WRITING SKILLS

- Developing styles of writing
- Paragraph writing, Resume/CV, Report writing

RULES OF WRITING (IN BRIEF)

- Capitalisation- for proper nouns and adjectives
- Periods, question marks, and exclamation points
- Avoiding faulty sentences
- Commas and sentence parts
- Commas that separate
- Semicolons and colons
- Apostrophes and dashes
- Quotation marks
- Designer punctuation

- Verb tense
- Using verbs to create strong writing
- Subject-verb agreement
- Using pronouns
- Problem verbs and pronouns
- Modifiers
- Easily confused word pairs
- Diction
- Communicating your ideas

PARAGRAPH WRITING

- Topic sentence
- Supporting sentences
- Concluding sentence

Elements

- Unity (focus on an idea)
- Coherence (logical bridges or using keywords)
- Topic sentence
- Development (adequate explanation)

SOME RULES

- Put only one main idea per paragraph.
- Aim for three to five or more sentences per paragraph.
- Include on each page about two handwritten or three typed paragraphs.
- Make your paragraphs proportional to your paper. Since paragraphs do less work in short papers, have short paragraphs for short papers and longer paragraphs for longer papers.
- If you have a few very short paragraphs, think about whether they are really parts of a larger paragraph—and can be combined—or whether you can add details to support each point and thus make each into a more fully developed paragraph.

CURRICULUM VITAE

- **What to Include in a CV:**

- Contact Information
- Research Objective, Personal Profile, or Personal Statement
- Education
- Professional Academic Appointments
- Books
- Book Chapters
- Peer-Reviewed Publications

- Other Publications
- Awards and Honors
- Grants and Fellowships
- Conferences
- Teaching Experience
- Research Experience / Lab Experience / Graduate Fieldwork
- Non-Academic Activities
- Languages and Skills
- Memberships
- References

RESUME

- Contact Information including Job Title
- Resume Summary or Resume Objective
- Work Experience
- Education
- Skills
- Additional Sections (Awards, Courses, Publications, Licenses and Certificates, Interests, etc.)

STATEMENT OF PURPOSE

- Statement of Purpose (MIT)

My primary research objective and interest is in the area of computer graphics. I am currently studying computer science at Princeton University, and I am actively involved in a research project that is developing an automated system to assist archaeologists in reconstructing excavated frescoes. My work focuses in particular on analyzing fracture patterns from images of frescoes and developing a model of brittle fracture. This project has opened my eyes to a broad range of research in computer graphics and motivated me to undertake further study through a Ph.D. program. I am especially interested in problems of visualization, computational photography, and simulation, but I am open to trying new ideas as well.

Under the supervision of Professor Thomas Funkhouser, I conducted research that analyzed fracture patterns observed in frescoes excavated from Akrotiri (modern Santorini, Greece), an ancient Bronze Age city destroyed by earthquakes around the 17th century B.C. I developed a two-stage processing pipeline for this purpose. In the first stage, I used an interactive program to trace detailed fragment boundaries in high-resolution images of manually reconstructed frescoes. The output was a polygonal mesh, with each polygon representing a fragment. Next, I implemented geometric analysis algorithms to study the shapes and contacts of the fragment boundaries. Specifically, I produced statistical distributions of the lengths of cracks, the angles at which cracks met, the fragment areas, and the adjacencies found in fragment arrangements. The main contribution of my study is a statistical model for crack patterns of fractured frescoes, which can guide scoring functions used in computer-assisted fragment reconstruction algorithms and also suggest a generative model about fracture processes. Last summer, I participated in a workshop at the archaeological site of Akrotiri, where I presented my study and learned about the diverse research that others had undertaken (both technical and nontechnical).

The work ranged from scanning of fresco fragments or constructing virtual reality models of the ancient city to historical interpretation of the fresco paintings. It was an eye-opening experience; I was able to place my research in the context of a broader study and application. In addition, I was motivated by the feedback I received to plan a direction for my research in senior year. I recently published my study at the VAST International Symposium on Virtual Reality, Archaeology and Cultural Heritage. I am continuing the research this year, implementing methods to verify the suggested model of the fracture process by simulating factures using physics-based heuristics. I am also collaborating with a graduate student to record and analyze the actual fracture process with a high-speed video camera. In addition, I plan to utilize the statistical model to improve existing reconstruction algorithms and to develop new algorithms that reverse the fracture process. These experiences attracted me to various research problems in applications for cultural heritage, such as scanning, modeling, visualization, computational photography, and user interface dealing with 3D data. In my graduate study, I wish to do research in the area of computer graphics with broad applications in other disciplines, including but not limited to cultural heritage, such as medicine or education.

