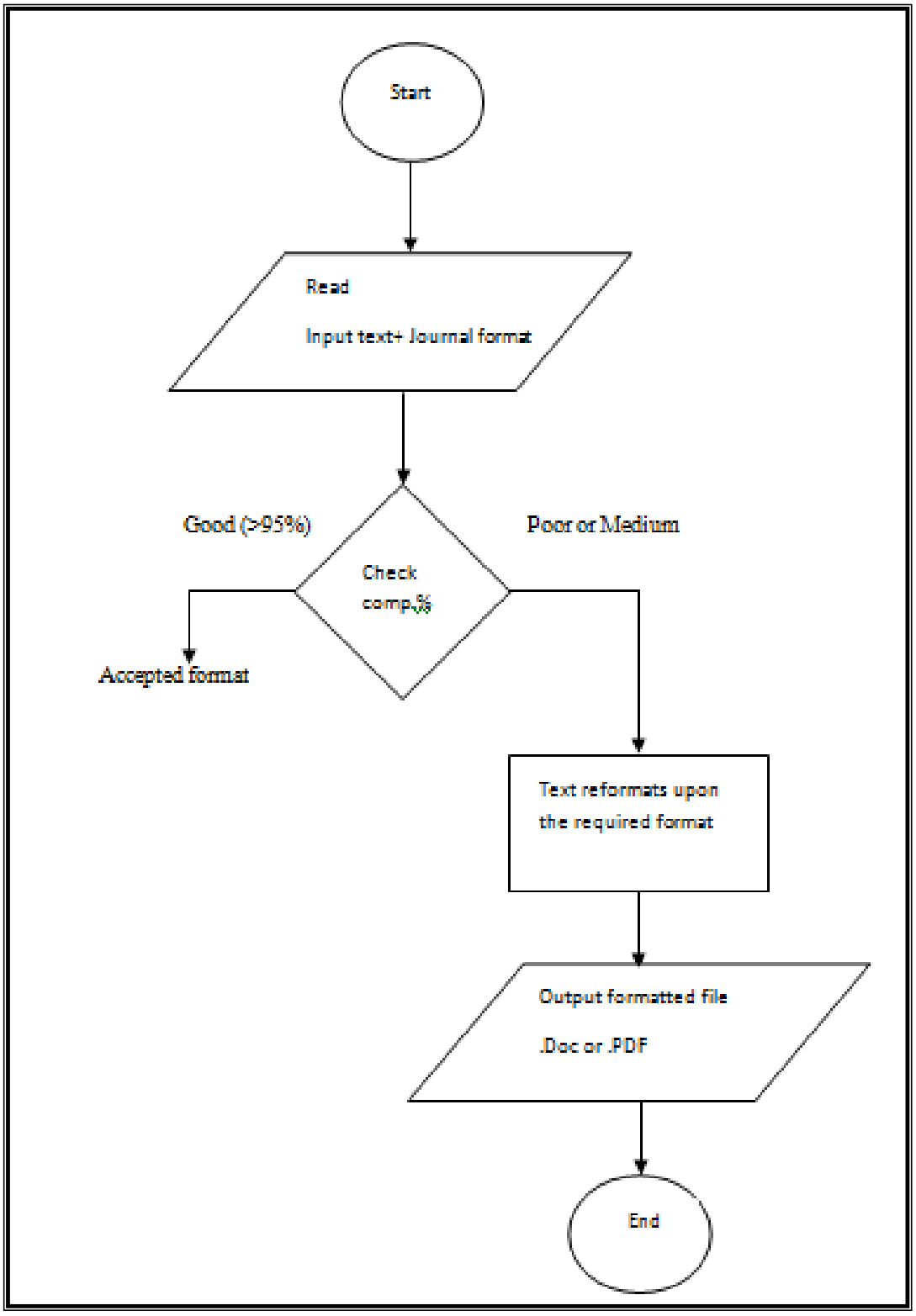


Figure 3.1: The flowchart of the proposed model

The proposed system includes the following steps:

-In the first step the journal format or instructions are entered to the system as an input, and also the paper to be formatted.

- The next step is to check the compatibility percent between the format of the paper and the journals' template or style. If the compatibility percent is high (over 95%) the paper is accepted, else it will be reformatted and also the comp.% is recalculated by the system to insure that it is over 95%.

- The final step is to get the formatted text and export to a MS Word file.

In this study, the aim and objectives will be achieved by the supplement of the following tools:

-Oracle virtual machine

-Python and spyder3

-Ubuntu and PyPDF2.

-VB.NET

Which will be discussed in chapter four.

Chapter 4

Simulation Results and Discussion

Chapter 4

Simulation Results and Discussion

4.1 Results

Results are divided to three stages, the first result is a code that can convert any PDF file into a data set (words or letters) which then can be manipulated and converted to any type of data with new format.

4.1.1 Code for converting PDF to a data set

The following code is used to convert any PDF file written by any format to a data which can be manipulated and processed to be converted to the required format after cleaning such data and be ready to be entry data to the final stage of the proposed system i.e. to be formatted upon authors instructions which is needed by the Journal. Figure 4.1 shows such code.

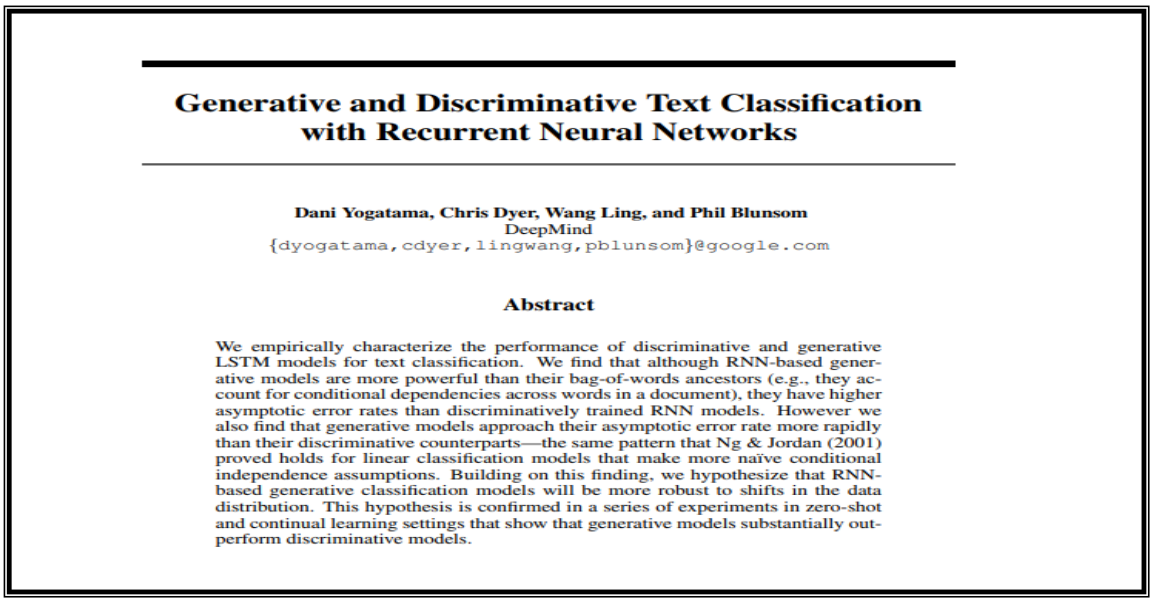
```
"""
@author: text_classification
"""
import PyPDF2
fromnltk.tokenize import sent_tokenize, word_tokenize
getFile = input('enter the absolute path of PDF file: ')

text_file = open('converted_PDF_Text.txt','w')
pdfFileObj = open(getFile,'rb')     #'rb' for read binary mode
pdfReader = PyPDF2.PdfFileReader(pdfFileObj)
numOfPages = pdfReader.numPages
for page in range(numOfPages):
pageObj = pdfReader.getPage(page)          #'9' is the page number
extracted = pageObj.extractText()
print(extracted)
text_file.write('#')
text_file.write('\n')
text_file.write(extracted)

print('\n')
print('total number of pages are', numOfPages)
#print(extracted.encode('utf-8'))
"""
content_file = open('converted_PDF_Text.txt','r').read()
```

```
tokenized_file = open('tokenizedFile.text','w')
for tokens in word_tokenize(content_file):
tokenized_file.write(tokens)
tokenized_file.write('\n')
    #print(tokens)
"""
```

The Original PDF-file is shown in Figure 4.1 below.



Generative and Discriminative Text Classification with Recurrent Neural Networks

Dani Yogatama, Chris Dyer, Wang Ling, and Phil Blunsom
DeepMind
{dyogatama,cdyer,lingwang,pblunsom}@google.com

Abstract

We empirically characterize the performance of discriminative and generative LSTM models for text classification. We find that although RNN-based generative models are more powerful than their bag-of-words ancestors (e.g., they account for conditional dependencies across words in a document), they have higher asymptotic error rates than discriminatively trained RNN models. However we also find that generative models approach their asymptotic error rate more rapidly than their discriminative counterparts—the same pattern that Ng & Jordan (2001) proved holds for linear classification models that make more naïve conditional independence assumptions. Building on this finding, we hypothesize that RNN-based generative classification models will be more robust to shifts in the data distribution. This hypothesis is confirmed in a series of experiments in zero-shot and continual learning settings that show that generative models substantially outperform discriminative models.

Figure 4.1: The original PDF file segment of the paper

Figure 4.2 shows the Converted text after running the code.

Figure 4.2: Original results of running code 1.

4.1.2 Code for cleaning data

This code will make cleaning of texts from any unneeded words or numbers in order to classify them into the three text classes(good, bad or medium) depending on comp.%.

```
# -*- coding: utf-8 -*-
#import nltk
import pandas as pd
df = pd.read_csv('text_data.csv')
df.head()
#with open('text_data.csv') as td:
#    for rows in td:
#        print(rows)

X = df.iloc[:,0] #all enteries of col_0
y = df.iloc[:,1] #all enteries of col_1
```

```
############## Tfidf vectorinzation is "term frequency-inverse
document frequency"
from sklearn.feature_extraction.text import TfidfVectorizer
#tf = TfidfVectorizer(tokenizer=lambda doc: doc,lowercase=False,
analyzer='word',  min_df = 0,     stop_words = 'english')
tf = TfidfVectorizer()

#X is a list having my **Text** which im reading from a CSV
tfidf_matrix =  tf.fit_transform(X)
feature_names = tf.get_feature_names()
print(tfidf_matrix.todense())
# generate the training and testing variables from the csv and pass it
to the model
from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split(tfidf_matrix, y,
test_size=0.33)
#X_train, X_test, y_train, y_test = train_test_split(tfidf_matrix, y,
test_size=0.33, random_state=42)

#intiating the value neighbors to 1 (maximum no. of neighbors)
from sklearn.neighbors import KNeighborsClassifier
neigh = KNeighborsClassifier(n_neighbors=1)
neigh.fit(X_train, y_train) #fitting the training set to KNN
classifier
y_preds = neigh.predict(X_test)

# computing the accuracy score of the KNN classifier with given
dataset
from sklearn.metrics import accuracy_score
from sklearn import metrics
# try K=1 through K=25 and record testing accuracy
#this will replicate in the given graph
k_range = range(1, 300)
# We can create Python dictionary using [] or dict(). So that a well-
defined
#traning and testing set will be creating and stored for the graph
scores = []
# We use a loop through the range 1 to 30 (could be changes according
to the user discreation)
# We append the scores in the dictionary
for k in k_range:
    knn = KNeighborsClassifier(n_neighbors=k)
    knn.fit(X_train, y_train)
    y_pred = knn.predict(X_test)
    scores.append(metrics.accuracy_score(y_test, y_pred)) #append the
scores dictionary
print('scores are', scores)
# import Matplotlib (scientific plotting library) used for polting the
graph
import matplotlib.pyplot as plt
# plot the relationship between K and testing accuracy
# plt.plot(x_axis, y_axis)
```

```
plt.plot(k_range, scores)
plt.xlabel('Value of K for KNN')
plt.ylabel('Testing Accuracy')
print('accuracy of KNN: ',accuracy_score(y_test, y_preds))

########## NAive Bayes Classfier ##########
#classifier = nltk.NaiveBayesClassifier.train(y_train)
#print("Classifier accuracy
percent:",(nltk.classify.accuracy(classifier, X))*100)
```

The results of running this code is shown in Figure 4.3 below.

```
# -*- coding: utf-8 -*-
#import nltk
import pandas as pd
df = pd.read_csv('text_data.csv')
df.head()
#with open('text_data.csv') as td:
#    for rows in td:
#        print(rows)

X = df.iloc[:,0]
y = df.iloc[:,1]

############## Tfidf vectorization is "term frequency-inverse document frequency"
from sklearn.feature_extraction.text import TfidfVectorizer
#tf = TfidfVectorizer(tokenizer=lambda doc: doc,lowercase=False, analyzer='word',  min_df =
tf = TfidfVectorizer()

#X is a list having my **Text** which in reading from a CSV
tfidf_matrix =  tf.fit_transform(X)
feature_names = tf.get_feature_names()
print(tfidf_matrix.todense())
# generate the training and testing variables from the csv and pass it to the model
from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split(tfidf_matrix, y, test_size=0.33)
#X_train, X_test, y_train, y_test = train_test_split(tfidf_matrix, y, test_size=0.33, randor

#intiating the value neighbors to 1 (maximum no. of neighbors)
from sklearn.neighbors import KNeighborsClassifier
neigh = KNeighborsClassifier(n_neighbors=1)
neigh.fit(X_train, y_train) #fitting the training set to KNN classifier
y_preds = neigh.predict(X_test)

# computing the accuracy score of the KNN classifier with given dataset
from sklearn.metrics import accuracy_score
from sklearn import metrics
# try K=1 through K=25 and record testing accuracy
#this will replicate in the given graph
k_range = range(1, 30)
# We can create Python dictionary using [] or dict(). So that a well-defined
#traning and testing set will be creating and stored for the graph
scores = []
# We use a loop through the range 1 to 30 (could be changes according to the user discreatic
# We append the scores in the dictionary
for k in k_range:
    knn = KNeighborsClassifier(n_neighbors=k)
    knn.fit(X_train, y_train)
    y_pred = knn.predict(X_test)
    scores.append(metrics.accuracy_score(y_test, y_pred)) #append the scores dictionary
print(scores)
```

Figure 4.3: Code2 script.

Figure 4.4 shows the output of running last code which represents the accuracy of testing if

the input text is closest to the format required or not depending on KNN which represents K-nearest nighbour.

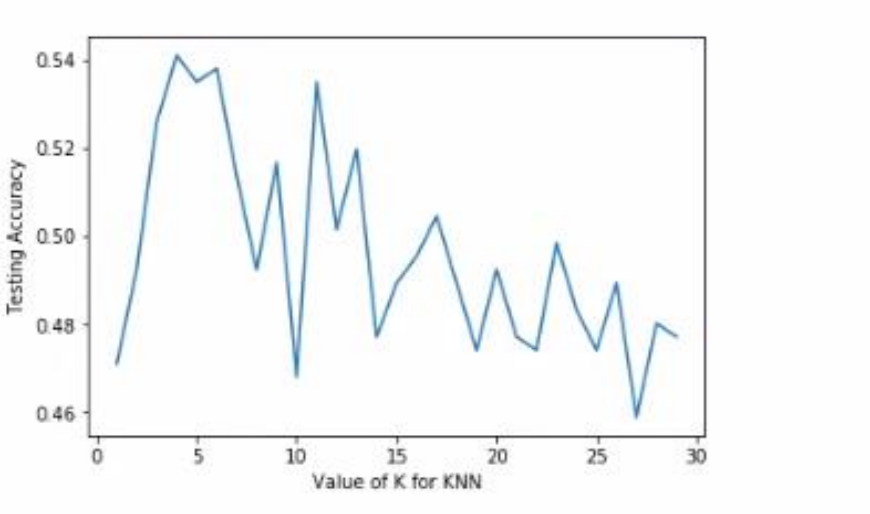


Figure 4.4: Accuracy of the text testing depending on KNN

4.2 VB.NET Simulation interface

Figure 4.5 shows the VB.NET interface to make the simulation and determining the comp.% of the papers.

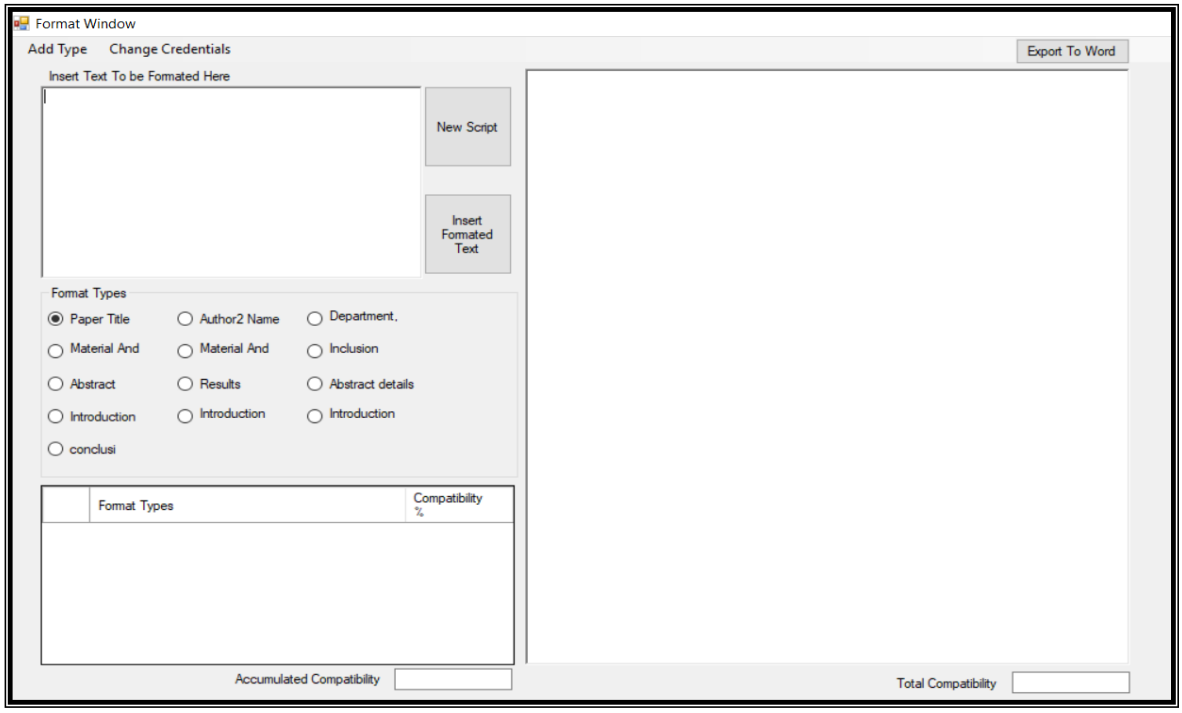


Figure 4.5: VB.NET simulation interface

In this simulation interace, the author or the editor can specify the format requirements upon the journal tempalte in the left hand boxes-Format type, then inserting text to be formated depending on its type (paper title, author name, abstract, introduction,…..). After that the author can choose the type and then select the type. In this stage the comp.% will be calculated for each part of the paper and the total or accumulative % of compatibility will be estimated automaticaly. Figure 4.6 shows these steps.

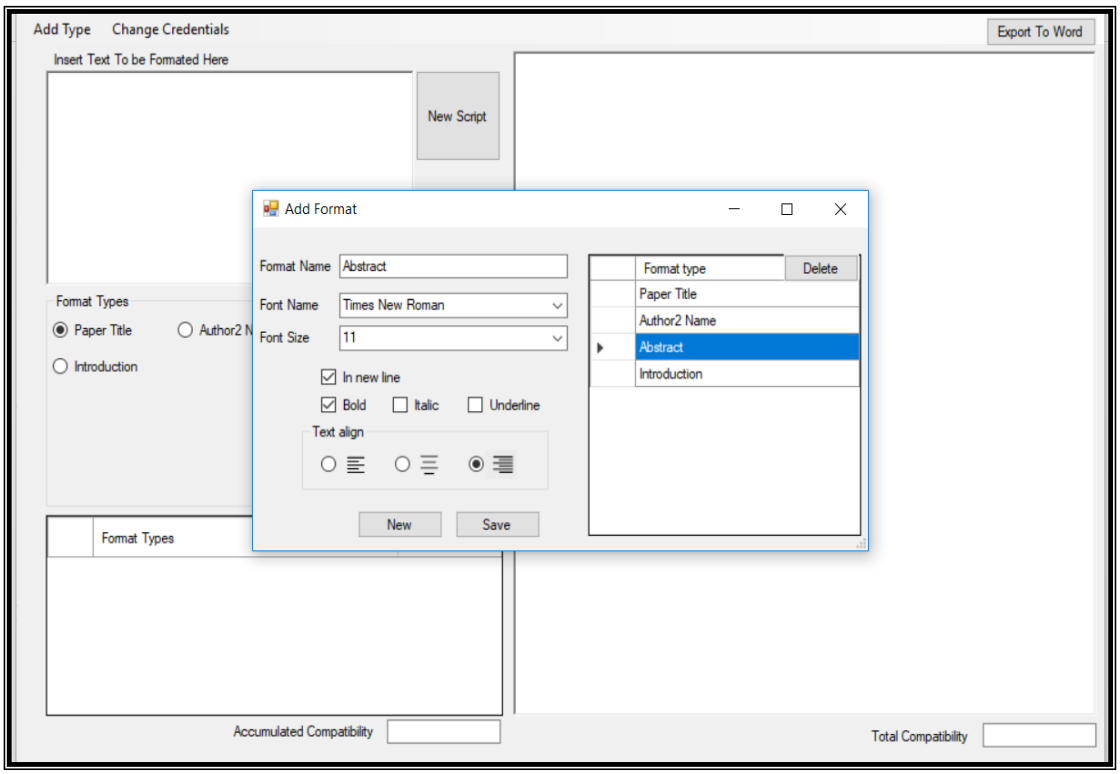


Figure 4.6: Specifying the format for each part of the paper

Figure 4.7 shows a text uploaded to the system and the compatibility % of the text.

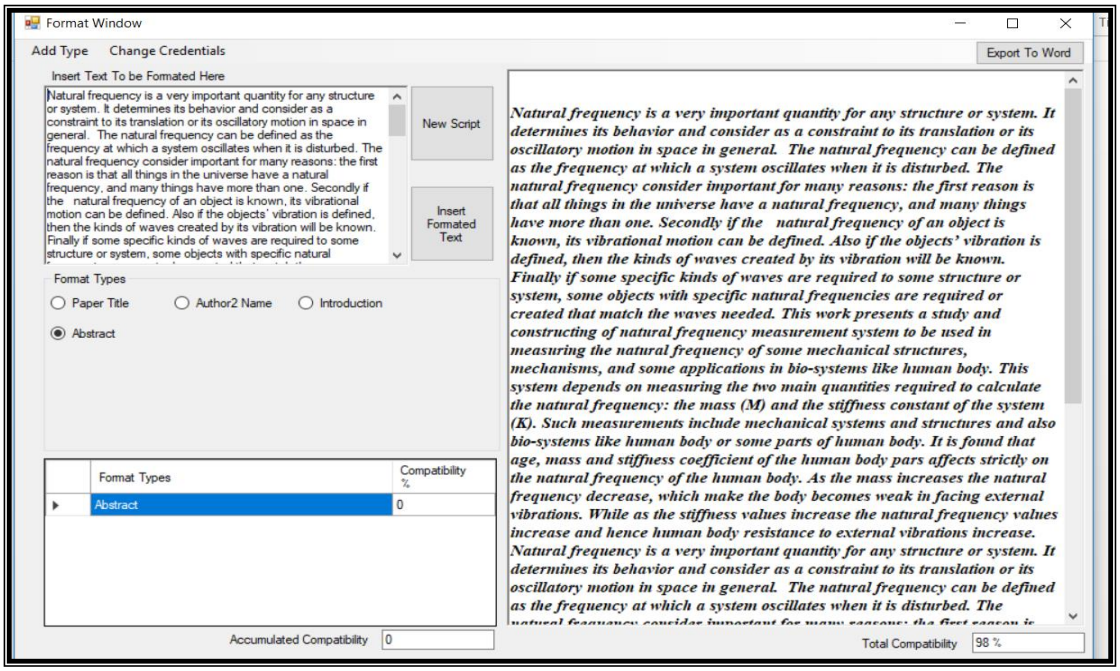


Figure 4.7: Text inserting with comp.% before and after and the formatted test

Also the simulation can export the resulted text (formatted text) into a word file upon the order required. Figure 4.8 shows the word file.

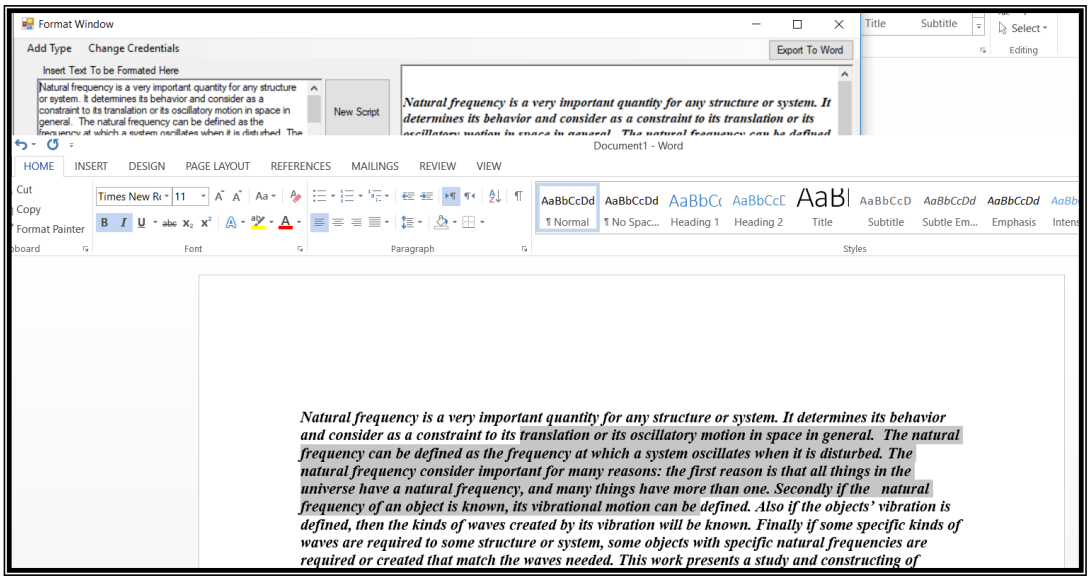


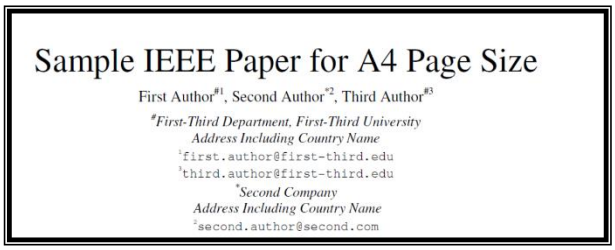
Figure 4.8: Export results to a word page file.

The compatibility pecent after conversion is about 95% to 98% as can be noticed in last results.

4.3 Results of VB.NET simulation

4.3.1 IEEE format

Figure 4.9 shows the format required by IEEE journals, which shows the properties of all segments of the paper from title of the paper, author's names format, abstract, and the body of the paper and so on.

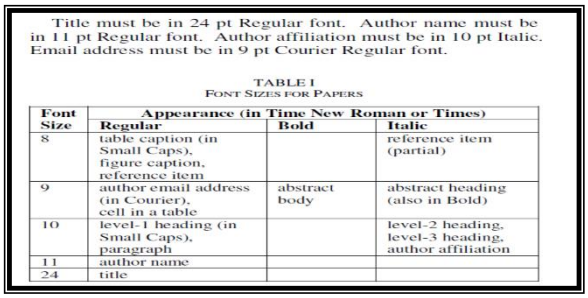


Sample IEEE Paper for A4 Page Size

First Author[#1], Second Author[*2], Third Author[#3]

[#]First-Third Department, First-Third University
Address Including Country Name
[1]first.author@first-third.edu
[3]third.author@first-third.edu
[*]Second Company
Address Including Country Name
[2]second.author@second.com

(a)

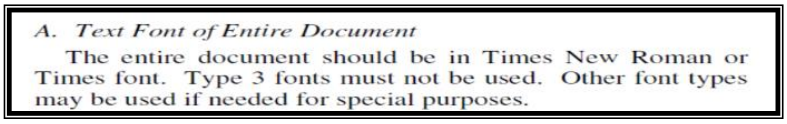


Title must be in 24 pt Regular font. Author name must be in 11 pt Regular font. Author affiliation must be in 10 pt Italic. Email address must be in 9 pt Courier Regular font.

TABLE I
FONT SIZES FOR PAPERS

Font Size	Appearance (in Time New Roman or Times)		
	Regular	Bold	Italic
8	table caption (in Small Caps), figure caption, reference item		reference item (partial)
9	author email address (in Courier), cell in a table	abstract body	abstract heading (also in Bold)
10	level-1 heading (in Small Caps), paragraph		level-2 heading, level-3 heading, author affiliation
11	author name		
24	title		

(b)



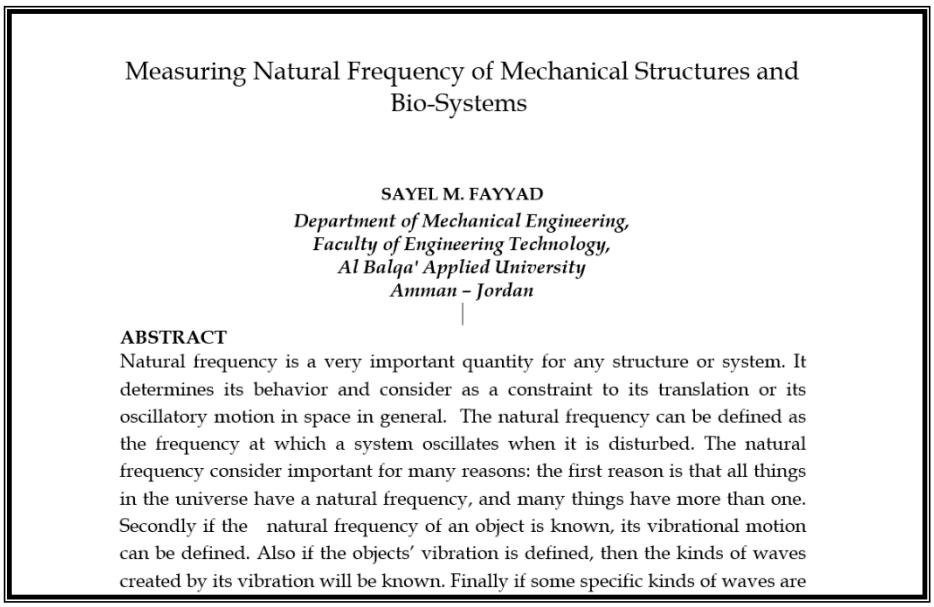
A. Text Font of Entire Document

The entire document should be in Times New Roman or Times font. Type 3 fonts must not be used. Other font types may be used if needed for special purposes.

(c)

Figure 4.9: (a) IEEE journals required format, (b) fonts of text used in the paper, and (c) font of entire documents

Figure 4.10 shows the original paper before reformatting.