For these reasons, the EECS department of MIT is especially attractive to me. I am intrigued by several interesting research projects carried on by its faculty members. In particular, Professor Wojciech Matusik’s and Professor Frédo Durand’s research application in Virtual Humans is fascinating; their work on “Hair Photobooth: Geometric and Photometric Acquisition of Real Hairstyles” and Matusik’s work on “A Statistical Model for Synthesis of Detailed Facial Geometry” were especially interesting to read. My research interest has also led me to follow other works of Durand’s. I especially enjoyed reading the paper about “Procedural Modeling of Structurally-Sound Masonry Buildings.” It would be a privilege to study in the EECS department of MIT under the guidance of its remarkable faculty. I have enjoyed being able to apply what I learned in classes such as computer graphics and computational geometry to my research. On the other hand, I have also cultivated a broad interest in other areas, such as photography and art, as a source of inspiration. I seek different kinds of creativity in engineering and in art; both come from the persevering effort driven by the will to create something new and better. It is this creative will that I wish to pursue in MIT's Ph.D. program and afterwards as a researcher in academia. My learning experience under the guidance of my advisor has convinced me not only of the potential of research but also of the value of teaching. I have also enjoyed working as an undergraduate teaching assistant for introductory computer science courses. Through my graduate studies, I expect to become, and will work hard to be, an effective researcher and teacher.

REPORT WRITING

- A report is a formal communication written for a specific purpose; it includes a description of procedures followed for collection and analysis of data, their significance, the conclusions drawn from them, and recommendations, if required.

Types-

- **Oral**
- **Written**

- **Written is subdivided into formal and informal**

- **Under formal, there are informative, interpretive and routine reports**

It (a report) is often his (an engineer's) only tangible product. It presents his investigation, his testing and experimentation. If his efforts are to count in the judgement of his superiors, he must describe clearly what he has done. He must show the significance of his work. And often the engineer's written report is his only contact with the management.

- An informational report contains only the data collected or the facts observed in an organised form.
- An interpretive report contains only facts but it also includes an evaluation or interpretation or analysis of data and the reporter's conclusion.
- Progress reports
- Laboratory reports
- Inspection reports
- Inventory reports

STRUCTURE AND LAYOUT OF REPORTS

- Front matter: Cover, Frontispiece, Title page, Copyright Notice, Forwarding letter, Preface, Acknowledgement, Table of contents, List of illustrations, Abstract and Summary
- Main body: Introduction, Discussion, Conclusion and Recommendations
- Back Matter: Appendices, List of References, Bibliography, Glossary, Index

FRONT MATTER

Top Secret Report Number: 3068

NATIONAL AERONAUTICS LIMITED

Shaheedpur

AIRWORTHINESS OF ARROW-51 FIGHTERS

4 August 2014

TITLE PAGE

Report Number 326
BHARAT STEEL CORPORATION
Harshnagar
Chandpura-326917

A report
on
Installing a New Production Plant

Prepared
for
The Managing Director
by
S.J. Shinde
Assistant Engineer (Production)

Approved by
Sri Navrooz Khan
Production Manager

17 September 2014

A Report

on

Admissions Procedure at BITS

by

Ram Gopal Shewde

ID No. 96DIPS436

A report submitted in partial fulfilment

of the requirements of TAC 312:

Technical Report Writing

10 November 2009

FORWARDING LETTER

9 September 2009

Dear Secretary of State

I have the honour to present the Report of the Committee set up by your predecessor, Mrs. Thatcher, in 2009 to inquire into teaching, reading and writing of English. As the Committee's Chairman I should like to place on record the great help I have received from Dame Muriel Stewart, who has acted as Vice-Chairman throughout the inquiry. The Committee's debt to its Secretary, Mr. R. Arnold, HMI, is acknowledged in the introductory chapter. I should like to express my personal appreciation of the assistance he has given to the Chairman and of the close cooperation in which we have worked.

Yours sincerely
Alan Bullock
(Chairman)
The Rt. Hon. Reg. E. Prentice J.P., M.P.

SPECIMEN REPORT

A Report
on

The Design of a Honeycomb Collector
for a
Solar Pressure Cooker

by
S.K. Handa
and
Bharat Bhushan

A report submitted in
partial fulfilment of the requirements
of TA C312: Technical Report Writing

27 December 2014

ACKNOWLEDGEMENTS

We are grateful to Dr. D.P. Rao, Professor of Chemical Engineering, for all the help and guidance given for this study. We would also like to thank Dr. L.K. Jha and Sri R.S. Soni for many valuable ideas and suggestions they gave for completing this project.

CONTENTS

Abstract

Flat plate honeycomb collectors can be used successfully to get high plate temperatures. So far only glass and polymer honeycomb cores have been used to achieve this. This study shows that the use of paper drinking straws of a length to diameter ratio of 1 : 12 as honeycomb cores is not only more efficient but also more cost effective. We could achieve a maximum plate temperature of 203°C (during December) with a zero efficiency model. This high temperature

effect can be utilized to generate medium high pressure steam. The steam so generated can be directed into a pressure vessel for cooking.

1. Introduction

With the ever-increasing demand for energy and rapid depletion of the existing conventional energy sources, people all over the world are turning to the sun as a new source of energy. Scientists and engineers are directing their research efforts towards the utilisation of this enormous and as yet untapped source of energy.

It has recently been realised that considerable overall saving in the consumption of energy can be effected by finding an alternative to the conventional sources of energy for cooking. In India, mostly firewood or kerosene oil is used for cooking. The individual household need for energy is small and hence should be met by some simple and inexpensive mode of exploiting solar energy.

The present project was undertaken with this objective in view. A number of experiments were made to find out whether a flat plate honeycomb collector would yield better results than a simple flat plate collector to achieve a temperature high enough to generate pressure steam, which could be exploited for cooking.

The experiments were conducted on December 13, 19 and 20, 2014. The readings taken are given in Appendices A, B and C respectively. The data were monitored every 15 minutes. Manual heliostatic alignment and standard temperature measurement methods using thermocouples were employed for the collection of data.

2. Flat Plate Honeycomb Collectors

A simple flat plate collector consists of a thin sheet of metal of high thermal conductivity (mildsteel, aluminium, etc.) painted a dull non-reflecting black. This acts as a black body. It is placed in an insulated wooden box covered with a thin glass sheet. Three types of heat losses—losses by conduction, convection and radiation—can be identified in this.

The honeycomb is a device used primarily to reduce these losses. The idea originated from the hexagonal honeycomb used by bees. These tubes (preferably hexagonal and of a thermally nonconducting material like glass, polymers, etc.) are placed in a core-like formation on the absorbing surface. The use of a honeycomb can effectively reduce the radiation losses from a solar collector. However, in the range of 150–200°C the natural convective heat transfer between the absorbing surface and the glass cover plays a dominant role. The honeycomb (under certain conditions) suppresses natural convection currents, thus reducing the convective heat losses as well. The conduction loss directly through the honeycomb can be made negligibly small by choosing the right material.

3. Experiments Conducted

3.1 Flat Plate Collector without Honeycomb A 28 gauge aluminium sheet (1 ft^2 area) was used as the absorbing surface. A temperature of 135°C was attained at 12–30 (two hours before the peak sun intensity time) and after that a fairly rapid decrease was observed. The rate of increase and decrease was determined by the fact the aluminium has a high thermal conductivity and a very low heat capacity. After attaining a maximum temperature of 135°C the temperature gradient between the glass cover and the collector was very steep and the convective losses became large. Though the sun's intensity kept on increasing, the heat gain was largely offset by the large magnitude of convective losses.