Measuring Natural Frequency of Mechanical Structures and Bio-Systems

SAYEL M. FAYYAD
Department of Mechanical Engineering,
Faculty of Engineering Technology,
Al Balqa' Applied University
Amman – Jordan

ABSTRACT
Natural frequency is a very important quantity for any structure or system. It determines its behavior and consider as a constraint to its translation or its oscillatory motion in space in general. The natural frequency can be defined as the frequency at which a system oscillates when it is disturbed. The natural frequency consider important for many reasons: the first reason is that all things in the universe have a natural frequency, and many things have more than one. Secondly if the natural frequency of an object is known, its vibrational motion can be defined. Also if the objects' vibration is defined, then the kinds of waves created by its vibration will be known. Finally if some specific kinds of waves are

Figure 4.10: Paper sample before reformatting

While Figure 4.11 shows the paper during reformatting process, and the comp.% before and after are 9.44% and 95% respectively.

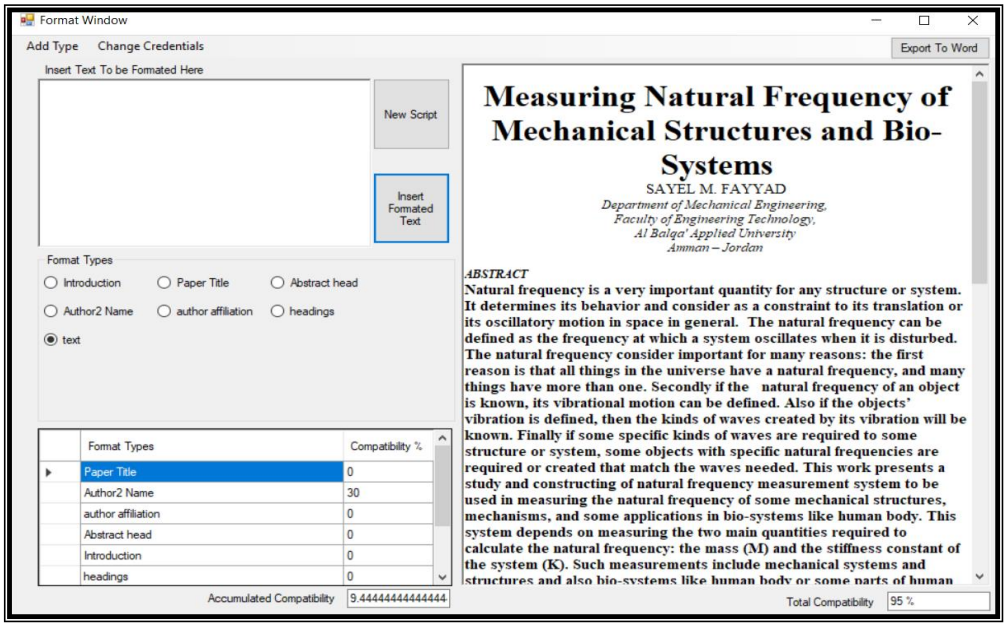


Figure 4.11: Paper after reformatting and comp.%

Figure 4.12 shows the final output paper in word file.

Measuring Natural Frequency of Mechanical Structures and Bio-Systems

SAYEL M. FAYYAD
Department of Mechanical Engineering,
Faculty of Engineering Technology,
Al Balqa' Applied University
Amman – Jordan

ABSTRACT
Natural frequency is a very important quantity for any structure or system. It determines its behavior and consider as a constraint to its translation or its oscillatory motion in space in general. The natural frequency can be defined as the frequency at which a system oscillates when it is disturbed. The natural frequency consider important for many reasons: the first reason is that all things in the universe have a natural frequency, and many things have more than one. Secondly if the natural frequency of an object is known, its vibrational motion can be defined. Also if the objects' vibration is defined, then the kinds of waves created by its vibration will be known. Finally if some specific kinds of waves are required to some structure or system, some objects with specific natural frequencies are required or created that match the waves needed. This work presents a study and constructing of natural frequency measurement system to be used in measuring the natural frequency of some mechanical structures, mechanisms, and some applications in bio-systems like human body. This system depends on measuring the two main quantities required to calculate the natural frequency: the mass (M) and the stiffness constant of the system (K). Such measurements include mechanical systems and structures and also bio-systems like human body or some parts of human body. It is found that age, mass and stiffness coefficient of the human body pars affects strictly on the natural frequency of the human body. As the mass increases the natural frequency decrease, which make the body becomes weak in facing external vibrations. While as the stiffness values increase the natural frequency values increase and hence human body resistance to external vibrations increase.

KEYWORDS:
Natural Frequency, Mechanical Structures, Mechanisms, Bio-Systems, Vibrations.

INTRODUCTION

The natural frequency varied from structure to structure and it depends mainly on mass and stiffness of the structure. The natural frequency can be considered as a unique value for structures because it is too difficult to have the same stiffness to mass ratio for any two different structures.

Natural frequencies can be considered as a fingerprint of an object. This is so for buildings as well as for objects of our daily life. Essentially, these natural frequencies are characterized by the geometry and by the material of these objects. For example, large bodies oscillate inaudibly with few vibrations per second or fewer (bridges, for example). On the other hand, small parts sound with a clearly perceptible tone or can be identified only by suitable sensors in the ultrasonic range (for example, small screws or pins). The natural mode is an internal dynamic property of a freely oscillating structure, the consequence of which is a particular deformation behavior.

The main objective is to create a tool or measurement system to evaluate the natural frequency of such mechanical systems and humans because no two humans have the same value which can be considered like DNA. Vibrations have significant effects on human body, so if the natural frequency of the human body is evaluated correctly, then the effects of vibrations on the human body can be specified and quantified easily.

The importance of the natural frequency that whenever the natural frequency of vibration of a machine or structure coincides with the frequency of the external excitation, phenomenon known as resonance will occur, which leads to excessive deflections and failure. The literature is full of accounts of system failures brought about by resonance and excessive vibration of components and systems.

Figure 4.12: Final output paper

4.3.2 Elsevier formatting

Figure 4.13 shows Procedia journal format as an Elsevier journals template.

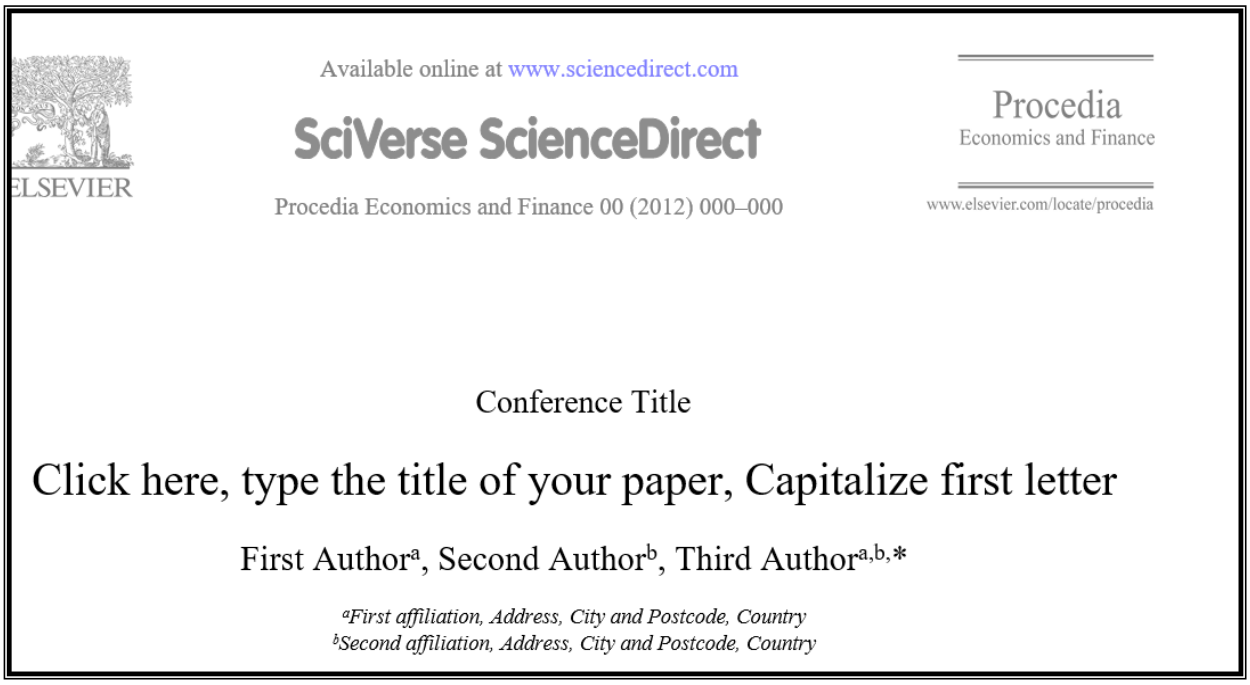


Figure 4.13: Elsevier journal format example

Figure 4.14 shows the result of paper reformatting using VB.NET proposed system and its comp.% before and after with the Elsevier journal.

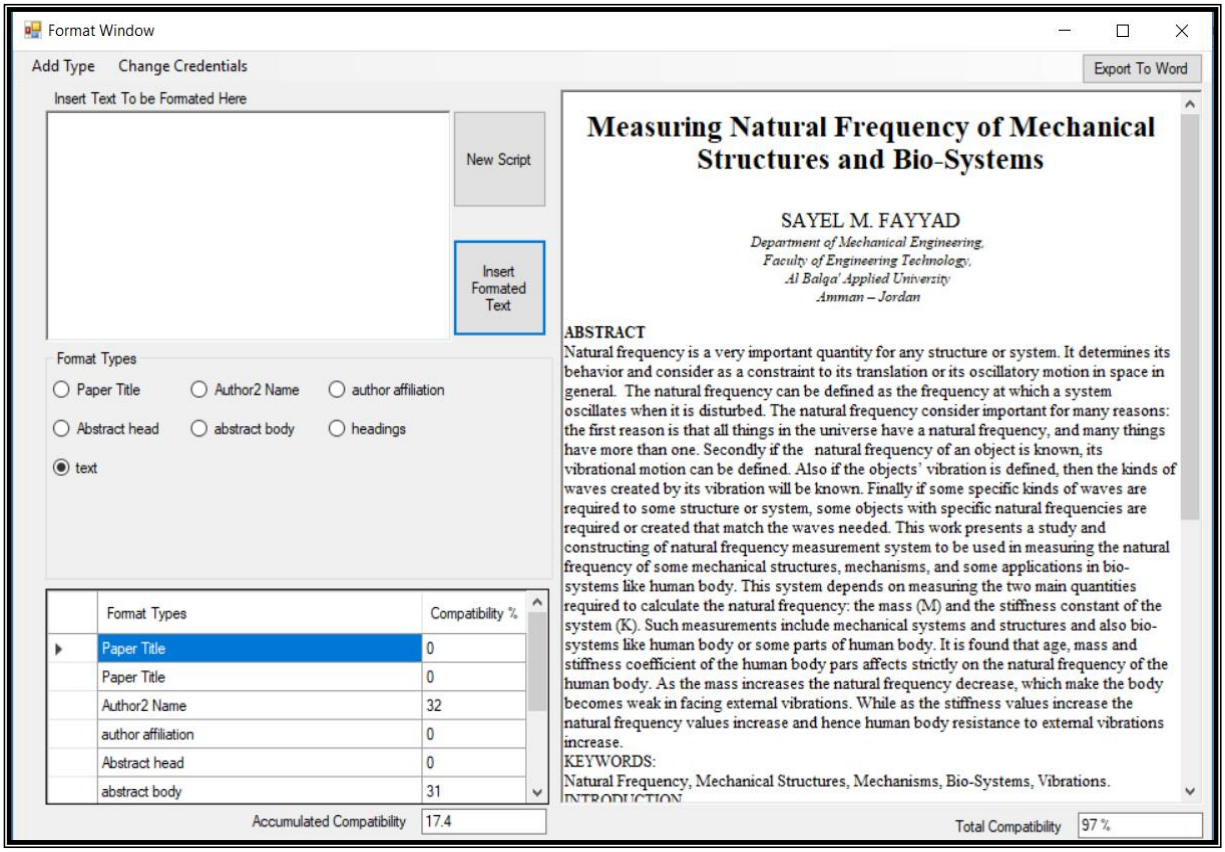


Figure 4.14: Reformatting paper results using the proposed model upon Elsevier journal

The final output paper of the second test is shown in Figure 4.15 with comp.% 17.4 before reformatting and 97% after being processed by the proposed system.

Measuring Natural Frequency of Mechanical Structures and Bio-Systems

SAYEL M. FAYYAD
Department of Mechanical Engineering,
Faculty of Engineering Technology,
Al Balqa' Applied University
Amman – Jordan

ABSTRACT
Natural frequency is a very important quantity for any structure or system. It determines its behavior and consider as a constraint to its translation or its oscillatory motion in space in general. The natural frequency can be defined as the frequency at which a system oscillates when it is disturbed. The natural frequency consider important for many reasons: the first reason is that all things in the universe have a natural frequency, and many things have more than one. Secondly if the natural frequency of an object is known, its vibrational motion can be defined. Also if the objects' vibration is defined, then the kinds of waves created by its vibration will be known. Finally if some specific kinds of waves are required to some structure or system, some objects with specific natural frequencies are required or created that match the waves needed. This work presents a study and constructing of natural frequency measurement system to be used in measuring the natural frequency of some mechanical structures, mechanisms, and some applications in bio-systems like human body. This system depends on measuring the two main quantities required to calculate the natural frequency: the mass (M) and the stiffness constant of the system (K). Such measurements include mechanical systems and structures and also bio-systems like human body or some parts of human body. It is found that age, mass and stiffness coefficient of the human body pars affects strictly on the natural frequency of the human body. As the mass increases the natural frequency decrease, which make the body becomes weak in facing external vibrations. While as the stiffness values increase the natural frequency values increase and hence human body resistance to external vibrations increase.

KEYWORDS:
Natural Frequency, Mechanical Structures, Mechanisms, Bio-Systems, Vibrations.

INTRODUCTION

The natural frequency varied from structure to structure and it depends mainly on mass and stiffness of the structure. The natural frequency can be considered as a unique value for structures because it is too difficult to have the same stiffness to mass ratio for any two different structures.

Natural frequencies can be considered as a fingerprint of an object. This is so for buildings as well as for objects of our daily life. Essentially, these natural frequencies are characterized by the geometry and by the material of these objects. For example, large bodies oscillate inaudibly with few vibrations per second or fewer (bridges, for example). On the other hand, small parts sound with a clearly perceptible tone or can be identified only by suitable sensors in the ultrasonic range (for example, small screws or pins). The natural mode is an internal dynamic property of a freely oscillating structure, the consequence of which is a particular deformation behavior.

The main objective is to create a tool or measurement system to evaluate the natural frequency of such mechanical systems and humans because no two humans have the same value which can be considered like DNA. Vibrations have significant effects on human body, so if the natural frequency of the human body is evaluated correctly, then the effects of vibrations on the human body can be specified and quantified easily.

The importance of the natural frequency that whenever the natural frequency of vibration of a machine or structure coincides with the frequency of the external excitation, phenomenon known as resonance will occur, which leads to excessive deflections and failure. The literature is full of accounts of system failures brought about by resonance and excessive vibration of components and systems.

Figure 4.15: The final output paper of the second sample.

Another case study of a paper contains tables and figures is shown in Figure 4.16.

THERMAL ANALYSIS FOR INTERNAL COMBUSTION CYLINDER BLOCK

Sayel M. Fayyad
Department of Mechanical Engineering, Faculty of Engineering Technology,
P.O. Box 15008, E-mail: ssfayad@yahoo.com
Al-Balqa Applied University
Amman-Jordan

ABSTRACT
This paper presents a simulation and analysis for the thermal stresses of the internal combustion engine and analyzed its effects on cylinders and engine performance. The main aim of this paper is to make a simulation and analysis of the thermal stresses affect internal combustion engine or thermal fatigue. A simulation using Solidworks is used here to analyze the thermal stresses of ICE problem. It is found that the thermal stresses of cast carbon are of smaller value than that of the alloy steel. Thermal displacements and strains of alloy steel blocks are smaller than that of cast carbon. Cooling contributes in reducing thermal stresses, strains and displacements on both different blocks.
Thermal fatigue cracks appear on the surface and within the outside layers of the parts
participating in the heat transfer. Thermal fatigue cracks specific that develops gradually because of cyclic temperature variations. These cracks appear and on the upper layers and on the surface of parts machineries (although in the most favorable operating conditions), limiting their use to situations which have negative effects on energy and economic indices of the engine [2],[3].