3.2 Flat Plate Collector with Honeycomb

3.2.1 Mildsteel Collector with Glass Honeycomb Two MS plates (1 ft^2 area, 0.25 in thickness) were welded together to form a hollow container. The total weight was 5.9 kg. The glass tube honeycomb had an L/D ratio of 9 and weighed 7 kg. A very slow increase in the temperature of the plate was observed. This was because of the enormous weight and the relatively high heat capacity of the collector. Further, the heat taken by the glass tubes was another factor of slow temperature increase. A maximum of 97.5°C was attained at about the normal peak time. A higher temperature could not be obtained because the total heat capacity of the system (collector + honeycomb) was so great that a large amount of heat was required per °C rise. The thickness of the glass tube (average thickness 2 mm) was another negative factor.

A temperature gradient of about 5°C was observed between the top plate of the collector and the bottom plate. This was because of the relatively non-conducting air gap between the two plates and the thickness of the MS sheets.

The results of the above test encouraged the continuing of experiments with the honeycomb model with some modifications.

3.2.2 Mildsteel Collector with Glass Honeycomb with Water Introduced in the Collector The model described above with water introduced between the collector plates was used. In this case a maximum temperature of 64°C was observed. The reasons given above apply here also; however, water further increased the heat capacity of the system. A continuous increase was observed, and the water extracted at the end of the day had a temperature of 64°C. This demonstrated that a 'solar pond' had been created and a method of storing the energy received was available.

3.2.3 Aluminium Collector with Glass Honeycomb An aluminium plate (1 ft^2 area, 28 gauge) was used with the glass honeycomb described earlier. A fairly rapid increase in the temperature of the collector was observed. This was expected because of the low heat capacity of the aluminium sheet.

3.2.4 Aluminium Collector with Drinking-straw Honeycomb The above described aluminium sheet was used with drinking-straws forming the honeycomb core. The thickness of the straw was 0.05 on the L/D ratio about 1 : 47. No appreciable results were achieved. It has been observed that an L/D ratio of 1 : 15 gives the optimum results. Unless the honeycomb is aligned precisely in a way that the sun's rays reach the collector directly, no energy can be received. This is so because by the time a ray can travel down the length of the straw through a series of reflections, most of its energy is absorbed or reflected back, as the paper has an opaque surface with non-specular reflections.

3.2.5 Aluminium Collector with Drinking Straw Honeycomb The same model as described in the previous section was used with the modification that the straws were cut to give L/D ratio of 1 : 12. A significant rate of increase in temperature was recorded with the maximum of 203°C at 2.30 p.m. At the same time the wax from the straws had decomposed and condensed on the inside of the glass cover, thus greatly reducing transmitivity. It was also observed that the straws started getting charred at about 150°C. The wax on the straws helped it to char at a lower temperature than the normal. The conclusions from this experiment were that we should:

(a) 'dewax' the straws by placing them in an incubator under controlled temperature before using them, and
(b) separate the straws from the collector by raising the entire honeycomb core by about 0.25 inch.

3.2.6 *Aluminium Collector with Drinking-Straw Honeycomb (Raised)* The same aluminium collector with drinking-straw honeycomb of an L/D ratio of 1 : 12 was used. The straws were tied together in bundles and raised from the plate by chalk pieces acting as pillars. A maximum of 102.5°C was attained. It was observed that the chalk pieces had become very hot (almost baked). A good and uniform packing could not be achieved due to improper handling. The experiment was discontinued after a few hours because of the impracticability of the method.

3.2.7 *Aluminium Collector with Drinking-Straw Honeycomb (Raised)* The model described in the above section was used with a modification. The honeycomb core was separated from the collector plate by a thin glass sheet (3 mm thickness) resting on wooden supports of thickness 0.25 inch. Thus, an effective separation of 0.7 cm existed between the honeycomb core and collector. A maximum of 165.5°C was attained but the charring of straws and wax decomposition still occurred. The bottom glass sheet cracked due to a temperature gradient which resulted in non-uniform expansion of the glass. This gap also effected greater convective losses, thus explaining the low value of the maximum temperature.

We concluded that raising the honeycomb core so as to create a gap between it and the collector results only in the decrease of effective heat gain—an undesirable feature. 'Dewaxing' the straws and impregnation with some fire-resistant chemical is necessary. A proper material for the honeycomb is required. This material should have all the desirable features of thin walls, thermally insulating, proper L/D ratio, non-charring, etc., and should not have any undesirable property, like the waxing described above.