Fig.1 Experimental bench to measure the temperature values of ICE.
In ICE heat produced during operation is transferred to a lesser extent during the gas engine fluid change.

Figure 4.16: Converting of a paper containing figures

4.4 Results Discussion

It can be noticed from last results that the proposed algorithms has the ability to reformat any article has a bad or medium comp. % with the required format of any journal. The comp. % of the final text is in the range of 95-98%. The two important thing appeared are the compatibility percent before and after reformatting and the time required to reformat any paper using the proposed system. The comp. % is a tool to decide to proceed to the next step in paper submission, or to reformat the paper either by the author or by the journal editor. The time of reformatting the paper using the traditional method upon the journal format is greater than that consumed by the proposed model. Figure 4.17 shows a comparison of these times. It reduces the time by one third as an average, and this estimated by reformatting six papers using both the manual method and the proposed system.

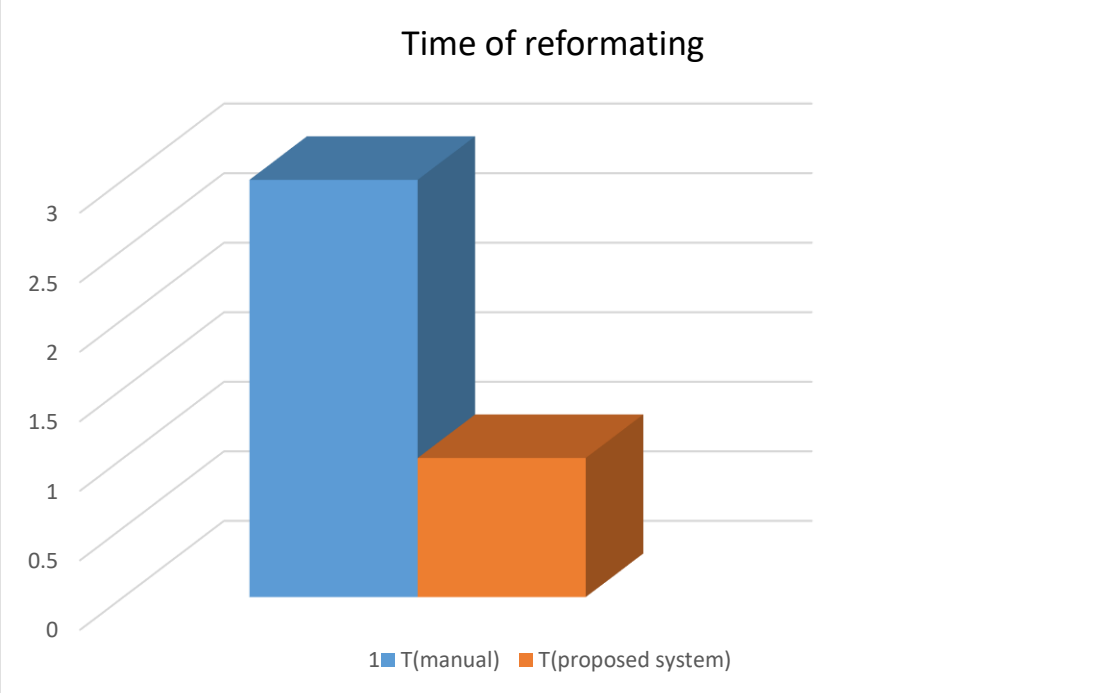


Figure 4.17: Comparing reformatting time (in hours) between traditional and proposed system

Figure 4.18 shows a comparison of final percentages of compatibility between the proposed model and the manual methods used in paper reformatting. It can be noticed that the time, effort and cost of reformatting any paper using the proposed model are reduced while the compatibility between the papers and journal templates using the proposed model is improved comparing with traditional methods but with less time and effort.

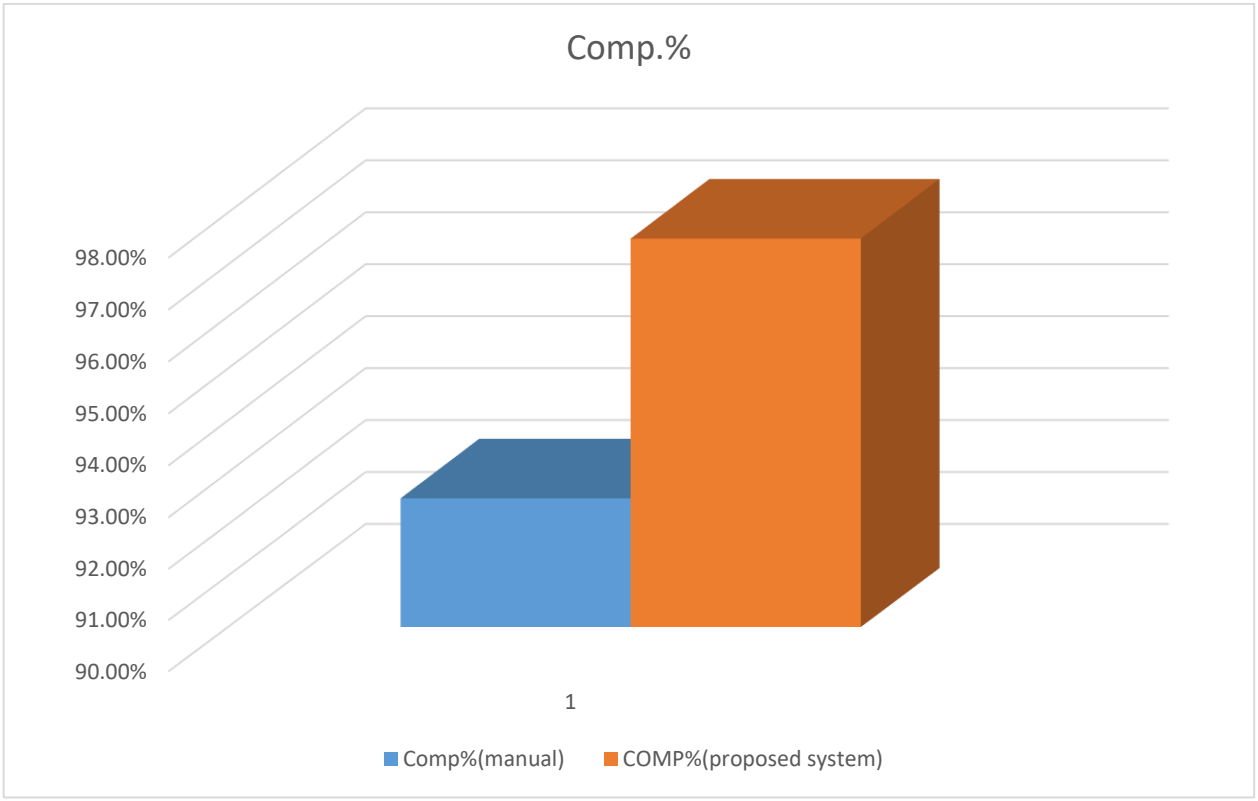


Figure 4.18: Compatibility comparison between manual method and the proposed system.

Chapter Five

Conclusions and Recommendations

Chapter Five
Conclusions and Recommendations

5.1 Conclusions

This work represents a first step to build a smart model and online-website to reformat any given paper (submitted to any scientific journal to be reviewed and then published) to the required format. The thesis aims to find an automatic reformatting system of such submitted papers to the journals to simplify the process and reduce both efforts and time required. Unfortunately a complete system is not built because of time, low utilities and the poor knowledge in some required advanced programs and high level programming languages, but this thesis represents the first or base step toward a full version of such system. In the first stage the system can convert any given file (PDF, text…) to a data set that can be processed and manipulated, then the second stage was aimed to clean up such data set to be ready for other advanced steps and to be an entry to a neural network or any artificial intelligent based system in future. The third stage use VB.NET programming language to check compatibility of the submitted text with the journal format and to reformat such texts upon the required format.

The proposed system gives good results by checking comp.% before and after reformatting and also in reformatting the text to the required journal format.

The proposed system reduces both efforts and time needed to reformat any text, and also gives acceptable results. The compatibility percent's of the reformatted texts reached to high values; it reaches to 99%. While the time needed to reformat any paper is reduced by 66%.

5.2 Recommendations

It is recommended to use neural networks and artificial intelligent tools to improve the proposed system to be an intelligent system to have a website in the network for more flexibility and applicability.

References

Alomari Z., El Halimi O., Sivaprasad K., and Pandit C. (2015). Comparative Studies of Six Programming Languages. at: https://www.researchgate.net/publication/274572185.

Bencze I. , Fark P., Hatala L., And Jeszenszky P.(2006). Server side PDF generation based on LATEX templates. TUGboat, Volume 27, No. 1—**Proceedings of EuroTEX2006.**

Bhunia A., Bhunia A. K., Banerjee P., Konwer A., Bhowmick A., Roy P., and Umapada Pal U. (2017). Word Level Font-to-Font Image Translation using Convolutional Recurrent Generative Adversarial Networks. E-mail of corresponding author: 2partharoy@gmail.com.

Hu J., Fang L., Cao Y. Zeng H., Li H. Yang Q., and Chen Z. (2008). Enhancing Text Clustering by Leveraging Wikipedia Semantics. **SIGIR'08**, July 20–24, 2008, Singapore.

Kawade G. and Ballal S. (2012). A Role Of Virtual Machine In Operating System. **Software Engineering.** Volume 3, Issue 1, 2012, pp.-21-24.

Kriesel D. (2005). A brief introduction to neural networks.dkriesel.com. http://www.dkriesel.com/en/science/neural_networks.

Kumar G. and Bhatia P. (2013). Neural Network based Approach for Recognition of Text Images. **International Journal of Computer Applications**(8887 – 0975) Volume 62– No.14.

Reul C., Dittrich M. and Martin Gruner M. (2016), Case Study of a highly automated Layout Analysis and OCR of an incunabulum: '**Der Heiligen Leben'** (1488). Available at https://go.uniwue.de/itf954ocr 2 http://www.kallimachos.de

Shetty R., and Heraje N. (2017). Recognition of Formatted Text using Machine Learning Technique. **American Journal of Intelligent Systems**, 7(3): 64-67.

Stallings W.(2005). Operating Systems: Internals and Design Principles, Fifth Edition. Prentice Hall, 2005.

Taqdir and Uttarhanica (2016) Recognition of Handwritten Characters Using Neural

Networks. **International Journal of Innovative Research in Computer and Communication Engineering** Vol. 4, Issue 6, June 2016.

Vijayarani S., and Sakila A. (2015). Template Matching Technique for Searching Words in Document Images. **International Journal on Cybernetics & Informatics (IJCI)** Vol. 4, No. 6.

Widjaja M., and Hansun S. (2015). Implementation of Porter's Modified Stemming Algorithm in an Indonesian Word Error Detection Plug in Application. **International Journal of Technology** (2015) 2: 139-150.

Yessenov K. et al. (2013). A Colorful Approach Text Processing by example. **UIST'13**, October 8–11, 2013, St. Andrews, UK.

Internet websites

http://www.oracle.com/html/privacy.htm, 2012. Date: 14-12-2018.

Scott Shell, 2014- https://engineering.ucsb.edu/~shell/che210d/python.pdf. Date: 15-12-2018.

http://ubuntu-manual.org. Date: 15-12-2018.

https://stepshot.atlassian.net/wiki/spaces/SGD/pages/122486821/How+to+configure+PDF+Template, date of entry: 15-12-2018.

http://aka.ms/623026/files, step by step office word 2007. Microsoft Press. Date: 15-12-2018

https://lib2.colostate.edu/images/cat/Acrobat_Intro_Create_Office.pdf. Date: 16-12-2018.

Academic and Research Computing, (2007). Text Formatting with LATEX. (http://www.rpi.edu/dept/arc/training/latex/. Date: 16-12-2018.

Appendix A
Full Test Sample

The following represents a full text paper in original format and then a reformatted paper using the proposed system

- **The original paper**

Measuring Natural Frequency of Mechanical Structures and Bio-Systems

SAYEL M. FAYYAD
Department of Mechanical Engineering,
Faculty of Engineering Technology,
Al Balqa' Applied University
Amman – Jordan

ABSTRACT

Natural frequency is a very important quantity for any structure or system. It determines its behavior and consider as a constraint to its translation or its oscillatory motion in space in general. The natural frequency can be defined as the frequency at which a system oscillates when it is disturbed. The natural frequency consider important for many reasons: the first reason is that all things in the universe have a natural frequency, and many things have more than one. Secondly if the natural frequency of an object is known, its vibrational motion can be defined. Also if the objects' vibration is defined, then the kinds of waves created by its vibration will be known. Finally if some specific kinds of waves are required to some structure or system, some objects with specific natural frequencies are required or created that match the waves needed. This work presents a study and constructing of natural frequency measurement system to be used in measuring the natural frequency of some mechanical structures, mechanisms, and some applications in bio-systems like human body. This system depends on measuring the two main quantities required to calculate the natural frequency: the mass (M) and the stiffness constant of the system (K). Such measurements include mechanical systems and structures and also bio-systems like human body or some parts of human body. It is found that age, mass and stiffness coefficient of the human body pars affects strictly on the natural frequency of the human body. As the mass increases the natural frequency decrease, which make the body becomes weak in facing external vibrations. While as the stiffness values increase the natural frequency values increase and hence human body resistance to external vibrations increase.

KEYWORDS: Natural Frequency, Mechanical Structures, Mechanisms, Bio-Systems, Vibrations.

INTRODUCTION

The natural frequency varied from structure to structure and it depends mainly on mass and stiffness of the structure. The natural frequency can be considered as a unique value for structures because it is too difficult to have the same stiffness to mass ratio for any two different structures.

Natural frequencies can be considered as a fingerprint of an object. This is so for buildings as well as for objects of our daily life. Essentially, these natural frequencies are characterized by the geometry and by the material of these objects. For example, large bodies oscillate inaudibly with few vibrations per second or fewer (bridges, for example). On the other hand, small parts sound with a clearly perceptible tone or can be identified only by suitable sensors in the ultrasonic range (for example, small screws or pins). The natural mode is an internal dynamic property of a freely oscillating structure, the consequence of which is a particular deformation behavior.

The main objective is to create a tool or measurement system to evaluate the natural frequency of such mechanical systems and humans because no two humans have the same value which can be considered like DNA. Vibrations have significant effects on human body, so if the natural frequency of the human body is evaluated correctly, then the effects of vibrations on the human body can be specified and quantified easily.

The importance of the natural frequency that whenever the natural frequency of vibration of a machine or structure coincides with the frequency of the external excitation, phenomenon known as resonance will occur, which leads to excessive deflections and failure. The literature is full of accounts of system failures brought about by resonance and excessive vibration of components and systems.

It is known that for any oscillating body, such body has several such natural frequencies or also vibrating modes. The nature of the extent and direction of the vibrations are characteristic of these modes. For solids, a differentiation is made between longitudinal and transverse modes of vibration. Longitudinal waves oscillate in the direction of propagation and transverse waves at right angles thereto. Also the geometry of the studied component is a main factor which determines the number and distribution of the natural frequencies; a rectangular solid shape for example has only a few natural frequencies, whereas a complex work piece has numerous (up to several hundred) natural frequencies. Hence the natural frequencies depend on the strength, the geometry and the material; these can be used in order to evaluate an object also with respect to mechanical parameters. This is done within the framework of "acoustic resonance analysis". Natural frequency is changed

when the component geometry is changed. For example, a crack has an effect on the strength of a component and its natural frequencies are accordingly changed.[1, 2]

Vibrations have a strong effects on human body, mechanical systems, machines, and structures, they can cause cracks, damage, or failure. Figure 1. Shows the failure of Tacoma

Bridge in 1940 because of vibrations and resonance. Because of the devastating effects that vibrations can have on machines and structures, vibration testing has become a standard procedure in the design and development of most engineering systems.[6]

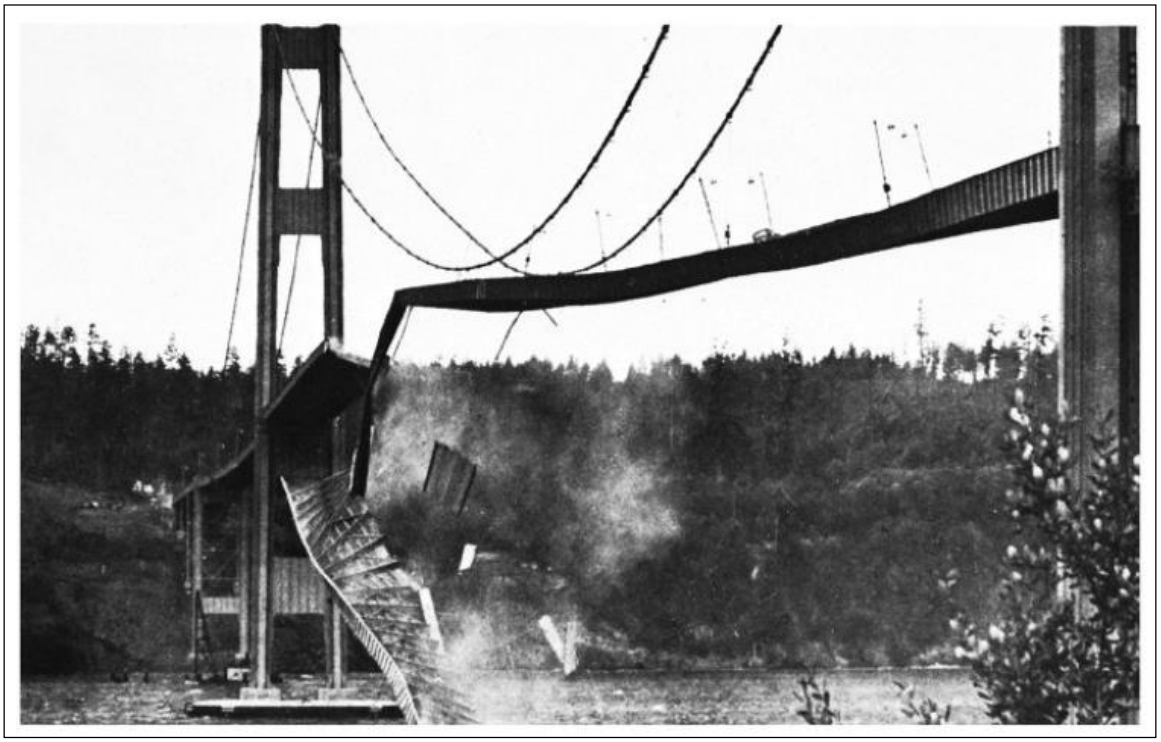


Fig.1 Tacoma Narrows bridge during wind-induced vibration. The bridge opened on July 1, 1940, and collapsed on November 7, 1940. (Farquharson photo, Historical Photography Collection, University of Washington Libraries-Rao).[6]

So studying and analyzing the effects of vibration and also natural frequencies on mechanical and bio-systems is a very important issue that may give the designers an idea about the safety requirements should be taken during systems' operation to against such vibrations effects and to avoid some problems caused by vibrations like resonance and others.

LITERATURE REVIEW

There are little papers dealt with such issue, most of previous works concentrated on the effects of vibrations on human body. **Dariusz W. (2006)** discussed the issue of natural frequencies of parts of the human body which has been raised and attention has been drawn to the lack of data about natural frequencies of parts of the child's body. A method has been proposed that would make it possible to estimate the frequencies of free vibration of organs and parts of the child's body, based on data collected from adults. A computational method to estimate the natural frequencies of parts of the body has been presented. Results of

experimental road tests carried out with the use of dummies representing an adult (HYBRID II) and a child, made at PIMOT, have been included. [1]

Helmut W. et al. (2011) proved that the human body can be considered as a whole and each individual organ have natural frequencies that can resonate with vibration energy received at their natural frequencies. Resonance of the body or its parts due to WBV is suspected to cause adverse health effects, primarily with chronic exposure. Presently, most evidence supporting this relationship is epidemiological. Direct medical evidence is scarce, especially when compared to the greater amounts of data available for hand-arm vibration (HAV) illnesses that occur at higher frequency ranges. [2]

Nikooyanz et al. (2011) Reviewed the various types of mass– spring–damper models including one-body and multi-body models. The governing equations of motion of all models as well as their parameters are presented. The specific ways that the models take account of the shoe–ground interactions are discussed as well. The methods used for determination of different modeling parameters are briefly surveyed. The advantages and disadvantages of the different types of mass–spring–damper models are also discussed. The paper concluded with a brief discussion of possible future research trends in the area of mass–spring–damper modeling and apply them as a human body system.[4]

Gregory P. S. (2008). Three purposes of this study the first one was to measure the acute effect of seated whole-body vibration on the postural control of the trunk during unstable seated balance. The second study was to measure the effect of seated whole-body vibration on the parameters of spinal stability control: passive stiffness, active stiffness, and neuromuscular reflexes. The third was to measure the changes in the natural frequency characteristics of the trunk (which can be related to trunk stiffness and damping) during exposure to seated whole-body vibration. The findings show that whole-body vibration caused a decrease in natural frequency suggesting a decrease in the trunk stiffness, and also an increase in the peak amplitude of the frequency response functions suggesting a decrease in overall trunk damping. [3]

Jacob R. et al. (2003). Studied the dynamic characteristics of a seated human body/seat system in a vibration environment. The main result is a multi degrees of freedom lumped

parameter model that synthesizes two basic dynamics: (i) global human dynamics, the apparent mass phenomenon, including a systematic set of the model parameters for simulating various conditions like body posture, backrest, footrest, muscle tension, and vibration directions, and (ii) the local human dynamics, represented by the human pelvis/vibrating seat contact, using a cushioning interface. The model and its selected parameters successfully described the main effects of the apparent mass phenomenon compared to experimental data documented in the literature. The model provided an analytical tool for human body dynamics research. It also enabled a primary tool for seat and cushioning design. The model was further used to develop design guidelines for a composite cushion using the principle of quasi-uniform body/seat contact force distribution.[5]

NATURE OF THE PROBLEM

Analyzing and studying the phenomena of natural frequency of some mechanical and bio-systems (human body) and suggesting some measurement system to measure natural frequency of such structures.

OBJECTIVES

1. Study, analyze, and evaluate the natural frequency of some mechanical and bio-systems like human body.
2. Studying and analyzing the effects of vibrations on human body.

MATERIALS AND METHODS

Depending on the theory of the strength of materials, the longitudinal and bending stiffness of a beam or bar elements depends on the modulus of longitudinal elasticity (Young's modulus, E). For tension, the specific stiffness K is defined as:

$$K = \frac{E.A}{L} \qquad (1)$$

Where A: is the cross-sectional area (m^2), E: is the modulus of elasticity of the material (Pa), L: is the length of the element.

For unity length, equation (1) becomes:

$$K = E.A \qquad (2)$$

The natural frequency can defined as:

$$w_0 = \sqrt{\frac{K}{M} - (C/2M)} \qquad (3)$$

Where C: is the damping coefficient-which will be neglected here. So the natural frequency for any system or mechanism or bio-system (which is generally composed from more than one element) can be given as:

$$w_0 = \sqrt{\frac{K_{equ}}{M_{equ}}} \tag{4}$$

Where K_{equ}: is the equivalent stiffness coefficient (or equivalent spring constant) for all elements of the system or structure, M_{equ}: is the equivalent mass of the system.
So once K_{equ}, and M_{equ} of some mechanical element or structure are calculated or measured the natural frequency is easily determined.
Finding equivalent stiffness (K_{equ}) depending strictly on calculating the potential energy of the system i.e.P.E, while equivalent mass (M_{equ}) of any system depending determining the kinetic energy of the system.
As an example let us take the following mechanical system. Figure 2 shows some mechanical system.

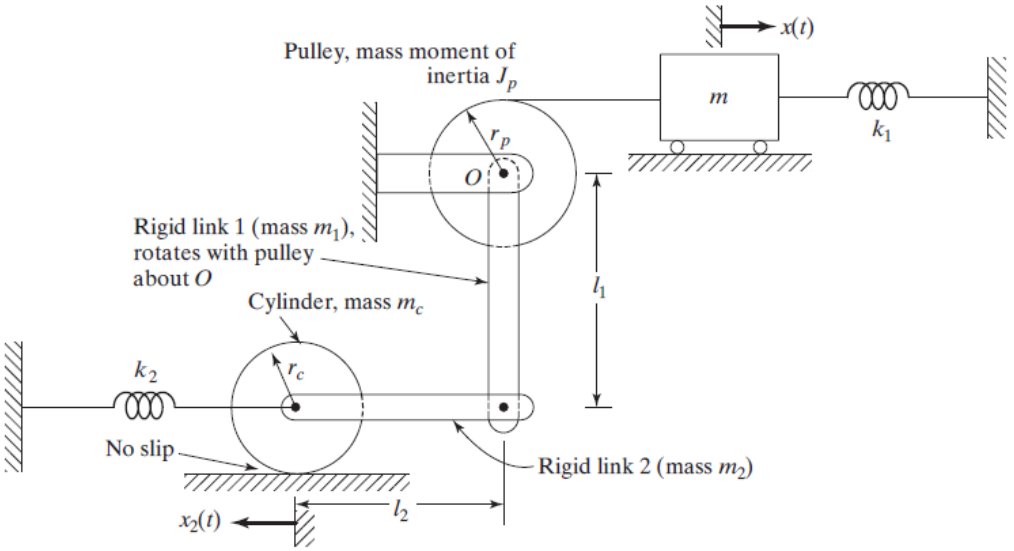


Fig.2 Mechanical system [6]

To find the equivalent mass: the kinetic energy of the system is calculated which can be written as:

$$T = \frac{1}{2}m\dot{x}^2 + \frac{1}{2}J_p\dot{\theta}^2 + \frac{1}{2}J_1\dot{\theta_1}^2 + \frac{1}{2}m_2\dot{x}_2{}^2 + \frac{1}{2}J_c\dot{\theta_c}^2 + \frac{1}{2}m_c\dot{x}_2{}^2 \tag{5}$$

Which gives an equivalent mass as:

$$M_{equ} = m + \frac{J_p}{r_p^2} + \frac{1}{3}\frac{m_1 l_1^2}{r_p^2} + \frac{m_2 l_1^2}{r_p^2} + \frac{1}{2}\frac{m_c l_1^2}{r_p 2} + m_c\frac{l_1^2}{r_p^2} \tag{6}$$

The equivalent stiffness constant K_{equ} for this system is calculated by using potential energy of the system. Then the natural frequency of the system can be determined easily using

equation (4).

For a human body or bio-systems the same procedure is followed i.e. if the mass of the human is determined using any method like using simply some balance or weighing system which considered as M_{equ}, and if the stiffness of the body is calculated or measured which considered as K_{equ}, then the natural frequency of the body can be calculated using equation (4) too.

METHODS OF NATURAL FREQUENCY MEASUREMENTS

There are many methods, techniques, and devices to measure natural frequency of mechanisms, systems, structures, and bio-systems including human bodies. Some of these methods like:

Stimulation method

Stimulation operations causes the test object to vibrate at its resonance frequency. This method uses sensors then record these vibrations. Noise is used to make vibrations: The component is acted continuously upon by an actor (shaker, loudspeaker) with broadband noise. Since the noise simultaneously contains all frequencies, the component responds with its natural frequencies. In practice, however, this method is used infrequently, since it is difficult to apply the energies required for the stimulation. Sinus The component is acted upon continuously by an actor (piezo-ceramic oscillator, loudspeaker) with a single frequency. This is a very precise method for determining the natural frequencies. This method permits the natural frequencies to be determined rapidly and the decay behavior to be evaluated. Fig. 3 shows the most common method of simulation.[1-5]

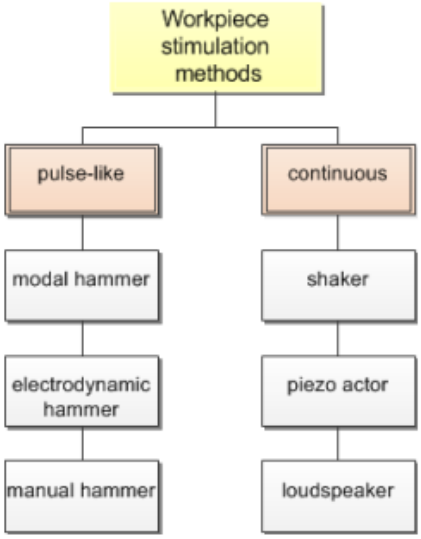


Fig.3 Noise method to determine natural frequency

In this method a simulating device is used, a modal hammer uses a quartz force sensor on the beating side of the head of the hammer; the sensor measures the force during the striking. Since the stimulating force has an effect on the amplitude of a resonance frequency but not on the position of the frequency, a modal hammer is not absolutely necessary for measuring the natural frequency. The electrodynamics hammer is designed so that it makes

only brief contact with the test object. The striking force is adjustable and makes constant amplitudes possible. This device is adequate for determining the natural frequencies and is used predominantly for automated solutions. Also the sensor system is a body sound sensors, such as acceleration sensors or laser vibrometers are frequently used to measure natural frequencies. However, these measures the vibrations only point by point. A statement for the whole of the workpiece is not possible.

2-Evaluation method using Fourier series

This method using Modal analysis which is the method used most frequently in laboratory applications. The transfer function of the component is used for determining the natural frequencies of the element. For this purpose it is necessary to measure the resonance response of the test object as well as the stimulation itself. All the measurements are made using force and/or acceleration sensors, which are mounted on the modal hammer, used for the stimulation, as well as on the workpiece. Frequently, numerous stimulations are brought about at different positions of the workpiece, in order to be able to represent the vibration forms of the workpiece by means of a lattice model. It should be noted here that the natural frequencies resulting from the additional mass of the sensors be kept as small as possible. In manufacturing applications, the pulse-type stimulation with an electrodynamics hammer is generally used and the natural frequencies of the measured component vibrations are calculated by a frequency analysis (FFT, Fast Fourier Transformation). The advantage of this method lies there in that the attenuation of the individual natural frequencies as well as their quality can be determined.[7]

MODELING RESULTS AND DISCUSSION

Suggested methods

1. Direct method

   The suggested method is summarized by the following flow-chart

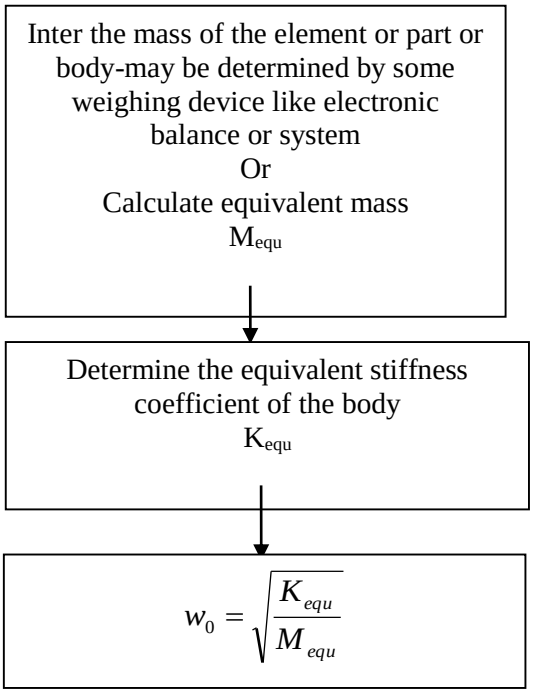


Fig.4 Flow-chart to calculate the natural frequency of any body

For example for a human leg of 78 kg mass, the stiffness constant of the leg is 28500 N/m, the natural frequency is calculated to be 19.11 rad/s.