3.2.8 *Aluminium Collector with Drinking-Straw Honeycomb* The same model as described in the previous sections was used. The L/D ratio of honeycomb was 1 : 12. This time the model was fixed facing south and at an inclination of 33° to the vertical. No heliostatic alignment was followed. This was tried out with the understanding and anticipation that in the ultimate design, heliostatic alignment would create unnecessary problems and could also involve complications in design. The maximum temperature achieved was 148°C. The rate of increase and decrease was very steep. This was expected since the straw took up almost no heat except in the wax decomposition and charring process.

4. Conclusions

The use of a honeycomb type flat plate collector is a very economical method of achieving high temperature.

We were able to get a maximum temperature of 203°C using a honeycomb of paper drinkings straws (L/D = 1 : 12). But the straws got charred due to the high temperature. Separating the honeycomb from the collector plate did not help as it reduced the useful heat gain.

Basically, for the honeycomb to be effective, the tubes used should have an L/D ratio of 12 : 15 and should possess low thermal conductivity a small diameter and thin walls.

This study indicates only the first stage of the design of an economical and convenient solar cooker. The next stages will involve the designing of a suitable honeycomb type flat plate collector, design of a simple heliostatic aligning mechanism, design of a pressure vessel and mechanism of transportation of steam from collector to the pressure vessel.

Evidently, a solar cooker using honeycomb flat plate collector is possible. Further research and development is required to improve the design and to reduce the cost.

Appendix A

Readings Taken on 13 December

Date: 13 December 2014

Model: Hollow mild steel collector (1 ft^2) with honeycomb of glass tubes (L/D = 9). The glass tubes rested on the collector plate.

Thermocouple used: Fe/Con

Position: Heliostatic aligning

Weather: Clear Sky

Time (IST)	Pot. Meter Reading (mV)	Plate Temperature (°C)	Ambient Temp. (°C)
11.52	4.50	85.0	23.0
12.01	4.70	89.5	23.0
12.15	4.90	93.0	23.0
12.30	5.05	96.0	23.0
12.45	5.15	98.0	23.5
01.00	5.20	99.0	23.5
01.15	5.25	99.7	24.0
01.30	5.20	99.0	24.0
01.45	5.12	97.5	24.0
01.52	5.14	97.8	24.0
02.00	5.10	97.0	24.5
02.15	5.00	95.0	25.0
02.30	4.90	93.5	24.5
02.45	4.72	90.0	24.0
03.00	4.51	86.0	24.0
03.15	4.39	84.0	23.0
03.30	4.05	71.5	23.0
03.45	3.96	76.0	23.0
04.00	3.73	71.5	22.0
04.15	3.60	69.0	22.0

Appendix B
Readings Taken on 19 December

Date: 19 December 2014
Model: Aluminium collector (1 ft^2) with no honeycomb.
Thermocouple used: Fe/Con
Position: Heliostatic aligning
Weather: Clear sky

Time (IST)	Pot. Meter Reading (mV)	Plate Temperature (°C)	Ambient Temp. (°C)
11.45	7.00	132.0	23.0
12.00	7.10	134.0	23.0
12.15	7.13	134.2	23.5
12.30	7.17	135.0	24.0
12.53	7.12	134.1	24.0
01.00	7.12	134.1	25.0
01.15	7.12	134.1	24.0
01.30	6.98	131.0	24.0
01.45	7.02	132.0	24.0
02.15	7.01	132.0	23.0
02.30	6.94	130.5	25.0
02.45	6.75	127.0	23.5
03.07	6.70	126.0	22.5
03.24	6.58	124.0	22.0
03.45	6.40	121.0	22.0
04.00	6.14	116.0	22.0
04.15	5.73	109.0	22.0

Appendix C
Readings Taken on 20 December

Date: 20 December 2014
Experiment Model: Aluminium collector with honeycomb of paper drinking straw (L/D =
The straws were resting on the collector plate.
Thermocouple used: Fe/Con
Position: Heliostatic aligning
Weather: Clear sky

Time (IST)	Pot. Meter Reading (mV)	Plate Temperature (ºC)	Ambient Temp. (ºC)
10.54	3.48	67.0	22.0
11.00	3.84	73.5	22.5