Now if the human body is simulated to be a collection of springs, dampers and masses like that in Figure 5.

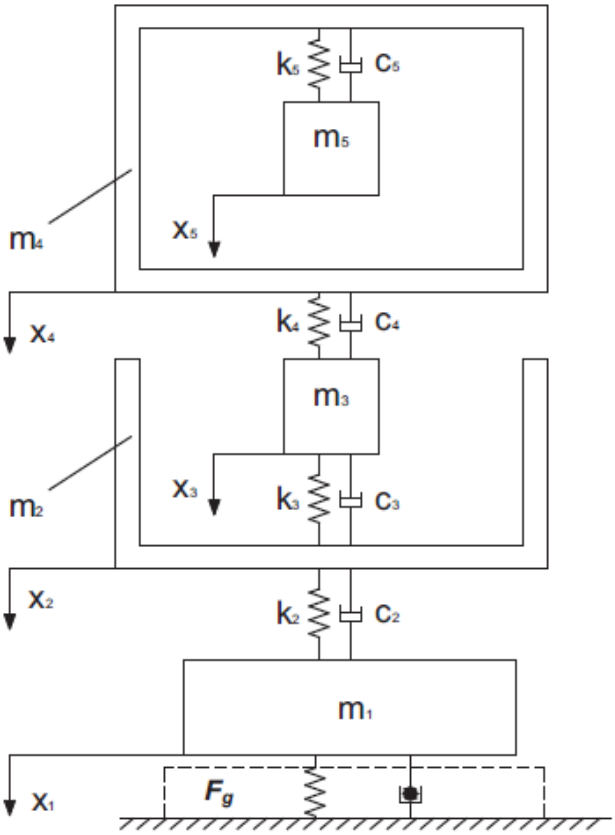


Fig.5 Case-study of human body simulation

Now to calculate the natural frequency of each part of the body model, mass and stiffness values are needed. From [5] suggested values of m's and k's are taken to be as follows: m_1 = 1.8 kg , k_2 = 1x10^5 N/m, m_2 = 6.3 kg, k_3=50N/m, m_3 = 5.4 kg, k_4=75 N/m, m_4 = 22.5 kg, k_5=10 N/m, and m_5=54 kg.(All damping values are neglected) The natural frequency for each part are calculated in table 1 below.

Table 1 Natural Frequencies of the studied model

mass (kg)	k(N/m)	w_0(rad/s)
m_2=6.3	k_2=100000	125.98
m_3=5.4	k_3=50	3.04
m_4=22.5	k_4=75	1.83
m_5=54	k_5=10	0.43

To calculate the total human body natural frequency modeled as in Figure 5. Both equivalent mass and stiffness is required. After calculations it is found that the natural frequency of human body depends on mass of the part and its stiffness and the values ranged from 0.5 Hz to 1000 Hz. If an average person of 60 kg (depending on its kinetic energy) is taken and if its all stiffness i.e. K_{equ}=50000N/m (depending in its potential energy) then its natural frequency is equal to 28.86 rad/s. For example human brain has a natural frequency ranging from few Hz to 20 Hz body skin has a frequency of 1000 Hz.

External vibrations affects human body but this depends on the part affected and the frequency of the external effect, which will make what is called resonance: i.e the maximum value of frequency received by the part of the body or the external frequency is reaches to the values of the natural frequency of the part. Figure 6 shows some values of resonance frequency of the human body. Figure 6 shows some calculated values of natural frequency or resonance frequencies (which represents the maximum value of N. Freq.) of human body parts.

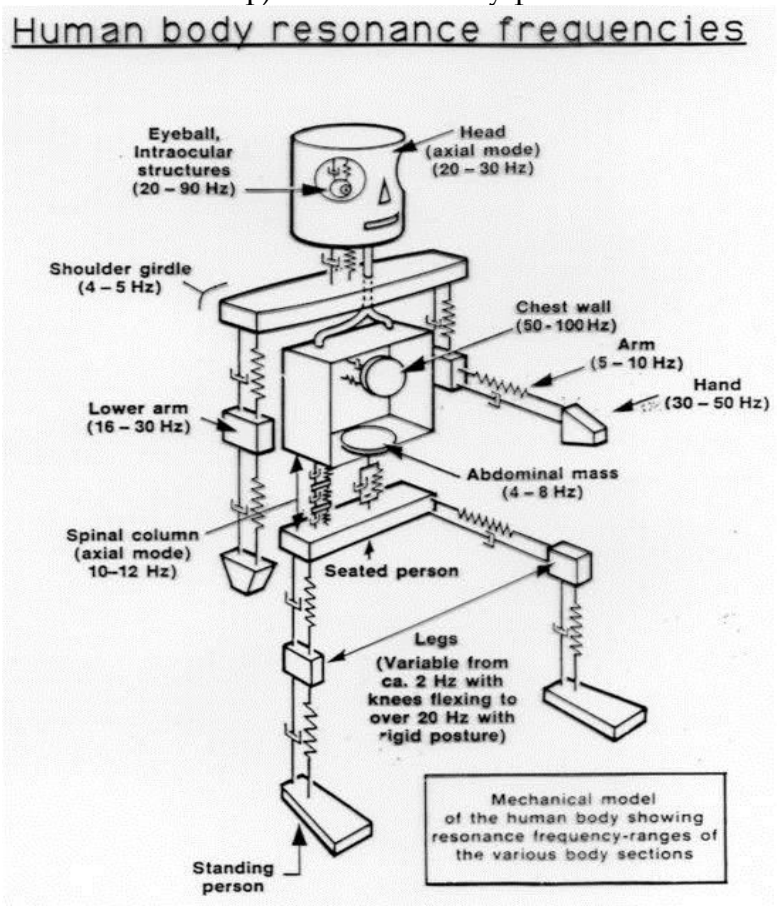


Fig. 6 Natural frequency values of some human body parts.

Some effects of vibrations on human body

The transmission of vibration to the human body at the natural frequency of the body as a whole or of its individual parts will result in resonance. It will make the body or a part of the body will vibrate at a magnitude greater than the applied vibratory force.
Some responses can be noticed, muscles will contract in a voluntary or involuntary manner and cause fatigue or a reduction in motor performance capacity. This response may be considered adverse in the occupational realm; however, some view whole body vibration-WBV- as a means to achieve body strengthening as part of an exercise regimen. WBV platforms are now popular and in widespread use for athletic training.
Health effects include interference with or irritation to the lungs, abdomen or bladder. Also, vibrations have adversely affects the digestive, genital/urinary and female reproductive systems. They have an effect on vision. It is noticed that WBV and vehicle jarring contributing on back pain in the mining industry and as a significant risk to mobile equipment operators.[8-10]
Vibrations have effects on the head, back and neck, and vehicular jarring.

Parameters affect on the natural frequency of human body

Three main parameters affects on human body's natural frequency: age, weight or mass, and stiffness coefficient of its parts. If the equivalent mass of the human body increases the natural frequency of the whole body decreases, age affects on both mass and stiffness of the human body. The main parameter is the equivalent stiffness constant of the human body which represents the resistance of the body or structure to external loads or frequencies. It is noticed that as the stiffness constant of the human body increases the natural frequency increase, and so the external vibration value which will cause resonance to human body parts affected by such vibrations increases. Figure 7 shows the relation between natural frequency values for different stiffness constants at affixed average mass of human body taken as 70 kg as an average value.

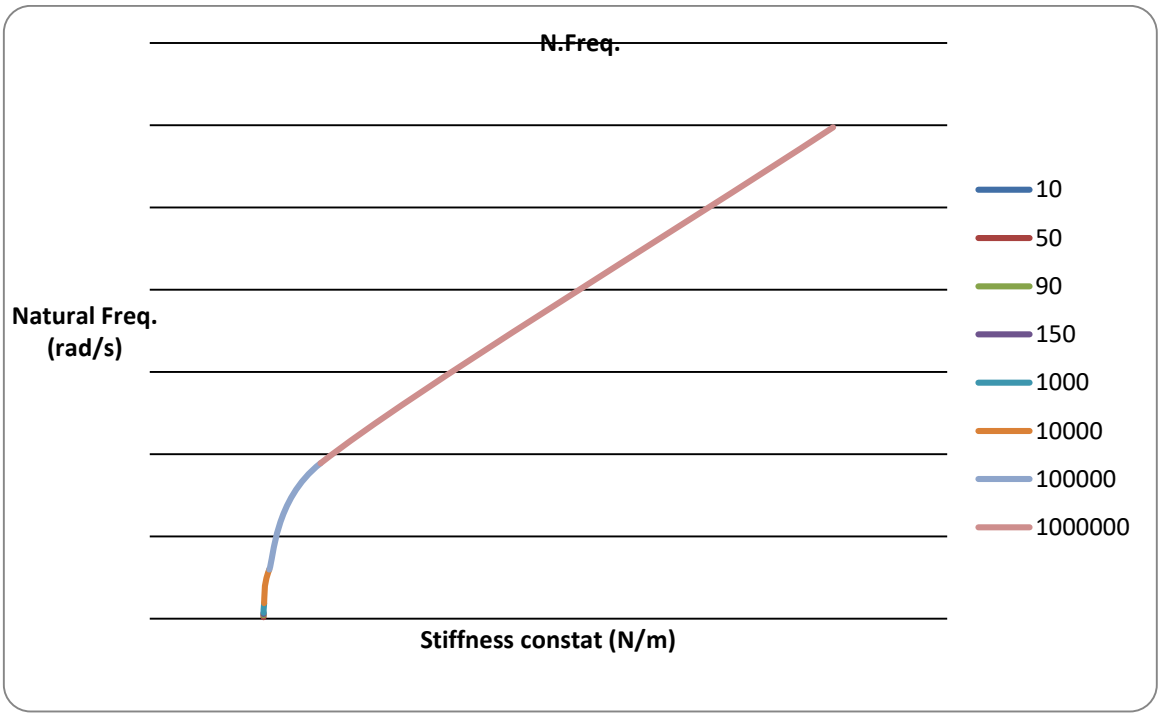


Fig. 7. Natural frequency of human body as a relation with stiffness coefficent.

Figure 8 shows the natural frequency values of the human body as a relation with the equivalent mass of the body-calculated at constant stiffness of 10000 N/m.

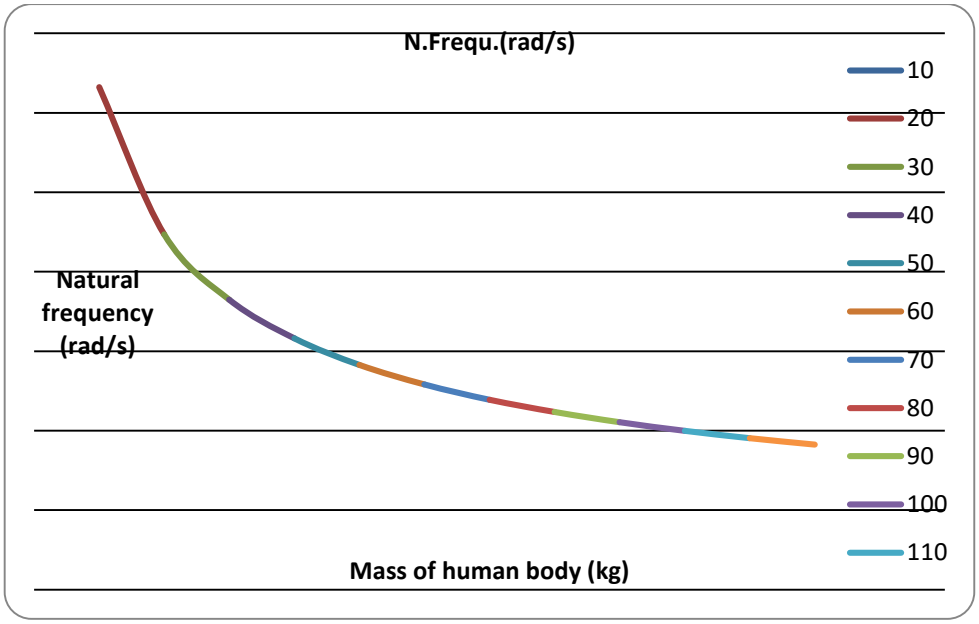


Fig.8 Natural requency of human body as a relation with mass

CONCLUSIONS

In this report the natural frequency of some mechanical structures simulate human bodies are studied, analyzed and calculated. The suggested measurement system depends directly on calculating both equivalent mass and stiffness of human body. Affects of vibrations on human body are studied which will causes resonance of that parts, also factors affects the values of natural frequency values of human body parts are analyzed. It is found that age, mass and stiffness coefficient of the human body pars affects strictly on the natural frequency of the human body. As the mass increases the natural frequency decrease, which make the body becomes weak in facing external vibrations. While as the stiffness values increase the natural frequency values increase and hence human body resistance to external vibrations increase.

ACKNOWLEDGMENT

This work has been carried out during sabbatical leave granted to the author Sayel M. Fayyad from Al-Balqa' Applied University (BAU) during the academic year 2015/2016. I would like to conduct my deepest appreciation to Al-Balqa' Applied University (BAU) for its support and constant help during the sabbatical leave period.

REFERENCES

[1] Dariusz Więckowski, 2006, "An Attempt to Estimate Natural Frequencies of Parts of the Child's Body", Automotive Industry Institute, Simulation Tests Laboratory, 55 Jagiellońska Street, 03-301 Warszawa, e-mail: d.wieckowski@pimot.org.pl.

[2] By Helmut W. Paschold and Alan G. Mayton, 2011, "Whole-Body Vibration Building Awareness in SH&E", Professional Safety Journal, APRIL 2011 www.asse.org.

[3] Gregory P Slota, 2008, "Effects of Seated Whole-Body Vibration on Spinal Stability Control", Dissertation submitted to the Faculty of the Virginia Polytechnic Institute and State University, November 14th, 2008 Blacksburg, Virginia.

[4] A A Nikooyanz and A A Zadpoor , 2011, Mass–spring–damper modelling of the human body to study running and hopping – an overview Proc. IMechE Vol. 225 Part H: J. Engineering in Medicine

[5] Jacob Rosen1, and Mircea Arcan, 2003, Modeling the Human Body/Seat System in a Vibration Environment Journal of Biomechanical Engineering, Vol. 125 (2-23).

[6] Singiresu S. Rao, 2010, Mechanical Vibrations Fifth Edition, Prentice Hall.

[7] Tomáš Hararik, Jozef Bocko, Kristína Maslákova, 2012, Frequency analysis of acoustic signal using the Fast Fourier Transformation in MATLAB, Procedia Engineering 48 (2012) 199 – 204

[8] J. M. Randall, R. T. Matthews and M. A. Stiles,1997, 'Resonant frequencies of standing

humans', Ergonomics, 40 (9), pp.879-886, 1997.

[9] . Y. Matsumoto, M. J. Griffin, 'Dynamic response of the standing human body exposed to vertical vibration: influence of posture and vibration magnitude', Journal of Sound and Vibration, Vol. 212, No. 1, pp. 85-107, Apr 1998

[10] B. R. Ellis and T. Ji, 'Human-structure interaction in vertical vibrations', Structures and Building, Proceedings ICE, 122, pp.1-9, Feb 1997.

-The following represents the reformatted paper upon the instructions and the proposed system

Measuring Natural Frequency of Mechanical Structures and Bio-Systems

SAYEL M. FAYYAD
Department of Mechanical Engineering,
Faculty of Engineering Technology,
Al Balqa' Applied University
Amman – Jordan

ABSTRACT

Natural frequency is a very important quantity for any structure or system. It determines its behavior and consider as a constraint to its translation or its oscillatory motion in space in general. The natural frequency can be defined as the frequency at which a system oscillates when it is disturbed. The natural frequency consider important for many reasons: the first reason is that all things in the universe have a natural frequency, and many things have more than one. Secondly if the natural frequency of an object is known, its vibrational motion can be defined. Also if the objects' vibration is defined, then the kinds of waves created by its vibration will be known. Finally if some specific kinds of waves are required to some structure or system, some objects with specific natural frequencies are required or created that match the waves needed. This work presents a study and constructing of natural frequency measurement system to be used in measuring the natural frequency of some mechanical structures, mechanisms, and some applications in bio-systems like human body. This system depends on measuring the two main quantities required to calculate the natural frequency: the mass (M) and the stiffness constant of the system (K). Such measurements include mechanical systems and structures and also bio-systems like human body or some parts of human body. It is found that age, mass and stiffness coefficient of the human body pars affects strictly on the natural

frequency of the human body. As the mass increases the natural frequency decrease, which make the body becomes weak in facing external vibrations. While as the stiffness values increase the natural frequency values increase and hence human body resistance to external vibrations increase.

KEYWORDS: *Natural Frequency, Mechanical Structures, Mechanisms, Bio-Systems, Vibrations.*

INTRODUCTION

The natural frequency varied from structure to structure and it depends mainly on mass and stiffness of the structure. The natural frequency can be considered as a unique value for structures because it is too difficult to have the same stiffness to mass ratio for any two different structures.

Natural frequencies can be considered as a fingerprint of an object. This is so for buildings as well as for objects of our daily life. Essentially, these natural frequencies are characterized by the geometry and by the material of these objects. For example, large bodies oscillate inaudibly with few vibrations per second or fewer (bridges, for example). On the other hand, small parts sound with a clearly perceptible tone or can be identified only by suitable sensors in the ultrasonic range (for example, small screws or pins). The natural mode is an internal dynamic property of a freely oscillating structure, the consequence of which is a particular deformation behavior.

The main objective is to create a tool or measurement system to evaluate the natural frequency of such mechanical systems and humans because no two humans have the same value which can be considered like DNA. Vibrations have significant effects on human body, so if the natural frequency of the human body is evaluated correctly, then the effects of vibrations on the human body can be specified and quantified easily.

The importance of the natural frequency that whenever the natural frequency of vibration of a machine or structure coincides with the frequency of the external excitation, phenomenon known as resonance will occur, which leads to excessive deflections and failure. The literature is full of accounts of system failures brought about by resonance and excessive vibration of components and systems.

It is known that for any oscillating body, such body has several such natural frequencies or also vibrating modes. The nature of the extent and direction of the vibrations are characteristic of these modes. For solids, a differentiation is made between longitudinal and transverse modes of vibration. Longitudinal waves oscillate in the direction of propagation and transverse waves at right angles thereto. Also the geometry of the studied component is a main factor which determines the number and distribution of the natural frequencies; a rectangular solid shape for example has only a few natural frequencies, whereas a complex work piece has numerous (up to several hundred) natural frequencies. Hence the natural frequencies depend on the strength, the geometry and the material; these can be used in order to evaluate an object also with respect to mechanical parameters. This is done within the framework of "acoustic resonance analysis". Natural frequency is changed

when the component geometry is changed. For example, a crack has an effect on the strength of a component and its natural frequencies are accordingly changed.[1, 2]

Vibrations have a strong effects on human body, mechanical systems, machines, and structures, they can cause cracks, damage, or failure. Figure 1. Shows the failure of Tacoma Bridge in 1940 because of vibrations and resonance. Because of the devastating effects that vibrations can have on machines and structures, vibration testing has become a standard procedure in the design and development of most engineering systems.[6]

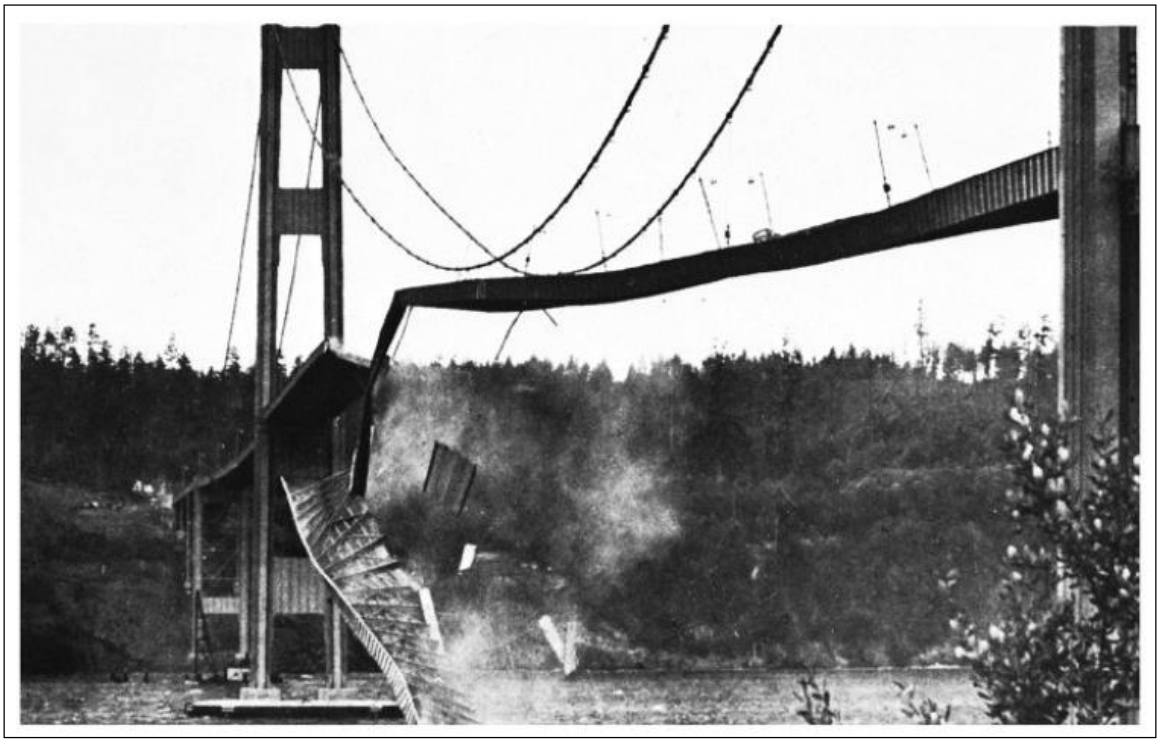


Fig.1 Tacoma Narrows bridge during wind-induced vibration. The bridge opened on July 1, 1940, and collapsed on November 7, 1940. (Farquharson photo, Historical Photography Collection, University of Washington Libraries-Rao).[6]

So studying and analyzing the effects of vibration and also natural frequencies on mechanical and bio-systems is a very important issue that may give the designers an idea about the safety requirements should be taken during systems' operation to against such vibrations effects and to avoid some problems caused by vibrations like resonance and others.

LITERATURE REVIEW

There are little papers dealt with such issue, most of previous works concentrated on the effects of vibrations on human body. Dariusz W. (2006) discussed the issue of natural frequencies of parts of the human body which has been raised and attention has been drawn to the lack of data about natural frequencies of parts of the child's body. A method

has been proposed that would make it possible to estimate the frequencies of free vibration of organs and parts of the child's body, based on data collected from adults. A computational method to estimate the natural frequencies of parts of the body has been presented. Results of experimental road tests carried out with the use of dummies representing an adult (HYBRID II) and a child, made at PIMOT, have been included. [1]

Helmut W. et al. (2011) proved that the human body can be considered as a whole and each individual organ have natural frequencies that can resonate with vibration energy received at their natural frequencies. Resonance of the body or its parts due to WBV is suspected to cause adverse health effects, primarily with chronic exposure. Presently, most evidence supporting this relationship is epidemiological. Direct medical evidence is scarce, especially when compared to the greater amounts of data available for hand-arm vibration (HAV) illnesses that occur at higher frequency ranges. [2]

Nikooyanz et al. (2011) Reviewed the various types of mass– spring–damper models including one-body and multi-body models. The governing equations of motion of all models as well as their parameters are presented. The specific ways that the models take account of the shoe–ground interactions are discussed as well. The methods used for determination of different modeling parameters are briefly surveyed. The advantages and disadvantages of the different types of mass–spring–damper models are also discussed. The paper concluded with a brief discussion of possible future research trends in the area of mass–spring–damper modeling and apply them as a human body system.[4]

Gregory P. S. (2008). Three purposes of this study the first one was to measure the acute effect of seated whole-body vibration on the postural control of the trunk during unstable seated balance. The second study was to measure the effect of seated whole-body vibration on the parameters of spinal stability control: passive stiffness, active stiffness, and neuromuscular reflexes. The third was to measure the changes in the natural frequency characteristics of the trunk (which can be related to trunk stiffness and damping) during exposure to seated whole-body vibration. The findings show that whole-body vibration caused a decrease in natural frequency suggesting a decrease in the trunk stiffness, and also an increase in the peak amplitude of the frequency response functions suggesting a decrease in overall trunk damping. [3]

Jacob R. et al. (2003). Studied the dynamic characteristics of a seated human body/seat system in a vibration environment. The main result is a multi degrees of freedom lumped parameter model that synthesizes two basic dynamics: (i) global human dynamics, the apparent mass phenomenon, including a systematic set of the model parameters for simulating various conditions like body posture, backrest, footrest, muscle tension, and vibration directions, and (ii) the local human dynamics, represented by the human pelvis/vibrating seat contact, using a cushioning interface. The model and its selected parameters successfully described the main effects of the apparent mass phenomenon compared to experimental data documented in the literature. The model provided an analytical tool for human body dynamics research. It also enabled a primary tool for seat and cushioning design. The model was further used to develop design guidelines for a composite cushion using the principle of quasi-uniform body/seat contact force distribution.[5]

NATURE OF THE PROBLEM

Analyzing and studying the phenomena of natural frequency of some mechanical and bio-systems (human body) and suggesting some measurement system to measure natural frequency of such structures.

OBJECTIVES

1. **Study, analyze, and evaluate the natural frequency of some mechanical and bio-systems like human body.**
2. **Studying and analyzing the effects of vibrations on human body.**

MATERIALS AND METHODS

Depending on the theory of the strength of materials, the longitudinal and bending stiffness of a beam or bar elements depends on the modulus of longitudinal elasticity (Young's modulus, E). For tension, the specific stiffness K is defined as:

$$K = \frac{E.A}{L} \qquad (1)$$

Where A: is the cross-sectional area (m^2), E: is the modulus of elasticity of the material (Pa), L: is the length of the element.
For unity length, equation (1) becomes:

$$K = E.A \qquad (2)$$

The natural frequency can defined as:

$$w_0 = \sqrt{\frac{K}{M} - (C/2M)} \qquad (3)$$

Where C: is the damping coefficient-which will be neglected here. So the natural frequency for any system or mechanism or bio-system (which is generally composed from more than one element) can be given as:

$$w_0 = \sqrt{\frac{K_{equ}}{M_{equ}}} \qquad (4)$$

Where K_{equ}: is the equivalent stiffness coefficient (or equivalent spring constant) for all elements of the system or structure, M_{equ}: is the equivalent mass of the system.
So once K_{equ}, and M_{equ} of some mechanical element or structure are calculated or measured the natural frequency is easily determined.
Finding equivalent stiffness (K_{equ}) depending strictly on calculating the potential energy of the system i.e.P.E, while equivalent mass (M_{equ}) of any system depending determining the kinetic energy of the system.
As an example let us take the following mechanical system. Figure 2 shows some mechanical system.

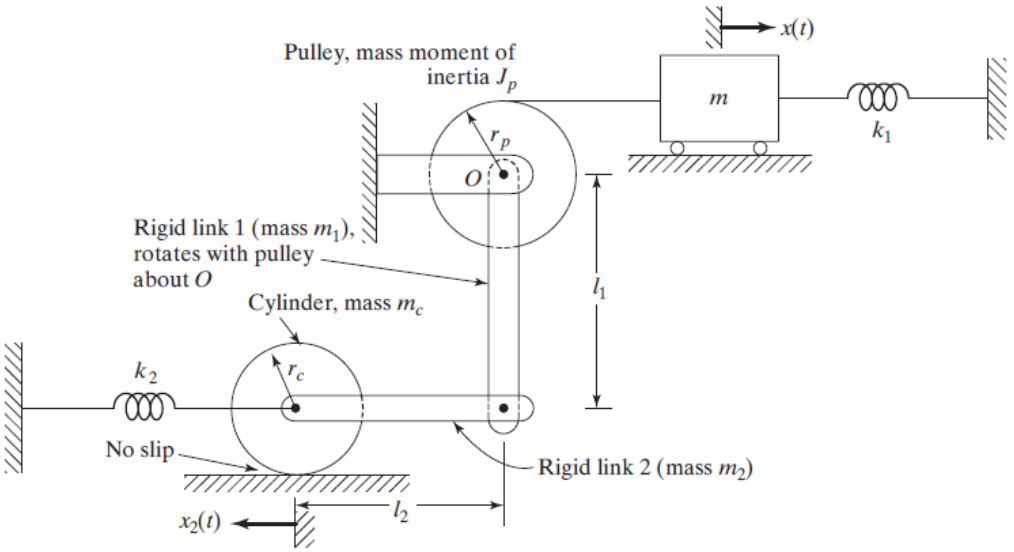


Fig.2 Mechanical system [6]

To find the equivalent mass: the kinetic energy of the system is calculated which can be written as:

$$T = \frac{1}{2}m\dot{x}^2 + \frac{1}{2}J_p\dot{\theta}^2 + \frac{1}{2}J_1\dot{\theta}_1^{\,2} + \frac{1}{2}m_2\dot{x}_2^{\,2} + \frac{1}{2}J_c\dot{\theta}_c^{\,2} + \frac{1}{2}m_c\dot{x}_2^{\,2} \qquad (5)$$

Which gives an equivalent mass as:

$$M_{equ} = m + \frac{J_p}{r_p^2} + \frac{1}{3}\frac{m_1 l_1^2}{r_p^2} + \frac{m_2 l_1^2}{r_p^2} + \frac{1}{2}\frac{m_c l_1^2}{r_p 2} + m_c\frac{l_1^2}{r_p^2} \qquad (6)$$

The equivalent stiffness constant K_{equ} for this system is calculated by using potential energy of the system. Then the natural frequency of the system can be determined easily using equation (4).

For a human body or bio-systems the same procedure is followed i.e. if the mass of the human is determined using any method like using simply some balance or weighing system which considered as M_{equ}, and if the stiffness of the body is calculated or measured which considered as K_{equ}, then the natural frequency of the body can be calculated using equation (4) too.

METHODS OF NATURAL FREQUENCY MEASUREMENTS

There are many methods, techniques, and devices to measure natural frequency of mechanisms, systems, structures, and bio-systems including human bodies. Some of these methods like:

Stimulation method

Stimulation operations causes the test object to vibrate at its resonance frequency. This method uses sensors then record these vibrations. Noise is used to make vibrations: The component is acted continuously upon by an actor (shaker, loudspeaker) with broadband noise. Since the noise simultaneously contains all frequencies, the component responds with its natural frequencies. In practice, however, this method is used infrequently, since it is difficult to apply the energies required for the stimulation. Sinus The component is acted upon continuously by an actor (piezo-ceramic oscillator, loudspeaker) with a single frequency. This is a very precise method for determining the natural frequencies. This method permits the natural frequencies to be determined rapidly and the decay behavior to be evaluated. Fig. 3 shows the most common method of simulation.[1-5]

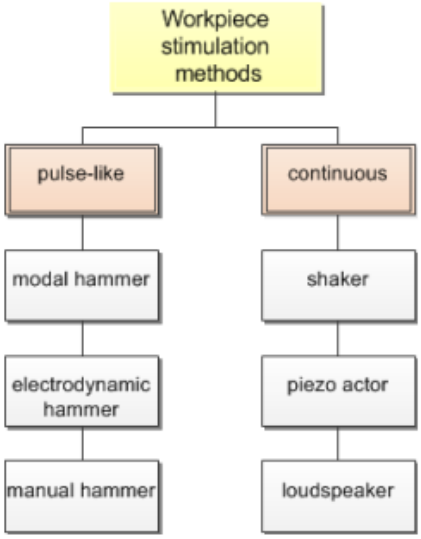


Fig.3 Noise method to determine natural frequency

In this method a simulating device is used, a modal hammer uses a quartz force sensor on the beating side of the head of the hammer; the sensor measures the force during the striking. Since the stimulating force has an effect on the amplitude of a resonance frequency but not on the position of the frequency, a modal hammer is not absolutely necessary for measuring the natural frequency. The electrodynamics hammer is designed

so that it makes only brief contact with the test object. The striking force is adjustable and makes constant amplitudes possible. This device is adequate for determining the natural frequencies and is used predominantly for automated solutions. Also the sensor system is a body sound sensors, such as acceleration sensors or laser vibrometers are frequently used to measure natural frequencies. However, these measures the vibrations only point by point. A statement for the whole of the workpiece is not possible.

2-Evaluation method using Fourier series

This method using Modal analysis which is the method used most frequently in laboratory applications. The transfer function of the component is used for determining the natural frequencies of the element. For this purpose it is necessary to measure the resonance response of the test object as well as the stimulation itself. All the measurements are made using force and/or acceleration sensors, which are mounted on the modal hammer, used for the stimulation, as well as on the workpiece. Frequently, numerous stimulations are brought about at different positions of the workpiece, in order to be able to represent the vibration forms of the workpiece by means of a lattice model. It should be noted here that the natural frequencies resulting from the additional mass of the sensors be kept as small as possible. In manufacturing applications, the pulse-type stimulation with an electrodynamics hammer is generally used and the natural frequencies of the measured component vibrations are calculated by a frequency analysis (FFT, Fast Fourier Transformation). The advantage of this method lies there in that the attenuation of the individual natural frequencies as well as their quality can be determined.[7]

MODELING RESULTS AND DISCUSSION

Suggested methods

2. **Direct method**

The suggested method is summarized by the following flow-chart

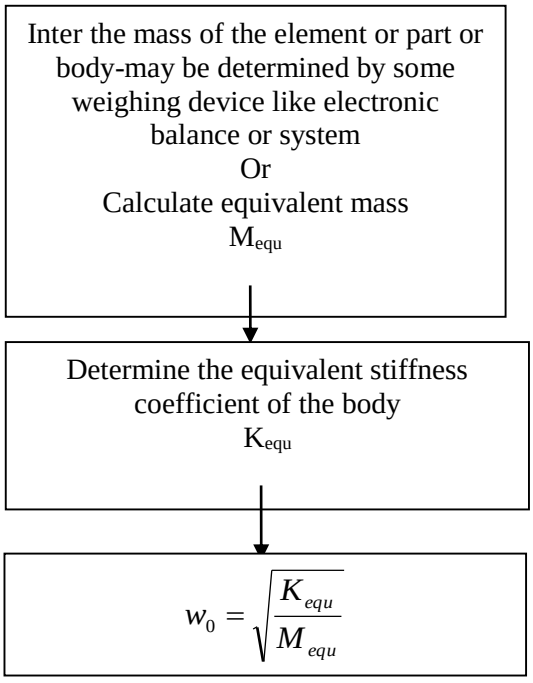


Fig.4 Flow-chart to calculate the natural frequency of any body

For example for a human leg of 78 kg mass, the stiffness constant of the leg is 28500 N/m, the natural frequency is calculated to be 19.11 rad/s.

Now if the human body is simulated to be a collection of springs, dampers and masses like that in Figure 5.

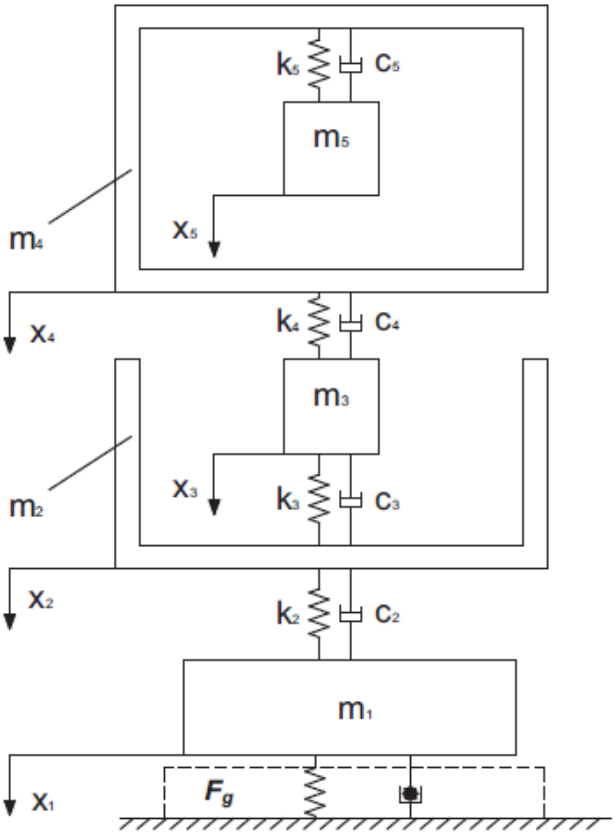


Fig.5 Case-study of human body simulation

Now to calculate the natural frequency of each part of the body model, mass and stiffness values are needed. From [5] suggested values of m's and k's are taken to be as follows: m_1 = 1.8 kg , k_2 = 1x10^5 N/m, m_2 = 6.3 kg, k_3=50N/m, m_3 = 5.4 kg, k_4=75 N/m, m_4 = 22.5 kg, k_5=10 N/m, and m_5=54 kg.(All damping values are neglected) The natural frequency for each part are calculated in table 1 below.

Table 1 Natural Frequencies of the studied model

mass (kg)	k(N/m)	w_0(rad/s)
m_2=6.3	k_2=100000	125.98
m_3=5.4	k_3=50	3.04
m_4=22.5	k_4=75	1.83
m_5=54	k_5=10	0.43

To calculate the total human body natural frequency modeled as in Figure 5. Both

equivalent mass and stiffness is required. After calculations it is found that the natural frequency of human body depends on mass of the part and its stiffness and the values ranged from 0.5 Hz to 1000 Hz. If an average person of 60 kg (depending on its kinetic energy) is taken and if its all stiffness i.e. K_{equ}=50000N/m (depending in its potential energy) then its natural frequency is equal to 28.86 rad/s. For example human brain has a natural frequency ranging from few Hz to 20 Hz body skin has a frequency of 1000 Hz.

External vibrations affects human body but this depends on the part affected and the frequency of the external effect, which will make what is called resonance: i.e the maximum value of frequency received by the part of the body or the external frequency is reaches to the values of the natural frequency of the part. Figure 6 shows some values of resonance frequency of the human body. Figure 6 shows some calculated values of natural frequency or resonance frequencies (which represents the maximum value of N. Freq.) of human body parts.

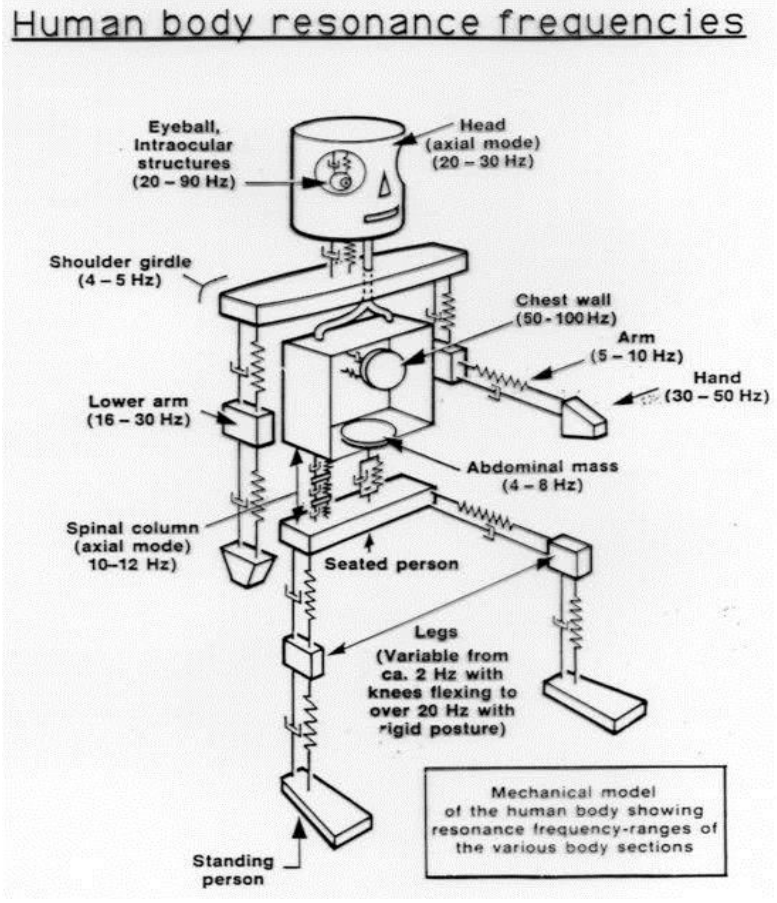


Fig. 6 Natural frequency values of some human body parts.

Some effects of vibrations on human body

The transmission of vibration to the human body at the natural frequency of the body as a whole or of its individual parts will result in resonance. It will make the body or a part

of the body will vibrate at a magnitude greater than the applied vibratory force.
Some responses can be noticed, muscles will contract in a voluntary or involuntary manner and cause fatigue or a reduction in motor performance capacity. This response may be considered adverse in the occupational realm; however, some view whole body vibration-WBV- as a means to achieve body strengthening as part of an exercise regimen. WBV platforms are now popular and in widespread use for athletic training.
Health effects include interference with or irritation to the lungs, abdomen or bladder. Also, vibrations have adversely affects the digestive, genital/urinary and female reproductive systems. They have an effect on vision. It is noticed that WBV and vehicle jarring contributing on back pain in the mining industry and as a significant risk to mobile equipment operators.[8-10]
Vibrations have effects on the head, back and neck, and vehicular jarring.

Parameters affect on the natural frequency of human body

Three main parameters affects on human body's natural frequency: age, weight or mass, and stiffness coefficient of its parts. If the equivalent mass of the human body increases the natural frequency of the whole body decreases, age affects on both mass and stiffness of the human body. The main parameter is the equivalent stiffness constant of the human body which represents the resistance of the body or structure to external loads or frequencies. It is noticed that as the stiffness constant of the human body increases the natural frequency increase, and so the external vibration value which will cause resonance to human body parts affected by such vibrations increases. Figure 7 shows the relation between natural frequency values for different stiffness constants at affixed average mass of human body taken as 70 kg as an average value.

Fig. 7. Natural frequency of human body as a relation with stiffness coefficent.

Figure 8 shows the natural frequency values of the human body as a relation with the equivalent mass of the body-calculated at constant stiffness of 10000 N/m.

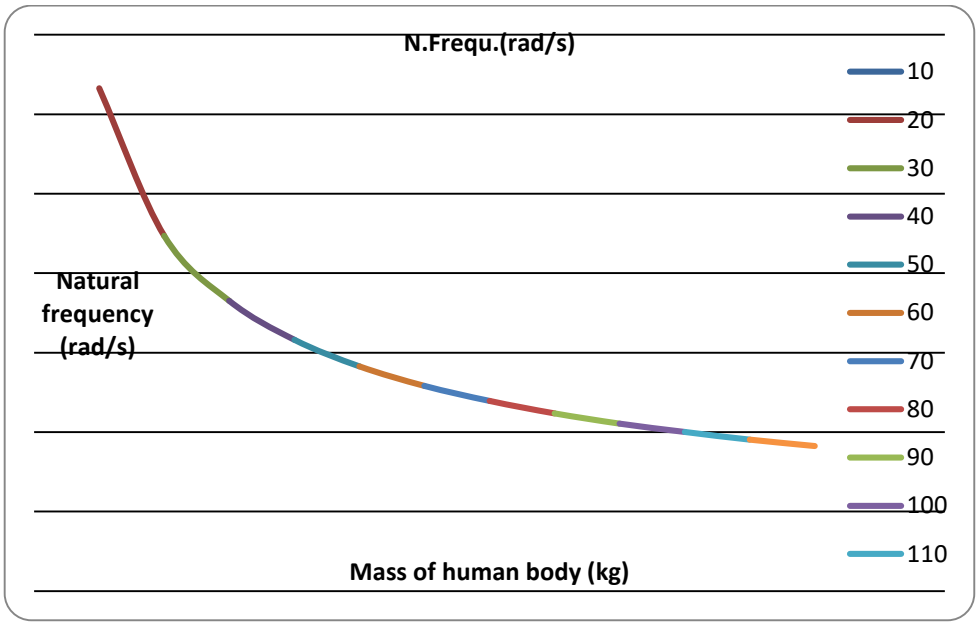


Fig.8 Natural requency of human body as a relation with mass

CONCLUSIONS

In this report the natural frequency of some mechanical structures simulate human bodies are studied, analyzed and calculated. The suggested measurement system depends directly on calculating both equivalent mass and stiffness of human body. Affects of vibrations on human body are studied which will causes resonance of that parts, also factors affects the values of natural frequency values of human body parts are analyzed. It is found that age, mass and stiffness coefficient of the human body pars affects strictly on the natural frequency of the human body. As the mass increases the natural frequency decrease, which make the body becomes weak in facing external vibrations. While as the stiffness values increase the natural frequency values increase and hence human body resistance to external vibrations increase.

ACKNOWLEDGMENT

This work has been carried out during sabbatical leave granted to the author Sayel M. Fayyad from Al-Balqa' Applied University (BAU) during the academic year 2015/2016. I would like to conduct my deepest appreciation to Al-Balqa' Applied University (BAU) for its support and constant help during the sabbatical leave period.

REFERENCES

[1] Dariusz Więckowski, 2006, "An Attempt to Estimate Natural Frequencies of Parts of the Child's Body", Automotive Industry Institute, Simulation Tests Laboratory, 55 Jagiellońska Street, 03-301 Warszawa, e-mail: d.wieckowski@pimot.org.pl.

[2] By Helmut W. Paschold and Alan G. Mayton, 2011, "Whole-Body Vibration Building Awareness in SH&E", Professional Safety Journal, APRIL 2011 www.asse.org.

[3] Gregory P Slota, 2008, "Effects of Seated Whole-Body Vibration on Spinal Stability Control", Dissertation submitted to the Faculty of the Virginia Polytechnic Institute and State University, November 14th, 2008 Blacksburg, Virginia.

[4] A A Nikooyanz and A A Zadpoor , 2011, Mass–spring–damper modelling of the human body to study running and hopping – an overview Proc. IMechE Vol. 225 Part H: J. Engineering in Medicine

[5] Jacob Rosen1, and Mircea Arcan, 2003, Modeling the Human Body/Seat System in a Vibration Environment Journal of Biomechanical Engineering, Vol. 125 (2-23).

[6] Singiresu S. Rao, 2010, Mechanical Vibrations Fifth Edition, Prentice Hall.

[7] Tomáš Hararik, Jozef Bocko, Kristína Maslákóvá, 2012, Frequency analysis of acoustic signal using the Fast Fourier Transformation in MATLAB, Procedia Engineering 48 (2012) 199 – 204

[8] J. M. Randall, R. T. Matthews and M. A. Stiles,1997, 'Resonant frequencies of standing humans', Ergonomics, 40 (9), pp.879-886, 1997.

[9] . Y. Matsumoto, M. J. Griffin, 'Dynamic response of the standing human body exposed to vertical vibration: influence of posture and vibration magnitude', Journal of Sound and Vibration, Vol. 212, No. 1, pp. 85-107, Apr 1998

[10] B. R. Ellis and T. Ji, 'Human-structure interaction in vertical vibrations', Structures and Building, Proceedings ICE, 122, pp.1-9, Feb 1997.